Effects of Hatha Yoga on Physical and Mental Health: Mixed Methods Approach

LAU, Hoi Lam

A Thesis Submitted in Partial Fulfilment

of the Requirements for the Degree of

Doctor of Philosophy

in

Medical Sciences

The Chinese University of Hong Kong

August 2013

PREFACE

DECLARATION

I declare that this dissertation represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis submitted to this University or to any other institution for a degree, diploma or other qualification.

ABSTRACT

Abstract of thesis entitled:
Effects of Hatha Yoga on Physical and Mental Health: Mixed Methods Approach
Submitted by LAU, Hoi Lam
for the degree of Doctor of Philosophy in Medical Sciences
at The Chinese University of Hong Kong in August 2013

Physical inactivity is one of the main causes of major noncommunicable diseases and contributes substantially to the global burden of disease, death and disability. To reverse the trend towards inactivity, it is important to promote physical activities with low participation barrier and numerous benefits to encourage sedentary individuals to become physically active. Yoga has been increasingly popular and practiced as a low-to-moderate intensity physical activity in recent years. Yoga originated in India more than 5000 years ago and its principle is to achieve the integration of body, mind, and spirit. Growing evidence suggests the beneficial effects of Hatha yoga on various ailments, yet potential long-term effects of yoga on health are under-researched. Interpretation of and comparisons across many existing studies are limited by methodological problems. The current study aims to investigate the effects of yoga on physical and mental health quantitatively and qualitatively with the mixed methods approach.

Study One, a quantitative study, was conducted to investigate the physiological and psychological effects of a 12-week Hatha yoga program. A total of 173 participants (aged 34-71) participated in this study, of which 87 participants were assigned to the yoga group and 86 participants were assigned to the control group. The yoga group participated in the 12-week of yoga program (1-hour session/week), whereas the control group maintained their lifestyle as usual. Outcome variables of the study included metabolic risk factors, physical activity level, health-related physical fitness, cortisol level, psychological variables, and health-related quality of life. Analysis of

variance (ANOVA) and analysis of covariance (ANCOVA) were used in the data treatment. The primary analysis compared the changes of the outcome variables from baseline to post-intervention between the yoga and control groups of the whole study sample. The two subgroup analyses focused on samples with and without metabolic syndrome, respectively.

A total of 154 participants completed the study (yoga, n = 79; control, n = 75), the attrition rate of the overall sample was 11.0%. The attendance rate of those who completed the study was 93.6% for 12 sessions. No adverse effects were reported. Results of Study One revealed that the yoga intervention program has produced significantly beneficial effects on some metabolic risk factors including waist circumference, fasting blood glucose, triglyceride and metabolic syndrome z score, health-related physical fitness, general health perceptions domain and social functioning domain of health-related quality of life ($p < 0.05$). However, results did not indicate any significant effects of the yoga program on physical activity level, cortisol level, and any of the psychological variables. Results of the two subgroup analyses further suggested that yoga participants with metabolic syndrome (MetS) experienced more improvement in terms of the number of outcome variables than yoga participants without MetS. MetS yoga participants also experienced stronger beneficial effects than non-MetS yoga participants when the same outcome variables were compared.

Study Two, a qualitative study, was conducted to explore the perceived benefits and barriers of regular yoga practice and participation pattern. Eighty-six participants (aged 25-66), consisted of individuals who have practiced yoga for at least three months (EXP, n = 42) and individuals who had never practiced yoga (NIL, n = 44), were recruited and assigned to participate in one of the 14 discussion group sessions (on average six participants in a group). The researcher facilitated each 1-hour discussion session based on the guiding questions which related yoga practice and health related issues.

Findings of Study Two indicated that motivations for initiating yoga practice included: participants' concerns on physical health and emotions, yoga information from mass media, relatives, friends, and health professionals. Perceived health benefit was the major reason for EXP participants to continue their yoga practice. Regardless of the yoga experiences, Study Two participants addressed a wide range of perceived health benefits. They believed that yoga practice could improve their physical health by having beneficial effects on different body systems, promoting physically active lifestyle, preventing diseases, and enhancing some physical fitness components. Participants also found yoga practice beneficial to various aspect of mental health, particularly stress reduction and senses of relaxation, calmness, and vitality. Differences in perceived barriers of yoga practice between participants with different yoga experiences were noted, with NIL participants perceiving more barriers than EXP participants. NIL participants had a number of negative impressions of yoga, whereas EXP participants encountered some obstacles in continuing their yoga practices.

By incorporating the results of both quantitative and qualitative studies, findings of this study enhances the understanding of the effects of Hatha yoga intervention on health and suggests that individuals practiced yoga regularly would experience a wide range of health benefits. Together with low-to-moderate intensity feature of yoga, sedentary individuals can establish a more physical active lifestyle through yoga and benefit from it. By understanding the reasons for discouraging individuals

from yoga practice, more comprehensive and integrated information of yoga practice is needed to reduce the participation barrier and promote this healthy activity.

Keywords: Yoga, physical activity, metabolic syndrome, cardiovascular, BMI, focus group, stress

ABSTRACT IN CHINESE
摘要

混合研究方法探討哈達瑜伽對身體和精神健康的影響

低運動量是引發城市人出現健康問題的一個主要因素。提升人的運動量以減少社會承擔是社會關注的議題。瑜伽源於印度，有五千多年歷史，相信透過修習瑜伽可達致身、心、靈的結合。越來越多的研究結果指出瑜伽對治療及預防多種疾病有良好影響，但欠缺長期練習瑜伽對健康影響的研究。此外，現存的科研結果因研究方法各異，仍難以對瑜伽的成效作出定論。本研究目的是探討哈達瑜伽對身體和精神健康的影響，並同時採取量化及質性混合研究方法。

甲項研究是量化研究，調查爲期十二週的哈達瑜伽訓練對身體和精神健康的影響。此研究共有一百七十三名參加者(年齡由三十四至七十一歲)，當中八十七名參加者被分配到瑜伽組，而其他的八十六名參加者被分配到對照組。瑜伽組參加者參加了爲期十二週的瑜伽課程(每星期一節，每節一小時)。而對照組的參加者保持他們往常的生活方式。研究變項包括：代謝性危險因子、體力活動量、健康體適能、皮質醇水平、心理變項及健康相關的生活質素。以上變項皆會進行兩次評估，分別是基線及後測，數據以變異數分析法及共變數分析法進行分析。此研究數據進行了三項分析，包括主要分析及兩項次組分析。主要分析是整個研究樣本的數據分析，而兩項次組分析則分別探討代謝綜合症樣本和非代謝綜合症樣本的數據。以上所有分析均對瑜伽組和對照組從基線到後測的各項變項之變化進行比較。

一共一百五十四名參加者完成此研究(瑜伽組, n = 79；對照組, n = 75)，參加者流失率爲 11.0%。完成瑜伽課程的參加者，其瑜伽堂出席率高達 93.6%。研究結果顯示，瑜伽對部分代謝性危險因子(腰圍、空腹血糖、三酯甘油酸和代謝

綜合症的 z 分數)、健康體適能和健康相關的生活質素中自覺健康範疇和社會功能範疇有著顯著良好的影響($p < 0.05$)。然而，結果亦顯示瑜伽訓練未能對體力活動量、皮質醇水平和所有的心理變項有顯著的影響。兩項次組研究結果更顯示患有代謝綜合症(MetS)的瑜伽組參加者相比非代謝綜合症(non-MetS)的瑜伽組參加者在更多變項得到改善，而且患有代謝綜合症的瑜伽組參加者在相同的變項上比起非代謝綜合症的瑜伽組參加者有更大程度的改善。

乙項研究是質性研究，調查恆常瑜伽練習的參與動機、益處和障礙。一共有八十六人(年齡由二十五至六十六歲)參與研究，當中四十二名參加者有三個月或以上的瑜伽練習經驗(後稱 EXP)，其他四十四名參加者是從來沒參與過瑜伽練習(後稱 NIL) ，八十六名參加者分爲十四個組以進行聚焦小組討論(平均六名參加者一組)。研究員引導參加者進行一小時的討論，討論與瑜伽練習及健康相關之題目。

綜合各聚焦小組討論結果，瑜伽練習的參與動機包括參加者對身體健康和情緒的關注，以及來自大眾傳媒、親友和醫護人員的資訊所影響。而 EXP 認爲參與瑜伽所體驗到的健康益處是持續練習瑜伽的主因。EXP 及 NIL 均認爲瑜伽練習有廣泛的健康益處，他們相信瑜伽練習對不同的身體系統的有良好的影響、能促進活躍的生活方式、預防疾病及增強多項體適能元素。參加者更指出瑜伽練習對多項心理健康方面都有好處，特別是減輕壓力及使人感覺放鬆、平靜和活力。至於參與瑜伽的障礙，EXP 及 NIL 所面對的障礙是存有差異的，NIL 比 EXP 面對較多障礙。NIL 對瑜伽有較多負面印象，而 EXP 則於持續瑜伽練習方面遇上不少困難。

綜合量化和質性研究的結果，本研究加深了對哈達瑜伽訓練對健康的影響，並指出瑜伽練習者透過瑜伽練習可能獲得多種健康益處。瑜伽是低到中等強度的體力活動，靜態人士可透過練習瑜伽去建立更活躍生活模式，並從中獲得健康益處。透過了解阻礙參與瑜伽的原因，若能提供更全面和綜合的瑜伽相關資訊，可有助減少大眾參加瑜伽的障礙和促進此健康活動。

關鍵詞：瑜伽、體力活動、代謝綜合症、心血管、身體質量指數、聚焦小組、壓力

ACKNOWLEDGEMENTS

The study was conducted in the Department of Medicine and Therapeutics of the Chinese University of Hong Kong during years 2009-2012. I would like to acknowledge the award of the Postgraduate Studentship (2009-2013) offered by the Chinese University of Hong Kong so that my research can be carried out.

I am grateful to Professor Jean WOO, my supervisor, Head of Division of Geriatrics, Department of Medicine & Therapeutics, the Chinese University of Hong Kong, for giving me opportunity to study this PhD program. She has been enlightening me about scientific research, continuously guiding and encouraging me throughout the entire project and preparation of this thesis. I will never forget her kindnesses and support during my 4-year study. Her careful and enthusiastic attitude to research work is a good example for my future.

Help and support from my friends and colleagues including but not limited to Professor Ruby YU, Professor Ruth CHAN, Dr. Forrest YAU, Dr. Joey KWONG, Dr. KO Kwok Wai, and Mr. Jason LEUNG. Also, I would like to express my heart-felt gratitude to all the participants in the studies. Without their enthusiastic participation in the studies, this research would have never been completed.

Last but not least, my mother, LEUNG Wai Lin; father, LAU Keung; brother, LAU Ho Yin are dearly thanked for their love and support throughout my life. Also my warmest thanks go to my dearest friend, KO Hang Yee, Kevin. I am deeply grateful for his love, encouragement and understanding during these years. I would like to send my genuine love and gratitude to my family and Kevin.

AUTHOR'S CONTRIBUTION

The study was designed by Professor Jean Woo (my supervisor) and me. The followings were my contributions in Study One and Study Two, respectively:

Study One

1. To select appropriate assessments in order to answer the research questions of this study.
2. To design the yoga program and appropriate fitness-specific adjustments to the content of the program.
3. To design all distributing written materials for the participants, including yoga photo and weekly self-practice record sheet.
4. To promote the study in the community and recruit subject by designing recruitment website, mass mailing, leaflets, posters, and application forms.
5. To coordinate with the laboratory staff for assay of blood samples and salivary samples.
6. To coordinate and conduct the briefing sessions in which study protocol was explained, and questions arose from potential participants were answered.
7. To coordinate the schedules of assessments and yoga class before participants' signing informed consent.
8. To conduct all the assessments including venipuncture, body measurement, blood pressure measurements, physical fitness assessment, and questionnaire assessments for participants during baseline and post-intervention assessments.
9. To teach all the yoga classes.
10. To perform data entry and quantitative analysis.
11. To update the progress of the study regularly.

Study Two:

1. To design guiding questions for the focus group discussion.
2. To promote the study in the community and recruit subject by designing recruitment website, mass mailing and application forms.
3. To schedule each focus group and coordinate with the participants.
4. To conduct focus group interviews with participants.
5. To transcribe the focus group recordings.
6. To perform data entry and qualitative analysis.

PUBLICATION AND PRESENTATION

Peer reviewed journals:

Lau, H. L. C., Kwong, J. S. W., Yeung, F., Chau, P. H., & Woo, J. (2012). Yoga for secondary prevention of coronary heart disease: Cochrane systematic review. *Cochrane Database of Systematic Reviews 2012*, *12*. Art. No.: CD009506. doi:10.1002/14651858.CD009506.pub2.

Conference proceedings / abstracts:

Lau, H. L., & Woo, J. (2013). Effects of yoga on physical health and psychological well-being. *Research in Complementary Medicine*, *20* (Suppl 1), 88. doi: 10.1159/000178122

Lau, H. L. C., & Woo, J. (2013). Positive impacts of yoga on cardiovascular risk factors, physical fitness, and quality of life in overweight and obese individuals. *European Journal of Preventive Cardiology*, *20* (Suppl 1), s106.

Presentations arose from the research reported in this thesis:

1. **Title:** Effects of Yoga on Physical Health and Psychological Well-being
   Format: Poster presentation
   Event: The 8th annual International Congress of Complementary Medicine Research - ICCMR 2013
   Organizer(s): The Royal London Hospital for Integrated Medicine (RLHIM)
   The National Institute for Health Research School for Primary Care Research
   The Consortium of Academic Health Centers for Integrative Medicine
   The International Society for Complementary Medicine Research (ISCMR)
   City/Country: London, United Kingdom
   Date: 11-13 April 2013

2. **Title:** Positive impacts of yoga on cardiovascular risk factors, physical fitness, and quality of life in overweight and obese individuals
   Format: Poster presentation
   Event: EuroPRevent 2013
   Organizer(s): The European Association for Cardiovascular Prevention and Rehabilitation (EACPR)
   City/Country: Rome, Italy
   Date: 18-20 April 2013

3. **Title:** Effects of Yoga on Physical and Mental Health
Format: Poster presentation
Event: "Can Foods Change Your Health?" 2013 Joint Symposium of Centre for Nutritional Studies, CUHK & Food Safety and Technology Research Centre, PolyU, Hong Kong
Organizer(s): Centre for Nutritional Studies, The Chinese University of Hong Kong
Food Safety and Technology Research Centre, The Hong Kong Polytechnic University
City/Country: Hong Kong
Date: 6 July 2013

RESEARCH-RELATED AWARD

The CUHK Research Postgraduate Student Grants for Overseas Academic Activities

The grant (HK$15000) for poster presentations at the 8th annual International Congress of Complementary Medicine Research - ICCMR 2013 (London, United Kingdom, April 2013) and the EuroPRevent 2013 (Rome, Italy, April 2013)

Honorable Mention of The ISCMR 2013 Trainee Poster Prizes

LAU, H. L., & Woo, J. (2013). Effects of Yoga on Physical Health and Psychological Well-being (Poster Presentation). The 8th annual International Congress of Complementary Medicine Research - ICCMR 2013 (Honorable Mention of The ISCMR 2013 Trainee Poster Prizes). London, United Kingdom, April 2013.

CONTENTS

APPENDICES

ILLUSTRATIONS

Figures

Tables

STATISTICAL SYMBOL AND ABBREVIATIONS

Statistical Symbol

ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
CI	Confidence interval
f	Frequency
M	Mean
n	Number of subjects in each group or subset of the sample
N	Number of subjects in the whole sample
p	Probability
SD	Standard deviation
t	*t*-test value
z	Mann-Whitney *U* test value
η^2	Eta-square
χ^2	Chi-square

Abbreviations

AACE	American Association of Clinical Endocrinologist
ACSM	American College of Sports Medicine
AHA	American Heart Association
ANS	Autonomic nervous system
BCort	The change of cortisol level at baseline
BMI	Body mass index
BP	Bodily pain
CAD	Coronary artery disease
CAM	Complementary and Alternative Medicine
CDC	Centers for Disease Control and Prevention
CES-D	Centre for Epidemiologic Studies Depression Scale
CHD	Coronary heart disease
CHP	Centre for Health Protection
CLBP	Chronic low back pain
CSEP	Canadian Society for Exercise Physiology
CV	Coefficient of variation
CVD	Cardiovascular disease
DBP	Diastolic blood pressure
DM 2	Type 2 diabetes
E-RYT	Experienced Registered Yoga Teacher
EGIR	European Group for Study of Insulin Resistance
EORTC QLQ-C30	European Organization for Research and Treatment of Cancer Quality of Life Questionnaire
ES	Effect size
EUC	Enhanced usual care
FACT	Functional Assessment of Cancer Therapy
FBG	Fasting blood glucose
GAS	General Adaptation Syndrome
GH	General health perceptions
HADS	Hospital Anxiety Depression Scale
HDL-C	High-density lipoprotein cholesterol

HPA	Hypothalamic-pituitary-adrenal
HRQoL	Health-related quality of life
IDF	International Diabetes Federation
IPAQ	International Physical Activity Questionnaire
ITT	Intention-to-treat
LCSD	Leisure and Cultural Services Department
LDL-C	Low-density lipoprotein cholesterol
MBS	Modified back-saver sit-and-reach
MCS	Mental health component score
MDCort	The change of cortisol level in Study One
MetS	Metabolic syndrome
MH	General mental health
NCD	Noncommunicable disease
NCEP-ATP III	National Cholesterol Education Program Adult Treatment Panel III
PAL	Physical activity level
PAR-Q & YOU	The Physical Activity Readiness Questionnaire
PCort	The change of cortisol level at post-intervention
PCS	Physical health component score
PF	Physical functioning
PP	Per-protocol
PSS	Perceived Stress Scale
QoL	Quality of life
RCT	Randomized controlled trial
RE	Role limitations due to emotional problems
RHR	Resting heart rate
RP	Role limitations due to physical problems
RPE	Rating of perceived exertion
RSES	Rosenberg Self-Esteem Scale
SBP	Systolic blood pressure
SEQ	Self-Esteem Questionnaire
SF	Social functioning
SF-36	MOS 36-Item Short-Form Health Survey (SF-36)
SNS	Sympathetic nervous system
STAI	State-Trait Anxiety Inventory
TC	Total cholesterol
TG	Triglycerides
USHHS	U.S. Department of Heath and Human Services
VO_{2max}	Maximum oxygen consumption
VO_{2peak}	Peak oxygen consumption
VT	Vitality
WC	Waist circumference
WHO	World Health Organization
YA	Yoga Alliance

CHAPTER 1 INTRODUCTION

This study was conducted to investigate the effects of Hatha yoga with mixed method approach. This introductory chapter describes the background of the study, which discusses physical inactivity and the need of promoting physical active lifestyle through practicing Hatha yoga. The purposes, objectives, research questions, and significance of this study are discussed in detail. The final section of this chapter presents the organization of this thesis.

1.1 Background of the Study

Physical inactivity is the main cause of the major noncommunicable diseases (NCD), including cardiovascular disease (CVD), type 2 diabetes (DM 2), and breast and colon cancers, and contributes substantially to the global burden of disease, death and disability (World Health Organization [WHO], 2012a). Risks factors for NCD such as hypertension, hyperlipidaemia, tobacco use, alcohol consumption, and overweight, frequently coexist and interact, and are closely related to physical activity (WHO, 2002). A few major risk factors account for much of the morbidity and mortality (WHO, 2004). Globally, six percent of deaths are attributed to physical inactivity. This percent of deaths follows hypertension (13%), tobacco use (9%), is equal to hyperglycaemia (6%), and higher than overweight and obesity (5%) (WHO, 2011). Approximately 3.2 million deaths each year are attributable to insufficient physical activity (WHO, 2012a). Physical activity is an effective strategy to reduce the risk factors for NCD. Strong evidence shows that physical activity has a wide range of beneficial effects for both physical and mental well-being: cutting by about 25% the risk of many disorders related to inactivity (such as heart disease and type 2 diabetes), substantially reducing the risk of hypertension and some forms of cancer, and decreasing stress, anxiety, depression and loneliness (WHO/Europe, 2012).

Despite physical activity being a fundamental means of improving one's physical and mental health, more and more people in both developed and developing countries fail to engage in this preventive behaviour. Globally, around 31% of adults aged 15 and above were insufficiently active in 2008 (WHO, 2012a). The results of recent survey suggested that more than 60% of Hong Kong adults aged 20 and above were found to be insufficiently active (Leisure and Cultural Services Department [LCSD], 2012). The current levels of physical inactivity are partly due to insufficient physical activity participation during leisure time and an increase in sedentary behaviour during domestic and occupational activities (Chinapaw, Proper, Brug, van Mechelen, & Singh, 2011; Dunstan et al., 2010; Stamatakis, Hamer, & Dunstan, 2011; van Uffelen et al., 2010). An increase in the use of motorized transport (e.g. car, bus, or train), rather than on foot or by bicycle, has also associated with declining physical activity levels (Centre for Health Protection [CHP], 2012). Increased urbanization has contributed several environmental factors which may discourage people from participating in physical activity such as violence, high-density traffic, low air quality, pollution, lack of parks, sidewalks and recreation facilities (WHO, 2012a). To reverse the trend towards inactivity, it is important to promote physical activities with low participation barrier and numerous benefits to encourage sedentary individuals to become physically active.

Yoga, an ancient Indian philosophical tradition, and what we commonly refer to as "yoga" nowadays – the physical activity – is really Hatha yoga, the physical aspect of this philosophy (Carrico, 2005). Yoga has become a standard feature of class schedules in gyms, clubhouses, and community centres. Growing evidence indicated the potential benefits of yoga on health. Yoga is a relatively gentle and safe physical activity for promoting physical and emotional well-being for sedentary individuals who have special health concerns such as established CVD, obesity, and musculoskeletal problems that can limit their mobility and tolerance to highly demanding physical exercises (Lau, Kwong, Yeung, Chau, & Woo, 2012). Compared to most physical activities, practicing yoga does not require many equipment and much space, and can be conducted in either indoor or outdoor settings. Yoga is not only a physical activity but also a popular kind of complementary and alternative medicine (CAM) in western countries. Yoga was one of the most commonly used CAM in Australia (Xue, Zhang, Lin, Da Costa, & Story, 2007). Similarly, yoga was one of the most commonly used by U.S. adults and the increased use of yoga was found between 2002 and 2007 (Barnes, Bloom, & Nahin, 2008). The physical and psychological benefits of yoga are well accepted (da Silva, Ravindran, & Ravindran, 2009; Pilkington, Kirkwood, Rampes, & Richardson, 2005; Raub, 2002). A growing body of evidence has demonstrated that yoga has positive influences on various health conditions. For example, yoga has been found to manage and reduce the symptoms of urological disorders (Ripoll & Mahowald, 2002), pulmonary tuberculosis (Visweswaraiah & Telles, 2004), osteoarthritis (Bukowski, Conway, Glentz, Kurland, & Galantino, 2007), and menopause (Booth-LaForce, Thurston, & Taylor, 2007); and to have physical benefits with decreased distress and relief of perceived pain for individuals with rheumatoid arthritis (Bosch, Traustadottir, Howard, & Matt, 2009), chronic obstructive pulmonary disease (Donesky-Curenco, Nguyen, Paul, & Carrier-Kohlman, 2009), and chronic back pain (Groessl, Weingart, Aschbacher, Pada, & Naxi, 2008; Tekur, Singhow, Nagendra, & Raghuram, 2008). Evidence also suggested that yoga has beneficial effects on various psychological states on different populations such as the mood state of individuals undergoing inpatient psychiatric treatment (Lavey et al., 2005); decreased symptoms of depression, trait anxiety, negative mood, and fatigue in mildly depressed young adults (Woolery, Myers, Sternlieb, & Zeltzer, 2004); reduced stress and improved psychological outcomes in women suffering from mental distress (Michalsen et al., 2005); and improved sleep quality in a chronic insomnia population (Khalsa, 2004). As listed above, yoga has a lot of potential benefits on various health conditions. With growing popularity, promoting yoga participation might be able to reverse the increasing trend of physical inactivity. Therefore, further investigation of the effects of Hatha yoga on physical and mental health is needed.

1.2 Purpose of the Study

Growing evidence suggests the beneficial effects of Hatha yoga on various ailments, yet potential long-term effects of yoga are under-researched and not clearly understood. Moreover, interpretation of and comparisons across many existing studies are limited by methodological problems, e.g. absences of control group, small sample size, occurrences of selection bias, insufficient statistical analyses, and lack of description of the intervention. Furthermore, the effects of yoga may vary from one intervention to another. The differences imposed may be due to the choices of yoga styles, duration and intensity of each practice session, frequency of practice sessions of each intervention, etc. To fill the gap in the knowledge, the study is attempting to investigate the effects of yoga on physical and mental health with a controlled trial and at the same time explore the perception of individuals with and without yoga experience towards yoga with a focus group inquiry.

1.3 Objectives of the Study

The objectives of the present study are twofold:

1. To determine the effects of Hatha yoga intervention on physical and mental health.
2. To explore the motivations, perceived benefits and barriers of yoga practice of individuals with and without yoga experiences.

1.4 Hypotheses and Research Questions of the Study

The concurrent triangulation strategy of mixed methods design was employed in order to observe convergence in findings from different strands of the research, extend findings beyond those observable using a single method, and finally identify empirical contradictions that might be missed (Grafton, Lillis, & Mahama, 2011). The detail of mixed methods is further discussed in Section 3.2 of Chapter 3.

As this study employed the concurrent triangulation strategy, a quantitative study and a qualitative study were applied simultaneously. Therefore, the hypotheses of the quantitative study and the central questions of the qualitative study are presented separately.

We tested the following six null hypotheses in the quantitative study (Study One):

1. There are no significant differences in the changes of metabolic risk factors (i.e. waist circumference, blood pressure, fasting blood glucose, triglyceride, high density lipoprotein cholesterol, and MetS z score) between the yoga group and the control group.
2. There is no significant difference in the change of physical activity level between the yoga group and the control group.

3. There is no significant difference in the change of health-related physical fitness (i.e. body composition, cardiovascular endurance, muscular strength and endurance, and flexibility) between the yoga group and the control group.
4. There is no significant difference in the change of cortisol level between the yoga group and the control group.
5. There are no significant differences in the changes of psychological variables (i.e. self-esteem, perceived stress, state anxiety, trait anxiety, and depression) between the yoga group and the control group.
6. There is no significant difference in the change of health-related quality of life between the yoga group and the control group.

We asked the following three central questions that guided the inquiry in the qualitative study (Study Two):

1. What are the motivations of yoga practice? Do individuals with and without yoga experience have different motivations of yoga practice?
2. How do individuals with and without yoga experience perceive the benefits of regular yoga practice? Do they perceive differently?
3. How do individuals with and without yoga experience perceive the barriers of regular yoga practice? Do they perceive differently?

1.5 Significance of the Study

Unlike most of the existing yoga studies, a mixed methods approach was adopted in this study to investigate the effects of Hatha yoga on physical and mental health. Use of mixed methods approach allowed an expansion of the quantitative and qualitative findings of this study with a more comprehensive picture and an increase of the confidence of the conclusion drawn from this study when the results of the quantitative and qualitative studies coincided. From an educational perspective, the study enriches the existing understanding of the effects of yoga on various aspects of physical and mental health, and reveals how the general public perceives yoga. From a public health viewpoint, the evidence from this study may increase an individual's confidence and motivation of the use of yoga in health improvement, encourage an individual to practice yoga regularly, and hence become more physically active. Furthermore, the findings of the study may provide insight into health promotion and be useful in guiding community action. For example, individuals' misconceptions about yoga are identified, certain understandings on the subject matter can be clarified through education. The exploration of barriers of yoga participation may provide valuable information to the service providers. The service providers may develop some new strategies to tackle the barriers of participation based on the results of the current study.

1.6 Organization of the Thesis

This thesis consists of eight chapters. Chapter 1 is the introduction. Chapter 2 is a literature review on background information and prevalence of yoga, and potential effects of yoga on physical and mental health. Chapter 3 is a methodology chapter, which presents the research design and the method of this study in detail. The results of Study One are reported in Chapter 4 and discussed in Chapter 5. The results of Study Two are reported in Chapter 6 and then discussed in Chapter 7. Chapter 8 is a conclusion chapter, where summary and implications of this study are elucidated.

Chapter 2 Literature Review

The purpose of this chapter is to provide current research results and information concerning the effects of yoga on physical and mental health. For clarification purposes, key terms used throughout this text related to the aspects of physical and mental health are defined in the beginning of the chapter. The second half of the chapter focuses on yoga, briefly describes the detail of yoga and its prevalence, and then reviews the evidence of the physiological and psychological effects of yoga.

2.1 Physical Health

Numerous definitions of health exist and this study has adopted the WHO's definition. The WHO (2006) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". With respect to this broad definition of health, physical health of this study focuses on capacity of performing daily physical activity and absence of major risk factors. This study determines physical health by assessing the health-related physical fitness components and risk factors of metabolic syndrome (MetS).

2.1.1 Physical Activity and Fitness

According to American College of Sports Medicine [ACSM] (2010b), physical activity is defined as bodily movement that is produced by the contraction of skeletal muscle and that substantially increases energy expenditure. Exercise is a subclass of physical activity, is defined as planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness. Physical fitness is defined as a set of attributes that individuals have or achieve that relates to the ability to perform physical activity. These characteristics are usually separated into either health-related or skill-related components. The health-related components of physical fitness have a strong relationship with good health, are characterized by an ability to perform daily activities with vigor, and demonstrate the trait and capacities associated with low risk of premature development of the hypokinetic diseases such as those associated with physical inactivity. To determine the effects of yoga on physical health, all health-related physical fitness components are examined in the current study. U.S. Department of Health and Human Services [USHHS] (1996, 2008) defines health-related physical fitness component as follows:

1. Cardiorespiratory endurance (fitness)

Cardiorespiratory endurance is the ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity, and usually expressed as measured or estimated maximal oxygen uptake (VO_{2max}). Maximal oxygen uptake (VO_{2max}) is the body's capacity to transport and use oxygen during a maximal exertion involving dynamic contraction of large muscle groups, such as during running or cycling. It is also known as maximal aerobic power and cardiorespiratory endurance capacity. Peak oxygen consumption (VO_{2peak}) is the highest rate of oxygen consumption observed during an exhaustive exercise test.

2. Body composition

Body composition applies to body weight and the relative amounts of muscle, fat, bone, and other vital tissues of the body.

3. Muscular strength and endurance

Muscular strength is the ability of muscle to exert force, whereas muscular endurance is the ability of muscle to continue to perform without fatigue.

4. Flexibility

Flexibility is the range of motion possible at a joint, which is specific to each joint and depends on a number of specific variables, including but not limited to the tightness of specific ligaments and tendons.

2.1.2 Metabolic Syndrome

Metabolic syndrome (MetS) represents a constellation of risk factors that include abdominal obesity, hypertension, dyslipidemia, glucose tolerance, and insulin resistance, and has been identified as multiple risk factors for CVD and DM 2 (Reaven, 1988; Yang et al., 2008). This disorder is highly influenced by both genetic and lifestyle. Physical inactivity and stress are lifestyle-related contributing factors for MetS (Björntorp & Rosmond, 2000; Chrousos, 2000; Fowler, Moussouttas, & Mancini, 2005; Innes, Vincent, & Taylor, 2007; Kyrou, Chrousos, & Tsigos, 2006; Mittal, 2008; Rosmond, 2005; Tsiogos & Chrousos, 2002).

Several definitions of the MetS have been proposed including those of the WHO, the European Group for Study of Insulin Resistance (EGIR), the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III), the American Association of Clinical Endocrinologist (AACE), and the International Diabetes Federation (IDF) (Grundy et al., 2005). The inclusion criteria from NCEP-ATP III have been widely used due to its clinical simplicity, also this criteria satisfies both clinical and research needs, and allows better comparisons between different study populations (Morley & Sinclair, 2009; Sullivan, 2006; Tan, Chew, Ma, Tai, & Wai, 2004; Tong et al., 2007). The revised NCEP-ATP III clinical diagnosis criteria for Asian populations include the presence of at least three of the following criteria as shown in Figure 1.

1.	Waist circumference (WC) ≥ 90 cm in men and ≥ 80 cm in women
2.	Triglyceride (TG) ≥ 150 mg/dL or on drug treatment for elevated TG
3.	High-density lipoprotein cholesterol (HDL-C) < 40 mg/dL in men, < 50 mg/dL in women or on drug treatment for reduced HDL-C
4.	Systolic blood pressure (SBP) ≥ 130 mmHg or diastolic blood pressure (DBP) ≥ 85 mmHg or on antihypertensive drug treatment in a patient with a history of hypertension
5.	Fasting blood glucose (FBG) > 110 mg/dL or on drug treatment for elevated glucose

Figure 1. NCEP-ATP III clinical diagnosis criteria for Asian populations (Adapted from Grundy et al., 2005).

2.2 Mental Health

According to USHHS (1999), mental health refers to "the successful performance of mental function, resulting in productive activities, fulfilling relationships with other people, and the ability to adapt to change and to cope with adversity". The current study evaluates the effect of yoga on mental health by examining psychological aspects of an individual include self-esteem, stress, anxiety, depression, and health-related quality of life (HRQoL).

2.2.1 Self-esteem

Rosenberg (1965) defined self-esteem as a positive or negative attitude toward a particular object, namely, the self. The term "attitude" is used broadly to include facts, opinions, and values with regard to the self, as well as a favourable or unfavourable orientation toward the self. Self-esteem refers to a person's beliefs about one's own worth or the extent to which a person values or like oneself (Ritter & Lampkin, 2012). According to Ritter and Lampkin (2012), high self-esteem simply means that one respects oneself and considers oneself worthy; one does not necessarily consider oneself better than others, but one does not feel that one is ultimate in perfection but, on the contrary, recognize one's limitations and expects to grow and improve. Low self-esteem, on the other hand, implies self-rejection, self-dissatisfaction, and self-contempt.

2.2.2 Stress

Mental stress is defined as a negative emotional experience accompanied often produced by a perceived inability to cope with demands, by physiological and behavioural changes designed to respond to the stressor (Lazarus, 1966, as cited in Allen, 1998). The condition of stress has two components: physical, involving direct material or bodily challenge, and psychological, involving how individuals perceive circumstances in their live (Lovallo, 2005). For the purposes of the research on human beings, mental stress can be conceptualized as a stimulus, response, and process (Allen, 1998; Sarafino & Smith, 2011). One approach focuses on the environment: stress is seen as a stimulus, as when people have a demanding job or experience severe pain from arthritis or a death in the family. Physically or psychologically challenging events or circumstances are called stressors. The second approach treats stress as a response, focusing on people's reactions to stressors. Responses can be psychological, such as one's thought patterns and emotions when one "feel nervous", and physiological, as when one's heart pounds, one's mouth gets dry, and one perspire. The psychological and physiological response to a stressor is called strain. The third approach describes stress as a process that includes stressors and strains, but adds an important dimension: the relationship between the person and environment (Lazarus, 1999). This process involves continuous interactions and adjustments, namely transactions, with the person and environments each affecting being affected by the other. According to this view, stress is not just a stimulus or a response, but rather a process in which the person is an active agent who can influence the impact of a stressor through behavioral, cognitive, and emotional strategies.

Whether people appraise events as stressful depends on how they interpret, experience, and hence respond to a given psychosocial or even physical stimulus (Sarafino & Smith, 2011; Tsigos & Chrousos, 2006). Factors that contribute the differences include one's intellectual, motivational, and personality characteristics, for instance one's self-esteem and belief systems. Events tend to be appraised as stressful if they involve major life transitions, occur at an unexpected time in the life span, or involve strong demands, are imminent, are undesirable and uncontrollable (Sarafino & Smith, 2011). Thus, what is perceived stressful to an individual may be experienced as merely boring, trivial, or even amusing by the other (Sarafino & Smith, 2011; Tsigos & Chrousos, 2006).

When faced with excessive stress, whether physical or emotional, an individual's adaptive responses attain a relatively stereotypic nonspecific nature, referred to by Selye (1950) as General Adaptation Syndrome (GAS). GAS consists of the three-stage physiological reaction, namely the alarm reaction, the stage of resistance, and the stage of exhaustion. In alarm reaction, the body first reacts to a stressor, and sympathetic nervous system (SNS), adrenal glands, and hypothalamus-pituitary-adrenal (HPA) axis are activated (Sarafino & Smith, 2011). Hormones such as cortisol and adrenalin release into the bloodstream to meet the threat or danger. Cardiac output and respiration are accelerated, catabolism is increased, and blood flow is redirected to provide the highest perfusion and fuel to the aroused brain, heart, and muscles, and thus facilitate the fight or flight reaction (Tsigos & Chrousos, 2006). The body is mobilized to defend against the stressor.

If a strong stressor continues, the physiological reaction enters the stage of resistance. The initial reactions of the SNS become less pronounced and important, and HPA axis activation predominates. In this stage, the body tries to adapt to the stressor.

Physiological arousal remains higher than normal, and the body replenishes the hormones the adrenal glands released (Sarafino & Smith, 2011; Taylor, 2006). Despite this continuous physiological arousal, the individual may show few outward signs of stress. But the one's ability to resist new stressors may become impaired. This impairment may make the individual vulnerable to the health problems, especially illnesses that are resulted from impaired immune function, ulcers, hypertension, and asthma (Sarafino & Smith, 2011).

An individual may enter the stage of exhaustion after long-term exposure to the same stressor. At this point, resistance may again fall to below normal (Taylor, 2006). Chronic stress can weaken the immune system and deplete the body's energy reserves until the resistance is very limited. If stress continues, disease and damage to internal organs are likely, and death may occur (Sarafino & Smith, 2011).

Besides the aforementioned psychophysiological changes induced by stress, various emotions can accompany stress such as anxiety and depression. Further detail of anxiety and depression are presented in the next sections.

2.2.3 Anxiety

Anxiety is an emotion that arises in response to how we interpret and appraise an environment situation (Cox, 2007), and can be identified as a normal reaction to stressful events (Smith, Nolen-Hoeksema, Fredrickson, & Loftus, 2003; Walsh, 2009). Anxiety has both a state component and a trait component. State anxiety is an immediate emotional state that is characterized by apprehension, fear, tension, and an increase in physiological arousal. Conversely, trait anxiety is a predisposition to perceive certain environmental situations as threatening and to respond to these situations with increased state anxiety (Spielberger, 1971). Anxiety causes a person to experience physical symptoms such as headaches, dizziness, palpitation and sweating. If not treated appropriately, anxiety can cause physical exhaustion (Walsh, 2009). In a mental health point of view, anxiety is one of the most understood and major symptoms of mental disorders. The appropriate regulation of anxiety is critical to the survival of an individual in every environment. However, the mechanisms that regulate anxiety may be broken down in a wide variety of circumstances, leading to an excessive or inappropriate expression of anxiety (Ritter & Lampkin, 2012), for example generalized anxiety, phobias, and panic attacks. Thus, anxiety symptoms are more significant when they are abnormally severe, prolonged, impair normal functioning and occur in the absence of stress (Walsh, 2009).

2.2.4 Depression

Depression is a common mental disorder, characterized by a variety of physical, emotion, and cognitive symptoms. The physical symptoms of depression includes changes in appetite, sleep disturbances, fatigue, and loss of energy. Because a depressed individual's thoughts are focused inward rather than toward external events, one may magnify minor pain and aches and worry about one's health. The emotion symptoms of depression include unrelenting pain and despair. Individuals report that they have lost the ability to experience joy, even in response to the most joyous occasions, a symptom referred to as anhedonia. The cognitive symptoms consist of negative thoughts, with themes of guilt, hopelessness, worthlessness, and even suicide. The depressed person tends to be passive and has difficulty in initiating activities (Smith et al., 2003; WHO, 2012b).

Depression becomes a disorder when the symptoms become so severe that they interfere with normal functioning, and they continue for weeks at a time (Smith et al., 2003). Depression in its worst form can severely limited an individual's abilities to think, feel, interact with others, share a sense of purpose, work, love, experience gratification, care for others, and maintain self-responsibility (Miller & Reynolds, 2003). Depressive illness is more common in patients with physical illness than those without physical illness (Walsh, 2009). Some physical conditions may trigger depression if the condition is disabling, disfiguring or fatal (MacHale, 2002). Some patients with chronic disease may already have a previous depressive illness; others may have increased physical disability due to the depression, whereas those suffering both physical chronic illness and depression may trigger each other, for example, stress may cause both depression and stroke (Walsh, 2009).

2.2.5 Health-related Quality of Life (HRQoL)

Quality of life (QoL) can be defined in many ways, making its measurement and incorporation into study difficult. WHO (1997) defines QoL as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept, affecting in a complex way by the person's physical health, psychological state, personal beliefs, social relationships and their relationship to salient features of their environment. The concept of HRQoL and its determinants have evolved to encompass those aspects of overall QoL that can be clearly shown to influence on either physical or mental health (Centers for Disease Control and Prevention [CDC], 2012). The CDC (2012) has defined HRQoL as "an individual's or group's perceived physical and mental health over time". The physical component addresses physical functioning, role limitations due to physical problems (role physical [RP]), bodily pain, and general health aspect of HRQoL, whilst the mental component addresses social functioning, role limitation due to emotional problems (role emotional [RE]), vitality, and general mental health aspect of HRQoL (Ware, Snow, Kosinski, & Gandek, 1993). Assessment of HRQoL is increasingly important when evaluating the beneficial and harmful effects of an intervention being tested in a clinical trial. The details of HRQoL assessment in of the current study are presented in Chapter 3 (Section 3.3.4.5).

2.3 Introduction of Yoga

2.3.1 General Information about Yoga

Yoga originated from India more than 5000 years ago. Its principle is to achieve the integration and balance of body, mind, and spirit (Barnes, Bloom, & Nahin, 2008; Kappmeier & Ambrosini, 2006). Yoga is a method of reaching higher states of consciousness, and developing physical and mental health and well-being (Chan, 2010). Due to the long history of yoga, there are different opinions amongst scholars in classifying the systems of yoga (Hewitt 2001). Hatha yoga is the most widely practiced kind of yoga in the West (Hewitt 2001; Yoga Alliance [YA] 2012). Hatha yoga means forceful or active yoga (Hirschl, 2010). Hatha yoga is commonly recognized as an integration of the three basic yoga components, namely asana (physical postures), pranayama (breathing exercises), and dhyana (meditation), to calm the nervous system and balance body, mind, and spirit (Barnes et al, 2008; Riley, 2004). Practicing yoga postures improves flexibility and muscular strength in a controlled fashion. Controlled breathing exercises bring psychophysiological changes, for example, abdominal breathing helps the mind to focus and is an important component of relaxation, a modulator of autonomic nervous system function; intercostal breathing strengthens the respiratory muscles and improve ventilation (Raub, 2002). Meditation aims to calm the mind (Riley, 2004). Western physiological explanations of how Hatha yoga might be effective as a therapy focuses on the following points: 1) the modulation of autonomic nervous system tone, which commonly means a reduction in sympathetic tone; 2) the simultaneous activation of antagonistic neuromuscular systems such as flexion and extension and intrasfusal and golgi tendon-organ feedback may provide a way to maintain range of motion and increased the relaxation response in the neuromuscular system; and 3) these kinds of meditative exercises seems to be able to stimulate the limbic system (Riley, 2004).

Various styles of Hatha yoga are practiced nowadays such as Ananda, Ashtanga, Bikram, Iyengar, Integral, Kripalu, Kundalini, Power, Sivananda, and Vinyasa, and each style has unique characteristics (Hewitt, 2001; YA, 2012). Some of the differences among different styles of yoga include rate at which participants cycle through poses, different emphases on body alignment during executing yogic poses, the extent to which deep or rhythmic breathing is emphasized, the extent to which attention or concentration is emphasized, where cognitive attention is directed, room temperature, and the overall intensity and difficulty of the practice session (Groessl et al., 2008). The goal of yoga practice is to achieve liberation and peace regardless the styles of yoga (Hirschl, 2010).

2.3.2 Prevalence of Yoga Use

Despite yoga's apparent popularity in Hong Kong, to the best of our knowledge, there have been no published population-based surveys of the prevalence and patterns of yoga use in Hong Kong. Three recent national population-based surveys were found which investigated the use of CAM in U.S., Australia, and Singapore, respectively. Over a 12-month period, the percentages of those interviewed used at least one forms of CAM were 38.3% in U.S. (Barnes et al., 2008), 68.9% in Australia (Xue et al., 2007), and 76% in Singapore (Lim, Chan, & Heng, 2005). The findings of these surveys indicated that yoga was one of the most commonly used CAM therapies, the percentages of survey participants that used yoga were 6.1% in U.S., 12.0% in Australia, and 1.8% in Singapore. Similar to Hong Kong, Singapore is a cosmopolitan Asian society with its culturally diversity and majority of the population is Chinese. The results of the survey conducted in Singapore may be similar to the results found in other Asian countries.

2.4 Effects of Yoga on Physical Health

Since yoga is an integration of yogic poses, breathing, and meditation, there may be a variety of possible mechanisms for the effects yoga may produce. Growing evidence has found that regular practice of yoga produces various beneficial effects on various populations.

<u>2.4.1 Effects of Yoga on Health-Related Physical Fitness Components</u>

An individual may experience different kinds and degrees of physical health benefits and improvements in functional capacity depending on how they practice yoga. Improvements in muscular strength, flexibility, and posture may be achieved when the individual practices a single yogic posture separately, whereas improved cardiorespiratory fitness may be found when the individual practices poses continuously and intensively (Lau et al., 2012). Ten healthy, untrained adults (nine females and one male), ranging in age from 18-27 years, were recruited from a campus community to participate in an eight-week yoga intervention (Tran, Holly, Lashbrook, & Amsterdam, 2001). Yoga classes were offered four times per week for eight weeks, and the subjects were required to attend minimum two yoga classes per week. Significant improvements were found in muscular strength and endurance, and maximal oxygen uptake. Another single group study recruited 26 healthy adults (20 females and six males) aged 20-58 from local campus community to participate in a yoga intervention, and 17 subjects completed the study (Cowen & Adams, 2005). The intervention was conducted for 75-minute twice weekly for six weeks. Significant improvements at follow-up were noted for all subjects in upper body and truck dynamic muscular strength and endurance, and flexibility. Gaurav (2011) conducted a randomized controlled trial (RCT), in which 30 male university students aged 18-24 years were randomly assigned to an experimental group (n = 15) or a control group (n = 15). Subjects in the experimental group participated in an 8-week yoga intervention, which consisted of five yoga practice sessions per week and each session lasted for 55 minutes. Subjects in the control group received no treatment during intervention. The subjects were evaluated pre and post intervention, and the post-pre intervention differences of dependent data between these two groups were compared. Results indicated that muscular strength significantly improved in the experimental group compared with the control group. Results of these studies provided some evidence of positive effects of short-term yoga intervention on health-related physical fitness components. However, the characteristics of these studies (e.g. uncontrolled study, small sample size, lack of power analysis, subjects were healthy and young adults, recruited from local campus communities, and predominant by particular gender) may reduce the generalizability of the results.

Stronger evidence was found in a RCT with larger sample size conducted by Chen et al. (2008). Two hundred and four healthy older adults were recruited from eight senior activity centres, and 176 subjects aged 60-75 years completed the study.

Subjects were randomly assigned to three groups based on the centres: (1) yoga intervention with meditation (n = 57), (2) yoga intervention without meditation (n = 53), (3) waitlist control (n = 66). The interventions were conducted three times per week for 24 weeks. At the end of the intervention, the three groups had significant differences in all of the physical fitness components. The body weight and body mass index (BMI) of the yoga groups were significantly lowered compared with the control group. Lower body flexibility, lower limb muscle endurance, walking speed and range of motion of both shoulder and hip joints of the subjects in the two yoga groups were all significantly higher than those in control group. Results of these four reviewed studies suggested that yoga has beneficial effects on all health-related physical fitness components on healthy adults.

2.4.2 Effects of Yoga on Back Pain

High prevalence of CAM use for back pain was found in different countries (Barnes et al., 2008; Lim et al., 2005). Back pain was one of the top conditions of CAM use in Singapore (Lim et al., 2005). Similarly, U.S. adults used CAM most often to treat back pain or problems (Barnes et al., 2008). Studies have shown that yoga is an effective management for patients with chronic low back pain (CLBP) (Hartfiel et al., 2012; Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005; Tekur, Nagarathna, Chametcha, Hankey, & Nagendra, 2012; Tekur et al., 2008). A one-week residential intensive yoga-based lifestyle program was assessed by Terku et al. (2008) for relieving pain and regaining spinal flexibility of patients with CLBP. Eighty subjects with CLBP were randomly assigned to receive treatment with yoga or physical exercise. After a week of treatment, there were significant reduction in pain-related disability and improvement in spinal flexibility in the yoga group compared to the control group. The study by Sherman et al. (2005) randomized 101 patients with CLBP to one of the following interventions: yoga, exercise, self-care book. Findings that the yoga group had better physical functioning than the other two groups at the end of intervention at 12 weeks, and had significantly better back-related function and fewer symptoms than self-care book group at the 26-week follow-up. The yoga group had more improvement than the exercise group at the 26-week follow-up, but the difference was not significant. Results of these studies suggested that yoga helps manage chronic back pain by improving one's muscular strength and flexibility, and these benefits can persist for at least several months.

2.4.3 Effects of Yoga on Chronic Diseases

In spite of its growing acceptability and known positive effects on various ailments, yoga has not been widely recognized its efforts of preventing and managing major chronic health conditions (Barnes et al., 2008; Yang, 2007). This section review published studies of yoga interventions in determining the effects of yoga on common health problems such as overweight and obesity, hypertension, hyperglycemia, and hyperlipidaemia.

2.4.3.1 Effects of Yoga on Overweight and Obesity

Findings of surveys investigating the prevalence and relationship between weight control and the CAM use suggested that adults with obesity have lower prevalence of yoga use, and similar prevalence of use of several CAM modalities, including relaxation techniques, natural herbs, massage, chiropractic medicine, tai chi, and acupuncture, compared to normal-weight individuals (Bertisch, Wee, & McCarthy, 2008; Sharpe, Blanck, Williams, Ainsworth, & Conway, 2007). Results of Sharpe et al. (2008) further suggested yoga was named by the largest proportion of respondents as their most used complementary alternative therapy for weight control in the previous 12 months in U.S., followed by meditation, massage, acupuncture, and Eastern martial arts (such as Taichi or Qigong). However, the potential effects of yoga on overweight and obesity have not been sufficiently investigated. Data from several experimental studies suggested that yoga, either alone or as a part of a lifestyle modification program including dietary changes, may improve body composition (Hegde et al., 2011; Manchanda et al., 2000; Pal et al., 2011; Sivasankaran et al, 2006; Yang et al., 2011; Yogendra et al., 2004). Most of these studies were conducted either in India or U.S. among individuals with DM 2, at high risk of CVD or with established CVD.

A few recent studies investigated the effects of yoga intervention amongst overweight and obese population. A single group study was conducted to investigate the effect of a one-week yoga camp on obesity (Telles, Naveen, Balkrishna, & Kumar, 2010). The study recruited 47 subjects who had BMI more than 30 kg/m^2 were selected from 64 overweight individuals (BMI > 25 kg/m^2) who had enrolled in the yoga camp. The subjects aged 17-68 years were all Indians. The group was assessed on the first and last day of a yoga and diet change residential program with six days of the intervention between assessments. During the intervention, subjects were required to practice yoga for five hours every day and had a low fat, high fiber, vegetarian diet. Results of this study indicated that subjects had significantly decreased BMI, waist and hip circumferences, and fat-free mass. However, the diet change of the intervention was the confounding factor that hindered the interpretation of the findings.

In another study, sixteen postmenopausal Korean women were recruited to participate in a RCT that examined the effects of 16-week yoga intervention on all variables of body composition and visceral fat (Lee, Kim, & Kim, 2012). The subjects were healthy and sedentary (mean age 54.5 ± 2.75 years) with more than 36% body fat and without menstruation for at least one year. The subjects were randomly assigned to yoga exercise group (n = 8) or to a "no exercise" control (n = 8). All outcomes were measured before and after the intervention. After the intervention, the yoga group had significantly lower body weight, body fat percentage, BMI, waist circumference (WC), and visceral fat than the control group did. The study of Littman et al. (2012) recruited 63 overweight and obese (BMI ≥ 24 kg/m^2) breast cancer survivors aged 21-75 years. The subjects were randomly assigned to a 6-month, facility-based and home-based yoga intervention (n = 32) or a waitlist control group (n = 31). The yoga group subjects were given a goal of practising five times per week, including at least one 75-minute facility-based class. Three facility-based classes were offered each week. Subjects were permitted and encouraged to attend two or three facility-based classes if they desired. WC decreased significantly more among subjects in the yoga group as compared with the control group, with no between-group differences in weight, BMI, and hip circumference. Nonetheless, the study's ability to detect differences was limited by the small sample size (Lee et al., 2012) and potential uncontrolled variation in exposure to the intervention (Littman et al., 2012). Further research is needed to improve our understanding of the effects of yoga on overweight and obesity.

2.4.3.2 Effects of Yoga on Hypertension

A number of research studies have shown that yoga can reduce blood pressure of individuals with various health conditions, such as healthy adults (Chen et al., 2008; Cowen & Adams, 2005; Harinath et al., 2004), postmenopausal overweight and obese women (Innes & Selfe, 2012; Lee et al., 2012), individuals at high risk for DM 2 (Yang et al., 2011), individuals with cardiovascular risk factors (Cade et al., 2010; Sivasankaran et al., 2006), and patients with established coronary artery disease (CAD) (Pal et al., 2011).

Growing research is focusing on determining the efficacy of yoga in prevention and control of hypertension. A RCT was conducted to measure the efficacy of physical exercise, reduction in salt intake, and yoga, in lowering blood pressure among Indian adults aged 20-25 years with pre-hypertension (SBP 130-139 mmHg and/or DBP 85-89 mmHg) and hypertension (Saptharishi et al., 2009). A total of 113 subjects were randomly assigned to control (I), physical exercise (II) – brisk walking for 50-60 minutes, four days/week, salt intake reduction (III) – to at least half of their previous intake, and yoga (IV) – for 30-45 minutes/day on at least five days per week (30, 28, 28, and 27 subjects in groups I, II, III, and IV, respectively). The intervention lasted for two months and assessments were conducted before and after intervention. A total of 102 subjects (29, 27, 25, and 21 subjects in groups I, II, III, and IV, respectively) completed the study. All three intervention groups demonstrated a significant reduction in blood pressure, and there was no significant change of blood pressure in control group (I). Findings of the study suggested that yoga, physical exercise, and salt intake reduction were all effective non-pharmacological interventions in significantly reducing blood pressure among young pre-hypertensives and hypertensives.

Another RCT was conducted in U.S. evaluating the physiologic effects of a 12-week yoga program compared with an enhanced usual care (EUC) (based on individual dietary adjustment) in adults with untreated prehypertension to Stage I hypertension (Cohen et al., 2011). The study recruited 78 adults between the ages of 22 and 69 years with untreated SBP ≥ 130 mmHg but < 160 mmHg, and DBP < 100 mmHg. Average SBP (24 h SBP) and average DBP (24 h DBP) were measured by 24-hour ambulatory monitoring at Weeks 0, 6 and 12. In total, 26 and 31 subjects in the yoga and EUC arms, respectively, completed the study. In spite of no differences in both 24 h SBP and 24 h DBP between these two arms at Weeks 6 and 12, the yoga arm was found to have significant reduction of 24 h SBP and 24 h DBP at 12 weeks. The findings suggested that a 12-week yoga intervention may produce clinically meaningful improvements in 24 h SBP and DBP. Larger studies are needed to establish the efficacy of yoga intervention in prevention and control of hypertension.

2.4.3.3 Effects of Yoga on Hyperglycemia

There is notably growing evidence that yoga may aid in the prevention and management of hyperglycemia and DM 2. Significant reductions of insulin and FBG have been reported in some short-term randomized controlled yoga studies investigating subjects at risk for DM 2 (Lee et al., 2012; Yang et al., 2011). A U.S. study recruited 23 subjects at high risk for DM 2 and a significant improvement in insulin in the yoga intervention group compared with the educational group over a three-month intervention period was found (Yang et al., 2011). The study which was previously discussed (Section 2.5.3.1) also shown that significant declines in insulin and FBG have been found in obese postmenopausal women who participated in a 16-week of yoga intervention compared to their control counterparts.

Several recent publications reported beneficial influences of yoga in diabetic populations. A total of 132 Indian patients aged 20-74 years participated in three uncontrolled trials were conducted to evaluate the short term (ranging from eight days to six weeks) of yoga intervention in DM 2 (Bijlani et al., 2005; Madanmohan, Bhavanani, Dayanidy, Sanjay, & Basavaraddi, 2012; Singh et al., 2001). All showed a significant reduction of FBG after short-term yoga interventions. These studies did not include an appropriate control group, thus it is difficult to assess any confounding factors that might have contributed to the changes observed. Positive impact of yoga for managing hyperglycemia and DM 2 were also shown in two non-RCTs from India (Hegde et al., 2011; Mahapure, Shete, & Bera, 2008). Forty diabetes aged 40-55 years were assigned to receive either regular anti-diabetes therapy (n = 10) or regular anti-diabetes with additional yoga programs (n = 30). Subjects in the yoga group were required to attend one-hour yoga practice session everyday consecutively for six weeks except on Sundays. Results of the trial revealed that yoga enhanced superoxide dismutase level and reduced glycosylated Hb and FBG levels in the yoga group as compared to the control group (Mahapure et al., 2008). Another trial with larger sample size and longer intervention duration was conducted by Hegde et al. (2011). The trial involved 123 patients assigned to receive either standard care or standard care along with additional yoga. Compliance with the intervention was defined as attendance for at least three days per week at the yoga centre for three months. Yoga subjects achieved significant improvement in FBG, HbA1c, malondialdehyde, glutathione and vitamin C at three months compared with the standard care group. No significant changes in superoxide dismutase and vitamin E were observed between the two groups.

Two previous RCTs have been published and demonstrated contradictory results (Gordon et al., 2008; Skoro-Kondza, Tai, Gadelrab, Drincevic, & Greenhalgh, 2009). The Cuba trial consisted of 231 patients with DM 2 were assigned to (1) Hatha yoga group (n = 77), (2) conventional physical training exercise group (n = 77), and (3) control group (n = 77) (Gordon et al., 2008). The groups (1) and (2) were trained for 24 weeks in basic exercise techniques, diabetes education and instructions. Subjects in group (1) were required to attend one weekly two-hour yoga class for 24 weeks along with home exercise, whereas subjects in group (2) also attend one weekly two-hour class and were engaged mainly in aerobic exercise. All 231 subjects completed the study. Significant increase of superoxide dismutase and reductions of FBG and malondialdehyde were found in groups (1) and (2) after intervention. This study demonstrated the efficacy of yoga intervention on FBG, oxidative stress markers and antioxidant status in patients with DM 2. The study of Skoro-Kondza et al. (2009) recruited 59 subjects with DM 2 not taking insulin and randomly assigned subjects to either yoga intervention or control groups. The intervention group was offered 12 weeks of a twice-weekly 90-minute yoga class, whereas the control group was a waiting list for the yoga classes. Both groups received advice and leaflets on healthy lifestyle and were encouraged to exercise. The primary outcome was HbA1c and secondary outcomes included FBG, WC, BMI, QoL, and self-efficacy. On an intention-to-treat (ITT) basis, there was no difference in any outcome measure between two groups. This exploratory trial failed to demonstrate a significant impact of yoga in DM 2. The limitations characterizing most studies hinder us to draw firm conclusions of the effects on hyperglycemia. Thus, further high-quality RCTs are needed to confirm the effects of yoga on hyperglycemia.

2.4.3.4 Effects of Yoga on Hyperlipidaemia

Various studies demonstrated significant decreases in TG and low-density lipoprotein cholesterol (LDL-C) and significant increase in HDL-C (Bijlani et al., 2005; Lee et al., 2012; Madanmohan et al., 2012). The significant reduction of total cholesterol (TC) was also well documented (Bijlani et al., 2005; Gorden et al., 2008; Lee et al., 2012; Madanmohan et al., 2012).

Two Indian studies determined the effects of yoga intervention on lipid profile in coronary artery disease (CAD) patients. Manchanda et al. (2000) evaluated possible role of yoga lifestyle intervention on retardation of CAD. In this RCT, forty-two men with CAD aged 32-72 years were randomized to yoga intervention (n = 21) and control groups (n = 21) and followed for one year. The yoga group was treated with a user-friendly program consisting of yoga, risk factor control, diet control and moderate aerobic exercise, whereas the control group was managed by risk factor control and American Heart Association (AHA) step I diet. All subjects completed the study, and the yoga group demonstrated significant reduction in TC, LDL-C, and TG as compared with the control group at the follow-up. The results of Manchanda et al. (2000) should be interpreted with caution, as “moderate aerobic exercise” of the yoga intervention was not controlled in the study, the potential confounding effect, which exerted by the “moderate aerobic exercise”, should be taken into consideration. Another recent RCT (Pal et al., 2011) recruited 170 CAD patients of both sexes between the ages of 40 and 75 years and randomly assigned to the yoga group (n = 85) and control group (n = 85). The yoga group subjects attended five 35-40 minute yoga classes a week for six months. One hundred and fifty four subjects completed the study and significant improvement in TC, TG, LDL-C, and HDL-C were observed in the yoga group compared with the control group. Yoga may have beneficial influences of lipids in individuals who at risk of CVD and patients with CAD. Nonetheless, the generalizability of the evidence was limited by the particular population (i.e. Indian CAD patients). The findings may be confirmed by further RCTs conducted in other countries.

2.5 Effects of Yoga on Mental Health

2.5.1 Effects of Yoga on Mental Health Problems

Mental health problems such as stress, anxiety, and depression are amongst the most common reasons for individuals seek CAM (Barnes et al., 2008; Pilkington et al., 2005). In recent years, researchers have begun to evaluate the effectiveness of yoga on stress, anxiety, and depression (da Silva et al., 2009; Li & Goldsmith, 2012; Pilkington et al., 2005).

2.5.1.1 Effects of Yoga on Stress

Growing research has been conducted to determine the impact of yoga on stress. Positive impact of yoga on stress relief has been suggested by studies evaluated different populations such as healthy individuals (Cowen & Adams, 2005; Rocha et al., 2012; West, Otte, Geher, Johnson, & Mohr, 2004), distressed women (Michalsen et al., 2005), pregnant women (Satyapriya, Nagendra, Nagarathna, & Padmalatha, 2009), menopausal women (Chattha, Raghuram, Venkatram, & Hongasandra, 2008; Innes & Selfe, 2012), and patients suffering from breast cancer (Bower et al., 2012; Vadiraja et al., 2009), and chronic back pain (Hartfiel et al., 2012).

Perceived Stress Scale (PSS), a widely used psychological instrument for measuring perception of stress, was used in all these identified studies, except the Rocha et al. (2012) study. The Rocha et al. (2012) study used the LSSI, a psychological evaluation tool validated for use in Brazil, to identify the symptoms of stress presented by the subjects by registering the prevalence of physical and psychological symptoms as well as the stress stage. Amongst these ten identified studies, two were uncontrolled studies, two were non-RCTs, and six were RCTs. Studies varied in length of intervention ranging from six weeks (e.g. Vadiraja et al., 2009) to six months (e.g. Rocha et al., 2012), except the West et al. (2004) study, which investigated the effect of single bout of yoga session.

The aim of the West et al. (2004) study was to examine stress response to Hatha yoga and African dance. Sixty-nine healthy college students participated in one of three 90-minute classes: Hatha yoga (n = 18), African dance (n = 21), or a Biology lecture as a control session (n = 30). Before and after each condition, subjects completed the PSS. Both Hatha yoga and African dance groups have shown significant decline in PSS, whereas there was no significant change in the control group. Findings of the study indicated both Hatha yoga and African dance reduced perceived stress in a short-term. Harfiel et al. (2012) conducted a RCT to determine the effectiveness of a yoga-based intervention for reducing perceived stress and back pain at work. Subjects were recruited from a British local government authority, and randomized into a yoga group who received one 50-minute yoga session each week for eight weeks and a 20-minute DVD for home practice, or a control group who received no intervention. Baseline and end-programme measurements of self-reported stress and back pain were assessed with the PSS and Roland Morris Disability Questionnaire, respectively. Thirty-seven subjects were randomly assigned in each group, and 33 subjects in yoga group and 26 subjects in control group competed the study. When compared with the control group at the end of the intervention, the yoga group scores were significantly lower for perceived stress and back pain.

2.5.1.2 Effects of Yoga on Anxiety

Increasing evidence has shown the beneficial effects of yoga on the signs and symptoms of anxiety. Eleven trials noted a significant decrease in anxiety symptoms when a yoga intervention was implemented in different populations, for example, healthy individuals (Ganpat & Nagendra, 2011; Gururaja, Harano, Toyotake, & Kobayashiko, 2011; Rocha et al., 2012; Streeter et al., 2010), distressed women (Michalsen et al., 2005), menopausal women (Innes & Selfe, 2012), individuals experiencing mild depression without psychiatric diagnosis or treatment (Woolery et al., 2004), psychiatric inpatients (Lavey et al., 2005), and patients suffering from cancer (Vadiraja et al., 2009), chronic back pain (Tekur et al., 2012), and migraine (John, Sharma, Sharma, & Kankane, 2007). However, interpretation of the findings of these trials were hindered by limitations, such as lack of a control group (Lavey et al., 2005; Ganpat & Nagendra, 2011; Gururaja et al., 2011), lack of randomization (Rocha et al., 2012; Woolery et al., 2004), small sample size (Innes & Selfe, 2012; Streeter et al., 2010), and widely varied length of intervention ranging from five weeks (e.g. Woolery et al., 2004) to six months (e.g. Rocha et al., 2012) (except a one-week intensive residential intervention of the Tekur et al. (2012) study).

Two RCTs were conducted with larger samples to determine the effects of yoga on anxiety. Seventy-two patients with migraine without aura were randomly assigned to yoga intervention or self-care control groups, thirty-six subjects in each group (John et al., 2007). The Hospital Anxiety Depression Scale (HADS) was used in pre- and post-intervention assessments as the scale is designed for evaluating anxiety and depression in physically ill populations. During the three-month intervention, the yoga group patients attended a 60-minute yoga practice session for five days a week, whereas the control group patients were contacted once a month for an educational session on migraine. Thirty-two yoga subjects and 33 control subjects completed the post-intervention assessment. Anxiety was significantly lower in the yoga group compared to control group. Vadiraja et al. (2009) recruited 88 stage II and III breast cancer outpatients to participate in yoga (*n* = 44) or brief support therapy (*n* = 44). Interventions were conducted over a six-week period for both groups. The yoga group patients were required to attend a minimum of three in-person sessions in the hospital per week and to practice at home on the remaining days. Each in-person session lasted for one hour. The control group patients received brief support therapy with education during the intervention period. HADS was used to assess the anxiety of the patients immediately before and after the intervention. Four-two yoga patients and 44 control patients completed the study. Results of the study have shown that significant decrease in anxiety in the yoga group compared with the control group.

2.5.1.3 Effects of Yoga on Depression

There is an increasing scientific interest in the potential effectiveness of yoga intervention for the treatment of depression symptoms. Three uncontrolled trials (Ganpat & Nagendra, 2011; Lavey et al., 2005; Uebelacker et al., 2010), four non-RCTs (Bosch et al., 2009; Michalsen et al., 2005; Rocha et al., 2012; Woolery et al., 2004), and five RCTs (Bower et al., 2012; Chen et al., 2010; John et al., 2007; Tekur et al., 2012; Vadiraja et al., 2009) were identified. These studies provide some encouragement that yoga may be helpful for depression in a variety of populations such as healthy individuals (Chen et al., 2010; Ganpat & Nagendra, 2011; Rocha et al., 2012), distressed women (Michalsen et al., 2005), individuals experiencing mild depression without psychiatric diagnosis or treatment (Woolery et al., 2004), psychiatric inpatients (Lavey et al., 2005), and patients suffering from cancer (Bower et al., 2012; Vadiraja et al., 2009), chronic back pain (Tekur et al., 2012), depression (Uebelacker et al., 2010), migraine (John et al., 2007), and rheumatoid arthritis (Bosch et al., 2009).

However, the methodological heterogeneity makes it difficult to draw any generalizable conclusions. Trials varied in duration of intervention ranging from five weeks (e.g. Woolery et al., 2004) to 24 weeks (e.g. Chen et al., 2010). Seven out of 12 identified trials were either uncontrolled trials or non-RCTs, hence findings of these trials may provide evidence in feasibility of yoga intervention, but failed to evaluate the efficacy of the yoga intervention for depression. Small sample size (Bower et al., 2012) and residential intervention (Tekur et al., 2012) were found in two RCTs, these characteristics also hindered the interpretation of the results. Chen et al. (2010) conducted a RCT that recruited 69 elderly residents of assisted living facilities to participate in either yoga exercise intervention (n = 38) or control group (n = 31). The yoga group subjects attended supervised yoga program (three times per week at 70 minutes per practice session for 24 weeks), whereas the control counterparts were instructed to follow their usual daily activities and invited to participate in the yoga program after completion of the study. A total of 55 subjects completed the study, and their depression symptoms were evaluated using Taiwanese Depression Questionnaire in both pre- and post-intervention assessments. After six months of intervention, the yoga group had significantly lower depression as compared with the control group. Further research is needed in order to make any definitive conclusions about the effectiveness of yoga for depression.

2.5.2 Effects of Yoga on Health-Related Quality of Life

Noncommunicable chronic diseases are conditions that tend to stay with individuals for a long period of time and often require prolonged periods of treatment. Health-related quality of life of individuals suffering from chronic diseases may be badly affected when such chronic conditions are not properly controlled. Increasing evidence has shown yoga may help improve not only the HRQoL of healthy seniors (Oken et al., 2006), but also individuals suffering from variety of chronic conditions such as breast cancer (Culos-Reed, Carlson, Daroux, & Hately-Aldous, 2006; Galantion et al., 2012; Moadel et al., 2007), chronic low back pain (Tekur, Singphow, Nagendra, & Raghuram, 2010), osteoarthritis (Ebnezar, Nagarathna, Bali, & Nagendra, 2011), experiencing mild or moderate levels of stress (Smith, Hancock, Blake-Mortimer, & Eckert, 2007), and schizophrenia (Visceglia, & Lewis, 2011).

The HRQoL of these studies was measured with widely used and extensive validated instruments such as European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) (Culos-Reed et al., 2006), the Functional Assessment of Cancer Therapy (FACT) (Galantion et al., 2012; Moadel et al., 2007), the MOS 36-Item Short-Form Health Survey (SF-36) (Ebnezar et al., 2011; Oken et al., 2006; Smith et al., 2007), and WHOQoL-BREF (Tekur et al., 2010; Visceglia, & Lewis, 2011). All these identified studies that were RCTs with intervention in length ranging from seven weeks (e.g. Culos-Reed et al., 2006) to six months (e.g. Oken et al., 2006), with the frequency of the yoga practice session of the intervention varying from one session a week (e.g. Moadel et al., 2007) to six session a week (e.g. Ebnezar et al., 2011), and with the duration of a yoga practising session ranging from 40 minutes (e.g. Ebnezar et al., 2011) to 90 minutes (e.g. Galantion et al., 2012). For example, the study of Culos-Reed et al. (2006) examined the physical and psychological benefits afforded by short yoga program for breast cancer survivors. All subjects were screened and randomly assigned to intervention (*n* = 20) and control (*n* = 18) groups. The yoga program consisted of a weekly 75-minute yoga class for seven weeks. All subjects completed the pre- and post-intervention assessment immediately before and after the intervention, respectively. Significant differences between the intervention and the control groups at post-intervention were seen only in psychosocial variables (global quality of life and emotional function). Smith et al. (2007) conducted the RCT with sufficiently large sample, in which 131 subjects with mild to moderate levels of stress were recruited to participate in ten weekly one-hour sessions of Hatha yoga (*n* = 68) or relaxation (*n* = 63). Following the 10-week intervention, sixty-five yoga subjects and 53 control relaxation subjects completed the post-intervention assessment. Results of the study suggested that yoga was more effective in improving mental health domains of the SF-36 than relaxation.

The degree of impact on HRQoL varied according to the types of chronic disease (Lima et al., 2009). To the best of our knowledge, there is limited evidence of the effects of yoga on HRQoL of individuals with chronic conditions such as obese, hypertension, hyperglycaemia, and hyperlipidaemia (Skoro-Kondza et al., 2009). It is not possible to say that yoga is effective in improving HRQoL of individuals with the above chronic conditions. However, the results of the eight identified studies provided encouraging results. Additional research is needed to investigate the effects of yoga on HRQoL among individuals with various kinds of chronic diseases.

2.5.3 Effects of Yoga on Global Self-Esteem

Despite growing research regarding to the above psychosocial variables, research into the effects of yoga on self-esteem is very limited (Deshpande, Nagendra, & Nagarathna, 2009; Elavsky & McAuley, 2007). In the study of Elavsky and McAuley (2007), previously low-active menopausal women (*n* = 164) were randomly assigned to participate in walking (*n* = 63), yoga (*n* = 62), and control groups (*n* = 39). During the four-month duration of the trial, subjects in walking group and yoga groups were required to attend structure and supervised walking program meeting three times a week for one hour and a yoga program meeting twice a week for one hour, respectively. Pre- and post- intervention assessments were conducted immediately before and after the intervention, respectively. Global self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSES). Findings of this study have shown that both the yoga and walking interventions failed to enhance global self-esteem.

Deshpande et al. (2009) examined the efficacy of yoga on self-esteem in normal healthy adults. Two hundreds and twenty-six subjects aged 18-71 years were randomly allocated to the yoga (*n* = 109) and physical exercise control groups (*n* = 117). Subjects of yoga and control groups participated in yoga intervention and mild to moderate physical exercise, respectively. Both groups had supervised practices for one hour daily, six days a week, for eight weeks. Self-Esteem Questionnaire (SEQ) was employed to assess subject's the self-esteem components (competency, global self-esteem, moral and self-esteem, social esteem, family self-esteem, body and physical appearance, and the lie scale). One hundred and seventy-four subjects completed the study, and the yoga group (*n* = 87) showed significant increase in global self-esteem after the intervention, whereas control group (*n* = 87) also showed increase in global self-esteem but it was not significant. This analysis failed to demonstrate the between-group difference, therefore, the results of the study failed to confirm the positive impact of yoga on global self-esteem. Though active control group was adopted in Deshpande et al. (2009), inactive control group was absence, and thus the study might fail to isolate potential contributing factors or determine causal effects. Due to limited research has evaluated the effect of yoga on self-esteem and the methodological problems of the existing literature, further well-conducted investigation of the effect of yoga on self-esteem is warranted.

2.6 Potential Yoga Induced Psychophysiological Changes

Positive impacts of yoga on physical and mental health were discussed in previous sections, however, most of the literature have not discussed on the mechanisms of these observed changes. Researchers believe that yoga may improve physical and mental health by down-regulating HPA axis and SNS (Ross & Thomas, 2010). The potential mechanisms of yoga-induced psychophysiological changes include reducing the activation and reactivity of the SNS and the HPA axis (Innes, Vincent, & Taylor, 2007), and counteracting the aroused autonomic nervous system (ANS) activity and reversing it back to the relaxed state (Levine 2000; Michalsen et al., 2005). Limited research has explored the yoga-induced changes. For example, evidence has shown improved sympathetic and parasympathetic reactivity with pranayama practice in hypertensive patients (Mourya, Mahajan, Singh, & Jain, 2009); reduced stress and an improved adaptive autonomic response to stress in healthy pregnant women (Satyapriya et al., 2009), and significant reductions in noradrenline, self-rated stress, and stress behaviour were found in a randomized controlled study that investigated the effects of yoga on healthy individuals (Granath, Ingvarsson, von Thiele, & Lundberg, 2006). Further research is warranted for better understanding of the above yoga-induced changes and exploration of other effects of yoga on HPA axis.

Recently, growing studies examined the effect of yoga on cortisol level. West et al. (2004) examined the effects of Hatha yoga and African dance on salivary cortisol. Sixty-nine healthy college students (17-24 years old) participated in one of the three 90-minute classes based on personal preference: Hatha yoga (n = 18), African dance (n = 21), or a Biology lecture as a control session (n = 30). All classes took place with the 2-hour period of 4:00 pm to 6:00 pm. The salivary samples were collected before and after the classes. Results of the study suggested that there was a significant main effect for salivary cortisol ($p < 0.05$) and a significant interaction effect ($p < 0.0001$) such that cortisol decreased in Hatha yoga, increased in African dance, and did not change in the control session. Michalsen et al. (2005) recruited a sample of 11 experienced yoga practitioners, who practiced yoga for at least three month under the supervision by the same yoga teacher, to provide salivary cortisol samples before and after a yoga session which held from 8:00 pm to 9:30 pm. A significant decrease in salivary cortisol level (p = 0.029) was found in the study. Both West et al. (2004) and Michalsen et al. (2005) examined the acute effects of yoga, and these findings did not reflect the effects of repeated practice over time for salivary cortisol level. Moreover, the strength of the above evidence was limited by methodological problems, such as both studies were non-RCTs and small sample size. Also, West et al. (2004) did not mention if the participants had previous yoga experience. Future research with better study settings (such as participants are randomly assigned to the intervention or control condition, larger sample size, longer intervention period) is warranted for better understanding on the effect of yoga on salivary cortisol levels.

Woolery et al. (2004) conducted a RCT, which examined the effect of a 5-week yoga intervention on salivary cortisol level. Twenty-eight participants (18-29 years old), who were experiencing mild levels of depression and had no previous yoga experience, were randomly assigned to the yoga group (n = 13) and the control group (n = 15). During the course of the study, the yoga group attended two 1-hour yoga classes each week for five week, whereas the control group (n = 15) were asked to maintain their routine activities and not to begin any yoga or other mind-body program. One yoga participant and two control participants dropped out of the study. Salivary cortisol samples were obtained from the participants immediately upon awakening in three mornings (pre-test, midcourse, post-test). Results of the study suggested that there was a trend for higher morning salivary cortisol levels in the yoga group by the end of the yoga course, compared to controls (p = 0.08). The salivary cortisol samples were collected upon awakening in the mornings, while the salivary cortisol samples were collected before and after the yoga intervention session in both West et al. (2004) and Michalsen et al. (2005). Thus, comparison across the existing evidence is not possible. Further studies with more stringent study design are needed.

2.7 Potential Adverse Effects of Yoga

Similar to other physical activities and with the increased physical vulnerabilities present in an ageing population, the major adverse effects of yoga include musculoskeletal injuries (Jayasinghe, 2004; USHHS, 1996). Injuries may be due to incorrect movements, overtraining, and overuse of the muscles. The common injuries found when practicing yoga include strains as a result of falling down when executing balancing poses; muscle or tendon tears due to overstretching the muscle when executing stretching poses; and muscle soreness, muscle stiffness, and even bone fractures caused by spinal misalignment when performing weight-bearing poses repeatedly and incorrectly (Lau et al, 2012). Even though regular physical activity improves cardiorespiratory fitness, it can also increase the risk of serious cardiac events (for example sudden death) for sedentary individuals who suddenly exercise vigorously (USHHS, 1996). Yoga can be considered as a safe form of physical activity if practiced under the guidance and supervision of a qualified instructor who has a solid understanding of common medical conditions and their associated risks, as well as an ability to use this knowledge as a foundation for creating a safe and effective yoga practice (Krucoff, Carson, Peterson, Shipp, & Krucoff, 2010).

2.8 Summary

Evidence-based research has demonstrated some positive physiological and psychological effects of yoga in different populations under a variety of conditions, such as back pain, overweight and obesity, hypertension, hyperglycemia, hyperlipidaemia, stress, anxiety, and depression. However, existing studies reported by English language indexed journals are limited by methodological problems. In addition, research on the yoga participation of Hong Kong was absent. Thus, further investigations of the physiological and psychological effects of yoga and prevalence of yoga use with rigorous methodological design are needed. The purpose and significance of the present study was to address these gaps in knowledge.

CHAPTER 3 METHODOLOGY

This chapter describes the research methodology of this study. The research design for achieving the objectives of this study is discussed. The mixed methods research approach adopted in the study is briefly described, then followed by the detail methodologies of the quantitative and qualitative studies. The final section discusses the ethical considerations in conducting the current study.

3.1 Research Design

The objectives of the study were twofold:

1. To determine the effects of Hatha yoga intervention on physical and mental health.
2. To explore the perceived benefits, barriers, and cues to action of yoga of individuals with and without yoga experiences.

In order to achieve the above objectives, a mixed methods approach, consisting of both quantitative method and qualitative method, was employed.

To achieve the objective 1, a quantitative method (Study One) was adopted to determine the effect of Hatha yoga intervention on the following outcome variables:

1. Metabolic risk factors including waist circumference, systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood glucose (FBG), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), and MetS z score
2. Physical activity level (PAL)
3. Health-related physical fitness components including body composition (body weight and BMI), cardiovascular endurance (resting heart rate and VO_{2max}), muscular strength and endurance (results of Curl-up Test and Push-up Test), and flexibility

4. Cortisol level
5. Psychological variables including self-esteem, perceived stress, state anxiety, trait anxiety, and depression
6. Health-related quality of life (HRQoL)

To achieve objective 2, a qualitative method (Study Two) was used to explore the following perceptions from individuals with and without yoga experiences:

1. Benefits of regular yoga practice of individuals with and without yoga experiences
2. Barriers of regular yoga practice of individuals with and without yoga experiences
3. Reasons for discontinuing yoga practice of individual with yoga experiences
4. Reasons for not initiating yoga practice of individual without yoga experiences

The mixed methods design allows the researcher to obtain more comprehensive findings by incorporating the data collected from both quantitative and qualitative methods. Further detail of mixed methods is presented in the next section.

3.2 Mixed Methods

Growing number of health researches have been applying mixed methods (O'Cathain, 2010). Mixed methods approaches involve "mixing" qualitative and quantitative methods in one study (or among several studies) to best address a research question or questions (Hays & Singh, 2012). Concerning the complexity of health, health care, and the environment in which health research is undertaken, researchers require the application of mixed methods in order to address the research issue widely and generate a more thorough picture of a research topic (Guest, MacQueen, & Namey, 2012). Use of mixed methods can also offset some of the limitations of qualitative and quantitative methods, allow an expansion of the findings with a more comprehensive picture; and increase confidence in findings when the results from two different methods coincide, thereby increasing the validity and explanatory power of the study (Hays & Singh, 2012; O'Cathain, 2010).

Six mixed methods strategies were commonly described in the literature, namely sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent embedded, and concurrent transformative strategies (Creswell, 2009). This study employed the concurrent triangulation strategy, which is the most common strategy whereby both methods are used simultaneously to confirm or converge findings in a single study (Hays & Singh, 2012). Concurrent triangulation strategy has several advantages according to Creswell (2009), this approach generally uses separate quantitative and qualitative methods as a mean to offset the weakness inherent within one method with the strengths of the other, and also the strength of one method adds to the strength of the other. The approach can also result in well-validated and substantiated findings. Moreover, the data collection through concurrent triangulation strategy results can shorten the data collection time as compared to those sequential strategies as both the quantitative and qualitative data are gathered at one time. The researcher found that concurrent triangulation strategy was appropriate to address research questions of the study, because the researcher was able to integrate the quantitative data of Study One and qualitative data of Study Two. Quantitative data of Study One presented the finite effects of Hatha yoga intervention on novice practitioners, while the qualitative data of Study Two described the long lasting effects of yoga practice on experienced practitioners.

The qualitative findings of Study Two might provide information to help explain the quantitative intervention findings of Study One.

3.3 Methodology of Study One: A Quantitative Study

Study One, a quantitative study, was conducted to investigate the effects of a 12-week Hatha yoga program on physical and mental health. Several quantitative assessments were adopted in the study for assessing various aspects of physical and mental health.

3.3.1 Sample and Sampling of Study One

In order to ensure acceptance of the protocol, we relied on a quota sample, a type of nonprobability sample, which begins with a kind of matrix or table that creates cells or strata (Berg & Lune, 2012). Quota sampling is a nonprobability sampling procedure in which the population is divided into mutually exclusive subcategories, and interviewers or other data collectors solicit participation in the study from members of the subcategories until a target number of elements to be sampled from the subcategories have been met (Daniel, 2012). The researcher used gender and the number of NCEP-ATP III clinical diagnosis criteria for Asian populations as quota controls. With reference to the experiences of other yoga studies (Chen et al., 2008; Chen, Tseng, Ting, & Huang, 2007; Cowen & Adams, 2005; John et al., 2007; Oken et al., 2006; Sherman et al., 2005; Smith et al., 2006), the researcher anticipated that the number of female applicants would be much more than that of male applicants, thus gender was considered as a quota control to ensure the proportions of male and female participants in the yoga and control groups would be similar. Moreover, since the researcher planned to conduct two subgroup analyses which evaluated the MetS sample (consisting of participants who met at least three NCEP-ATP III clinical diagnosis criteria for Asian populations) and non-MetS sample (consisting of participants who met less than three NCEP-ATP III clinical diagnosis criteria for Asian populations), the number of NCEP-ATP III clinical diagnosis criteria for Asian populations was considered as a quota control to ensure the study would have sufficient number of MetS and non-MetS participants recruited for further subgroup analyses. Due to the special features of quota sampling, the representation of the sample and the ability to compare subgroups in the population were enhanced; data collector error was reduced; the inclusion of members of different subpopulations was ensured; and the stratification of population into the sampling process was introduced (Daniel, 2012).

3.3.2 Selection of Participants of Study One

All participants were screened for inclusion and exclusion criteria. The participants were included if they were Chinese and able to communicate in Cantonese, aged 18 or above, and physically and mentally capable of practicing yoga safely. Participants were not eligible for the study if they met any of the following situations:

1. Regular participation of (> 1/week) yoga for last three months or concurrent use of yoga, Qigong or meditation;
2. Pregnancy or breast feeding;
3. Anticipation of any planned life stressors (moving, divorce, changing job, etc.), shift work, or transcontinental travel during the intervention of the study
4. Undergoing any other concurrent nonpharmacological treatment of metabolic syndrome (MetS)

5. Suffering chronic illnesses such as cancer, kidney disease, cirrhosis, rheumatologic diseases, or chronic inflections
6. Suffering major psychiatric illnesses
7. Experiencing cognitive impairment or substance abuse
8. Concurrently participation in any other studies, experimental therapies, or blinded treatments.

If there would be change of participants' health status such as major psychiatric illnesses, chronic illnesses, chronic inflections, cognitive impairment, substance abuse or pregnancy would be found during the participation of the study, these participants were required to inform the researcher and be excluded from the study.

<u>3.3.3 Sample Size Determination of Study One</u>

Metabolic risk factors (waist circumference, fasting blood glucose, blood pressure, HDL-C, and triglyceride) and salivary cortisol were the primary outcomes of Study One. Among the above six primary outcomes, the cost of measuring salivary cortisol was the highest compared with the rest of the outcome valuables when we prepared the budget plan of the study. Thus, the change of salivary cortisol was adopted when we estimated the sample size.

Due to a lack of local research experience in running Hatha yoga intervention within the community, the researcher estimated the attrition rate by referring to three overseas studies with similar study setting which illustrated a 22.0% attrition for a 12-week Hatha yoga program (Moadel et al., 2007), a 15.3% attrition for a 10-week Hatha yoga program (Smith et al., 2007), and a 8.33% attrition for another 10-week program (Booth-LaForce et al., 2007). Because the study intervention duration lasted for 12 weeks, a 22.0% attrition rate was estimated. Based on an earlier study (West et al., 2004), a sample size of 36 participants per group was required to obtain an 80% power for detection of a difference of 0.08 g/dl in salivary cortisol level between the yoga group (intervention group) and the control group when performing a two-tailed test at $\alpha = 0.05$. With consideration of 22% attrition rate, the target sample size of Study One was determined to be 46 participants for each group.

3.3.4 Recruitment Process of Study One

Newspaper advertising, website, mass-mailing, and distribution of flyers were used to recruit participants. An information sheet of the study (see Appendix A) and enrolment form (see Appendix B) were given to an individual who contacted the researcher after the release of the advertisement. The enrolment form recorded the participants' name, telephone numbers, email addresses (if available), gender, date of birth, age, education level, employment status, marital status, physical measurements, medical history, lifestyle and healthy behaviours including smoking, alcohol drinking and weight management, and availability of attending yoga class. The researcher screened all enrolment forms, and classified those who met the aforementioned inclusion criteria presented as "prospective participant". The prospective participants were assigned to either yoga or control group according to quota controls described in section 3.3.1. To ensure acceptance of the protocol, the waitlist control participants were offered a free 12-hour Hatha yoga program upon completion of the trial. The researcher invited the prospective participants to participate in the study through telephone contact.

If the prospective participants were interested in participating in the study, they were then provided with the schedule of briefing sessions, intervention assessment sessions and yoga class for their consideration of participation. The prospective participants were given one week to consider if they would accept the invitation.

The eligibility of the prospective participant was reconfirmed at the beginning of the briefing session. The researcher then provided a written explanation of the procedures supplemented by verbal explanation. The prospective participants were encouraged to ask questions about the study, and asked to sign the consent form (see Appendix C). The researcher then checked if the participants required consulting their doctors prior becoming much more physically active by The Physical Activity Readiness Questionnaire (PAR-Q & YOU) (CSEP, 2002). The Chinese version of PAR-Q & YOU (LCSD, 2010) was applied in this study (see Appendix D). The researcher then fixed the schedule of baseline assessment session with each participant. Due to the number of prospective participants outweighed the sample size of Study One, the rest of the prospective participants were invited to participate in Study Two.

3.3.5 Data Collection Method of Study One

In this study, the instruments with established validity and reliability were used to measure the metabolic related risk factors, health-related physical fitness components, cortisol level, psychological variables, and HRQoL of the participants. The information of the instruments used was described in detail as follows:

3.3.5.1 Instruments Used to Measure Metabolic Related Risk Factors

The following instruments were used to measure metabolic related risk factors, including waist circumference (WC), blood pressure, fasting blood glucose (FBG), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), and MetS z score:

Waist circumference (WC)

WC was measured at the nearest 0.1 cm at the shortest point below the lower rib margin and the iliac crest.

Blood pressure

Blood pressure was measured using the automatic blood pressure device (HEM7011, Omron, Japan). According to American Heart Association (AHA) blood pressure measurement recommendations (Pickering et al., 2005), the participant was requested to remove all clothing that covered the location of cuff placement. The participant was comfortably and quietly seated for three to five minutes with the legs uncrossed, and the back and arm supported, such that the middle of the cuff on the upper arm is at the level of the right atrium. Three readings should be taken in succession, separated by at least one minute. The first is typically the highest, and the average of the second and third systolic and diastolic pressure readings was used in the analyses.

Fasting blood glucose, triglyceride, and high-density lipoprotein cholesterol

A fasting venous blood sample was taken for measuring FBG, TG, and HDL-C. The participant was required to have fasting for at least eight hours before blood sampling. The researcher had the participant comfortably seated with arm rested on the examination table, and prepared venipuncture site with an appropriate antiseptic. The researcher then used a tourniquet and either the 21-gauge winged infusion set (SV*21BI, Surflo, TERUMO, USA) or 21-gauge blood collection needle with holder (368607 & 364815, BD, USA) to perform the venipuncture for the participant. A 4 ml sample for TG and HDL-C was taken and stored in lithium heparin tube

(Vacuette, greiner bio-one, Austria) whilst a 2 ml sample for FBG was taken and stored in sodium fluoride tube (Vacuette, greiner bio-one, Austria). All the blood samples were sent to Chemical Pathology Laboratory, at Prince of Wales Hospital, Shatin, for assay. The laboratory is accredited by National Association of Testing Authorities, Australia (NATA) (Accreditation No. 14149). FBG, TG, and HDL-C were all assayed by spectrophotometric method and in a Cobas Modular Analyzer (c702, F. Hoffmann-La Roche Ltd., Switzerland). The interassay and intraassay coefficients of variation (CV) for the above blood profile were presented in Table 1.

Table 1
Coefficients of Variation for Clinical Chemistry Results

Variables	Concentration Unit	Interassay CV	Intraassay CV
FBG	4.78 mmol/l	1.35%	0.93%
	16.08 mmol/l	1.41%	0.59%
TG	1.09 mmol/l	2.30%	0.84%
	2.01 mmol/l	1.68%	0.31%
HDL-C	0.67 mmol/l	1.81%	0.44%
	1.55 mmol/l	1.82%	0.61%

CV coefficients of variation *FBG* fasting blood glucose; *TG* triglyceride; *HDL-C* high-density lipoprotein cholesterol.

MetS z score

MetS z score was calculated by summing the standardized values for WC, blood pressure, FBG, HDL-C, and TG. Gender-specific MetS z scores were used to account for variations in NTEC-ATP III criteria for men and women. Each variable was standardized by subtracting the sample mean from the individual mean and dividing by standard deviation. Both baseline and post intervention z scores were calculated with same transformation. The concept of a continuous score to evaluate MetS was also used by Johnson, et al. (2007) and Wijndaele, et al. (2009).

3.3.5.2 Instrument Used Measure the Physical Activity Level

The short (7 day) form of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) was applied to investigate the participants' physical activity level. A study was carried out to examine the reliability and validity of IPAQ in 12 countries (Craig et al., 2003). The result indicated that IPAQ had reasonable measurement properties for monitoring population levels of physical activity among 18 to 65 years old adults in the diverse sample settings. Spearman's Rho clustered around 0.8 indicating reliable responses between repeat administrations for all versions of the IPAQ. The short form of IPAQ has been translated to Chinese and has demonstrated adequate reliability and validity for the measurement of total physical activity in a Chinese population (Macfarlane, Lee, Ho, Chan, & Chan, 2007).

3.3.5.3 Instruments Used to Measure Health-Related Physical Fitness Components

This section describes the methods of assessing the four health-related physical fitness components, namely 1) body composition, 2) cardiovascular endurance, 3) muscular strength and endurance, and 4) flexibility.

1. Body composition

Body weight and body mass index (BMI) were measured. Body height was also determined in order to calculate the BMI.

Body height

Body height was measured to the nearest 0.1 cm with the participant in bare feet, back against the wall, heels together and eyes looking straight ahead. The right angle was brought down on the top of the head so that height was accurately measured.

Body weight

Body weight was measured to the nearest 0.1 kg with the participant in light clothing and bare feet using a TANITA Body Fat Scale (Model BF-522, TANITA, Japan).

Body mass index (BMI)

BMI was calculated as weight in kilograms (kg) divided by height in meters squared (m^2).

2. Cardiovascular endurance

Resting heart rate and maximum oxygen consumption (VO_{2max}) were measured as follows:

Resting heart rate

Resting heart rate was measured following a seated ten-minute rest period. The heart rate was detected by electronic device (Polar Electro, Finland).

Maximum oxygen consumption (VO_{2max})

The concept of cardiovascular endurance is an individual's aerobic capacity, and the most reliable and valid measure of aerobic capacity is VO_{2max} (Morrow, Jackson, Disch, & Mood, 2005). Detail of the apparatus used to measure VO_{2max}, procedure and the test-retest reliability of measuring the maximal exercise test were described as follows:

The apparatus used to measure VO_{2max}: FitMate PRO

Traditionally, VO_{2max} has been measured using an open circuit or Douglas Bag system. However, automated systems are widely available to measure VO_{2max} and related respiratory variables in real-time during exercise testing (American College of Sports Medicine [ACSM], 2010a). As concerning the availability of resources, the

FitMate PRO (COSMED, Rome, Italy), an automated system, was used to measure VO_{2max} of each participant. FitMate PRO (COSMED, Rome, Italy) was a compact (dimension: 24 x 20 x 8 cm) and portable (weight: 1.5kg) metabolic analyzer designed for measurement of oxygen consumption and energy expenditure during rest and exercise. Validation studies were conducted to assess the validity and reliability of FitMate PRO (COSMED, Rome, Italy) in measuring oxygen consumption and estimating resting metabolic rate (Nieman et al., 2006) and in measuring oxygen consumption during graded exercise (Nieman et al., 2007). Both studies compared FitMate PRO (COSMED, Rome, Italy) with traditional Douglas Bag system. Findings of these two studies indicated that FitMate PRO accurately measured oxygen consumption during graded treadmill exercise as well as during resting when compared with the Douglas Bag system in adults.

Procedure of conducting the maximal exercise test: the Bruce Protocol

The Bruce Protocol was the most widely adopted protocol and had been extensive validated (Hill & Timmis, 2002; ACSM, 2010b). The protocol consisted of six stages, and each stage lasted for three minutes. In Stage I, the participant walked at 1.7 miles per hour (mph) up a 10% incline. The speed and incline of the treadmill increased with each stage, and were outlined in Table 2. The rating of perceived exertion (RPE), an indication of impending fatigue, was recorded by the end of each stage of the test (ACSM, 2010b) and listed in Table 3.

Table 2

The Speed and Incline of Each Stage of the Bruce Protocol

Stage	Minutes	Speed (miles per hour, mph)	Incline (%)
I	1-3	1.7	10
II	4-6	2.5	12
III	7-9	3.4	14
IV	10-12	4.2	16
V	13-15	5.0	18
VI	16-18	5.5	20

Table 3
The Category-Ratio Scale of RPE

RPE	Description
0	Nothing at all
1	Very weak
2	Weak
3	Moderate
4	
5	Strong
6	
7	Very strong
8	
9	
10	Extremely strong

Prior to the start of the test, the researcher explained the category-ratio scale of RPE to a participant, and assisted the participant to fit with a heart rate transmitter (Polar Electro, Finland) and a silicon face mask (COSMED, Rome, Italy). The FitMate PRO (COSMED, Rome, Italy) underwent an autocalibration before each test. The heart rate and VO_2 were obtained on 30-second intervals. During the test, the researcher adjusted the speed and incline of the treadmill (Model JET-7000, Johnson, USA) according to the Bruce Protocol (see Table 2) and terminated the test according to the following eight indications (ACSM, 2010b):

1. Onset of angina or angina-like symptoms
2. Shortness of breath, wheezing, leg cramps, or claudication
3. Signs of poor perfusion: light-headedness, confusion, ataxia, pallor, cyanosis, nausea, or cold and clammy skin
4. Failure of heart rate to increase with increased exercise intensity
5. Noticeable change in heart rhythm
6. The participant requested to stop
7. Physical or verbal manifestations of severe fatigue (e.g. RPE is 8-10)
8. Failure of the testing equipment

Test-retest reliability of the maximal exercise test

To determine the test-retest reliability of this measurement, the researcher conducted VO_{2max} test following the aforementioned procedure with twelve participants. In order to establish repeatability, each participant was required to perform this test twice with same measurement procedure, same measuring instrument, and in same location. The second test was conducted one week after the first test. The test-retest reliability of the above test was 0.92, indicating the reliability was satisfactory.

3. Muscular strength and endurance

The Canadian Standardized Test of Fitness - Push-up and Curl-up Tests were conducted to measure the muscular endurance of upper-body muscles and the abdominal muscle groups, respectively. The test procedures for the measurements were according to the descriptions from Canadian Society for Exercise Physiology (Canadian Society for Exercise Physiology [CSEP], 2003, as cited in ACSM, 2010b):

Push-up Test

The participant started with the standard "down" position (the male participant was instructed to have hands pointing forward and under the shoulder, back straight, head up, using the toes as the pivotal point, whilst the female participant was instructed to have both legs together, lower leg in contact with mat with ankle plantar-flexed, back straight, hands shoulder width apart, head up, using the knees as the pivotal point). The participant the raised the body by straightening the elbows and return to the "down" position, until the chin touches the mat and the abdomen should not touch the mat. The maximal number of push-ups performed consecutively without rest was counted as the score. The test was terminated when the participant strained forcibly or was unable to maintain the appropriate technique within two repetitions.

Curl-up Test

The participant was instructed to perform a supine position on a mat with the knees at 90 degrees, then place the hands on the thighs and Curl up until the hands reach the knee caps. Shoes remain on during the test. The mobile metronome (Simões, 2012) was set to 50 beats per minute and the participant did slow, controlled Curl-ups to lift the shoulder blades off the mat (truck made 30-degree angle with the mat) in time with the metronome at a rate of 25 per minute. The test was conducted for one minute. The low back had to keep flattened before Curling up. The participant was encouraged to perform as many Curl-ups as possible without pausing, to a maximum of 25 (CSEP, 2003, as cited in ACSM, 2010b).

4. Flexibility

The modified back-saver sit-and-reach test (MBS test) was used to test low back and hamstring flexibility (Hui & Yuen, 2000). The participant was requested to sit on a 30 cm high bench with one leg extended and resting on the bench, whilst the foot of the other leg was placed on the floor. A meter rule was placed on the bench between the legs and the heel of the extended leg was in line with the 50 cm level on the meter rule. The participant was required to stretch both arm out in front of the body with hands held together and fingers pointing toward the extended leg. The participant was reminded to reach as far forward as possible without causing pain in the extended leg. The maximum distance (that the tips of the middle fingers of both hands) reached, as read from the meter rule, was indicated as the score of low back and hamstring flexibility. Three trials were conducted with each leg and the maximum score for each leg (to the nearest mm) was recorded and entered for analysis (Hui, Lau, Yuen, Wong, Lam, 2008). The MBS test was a comparatively better test to measure the low back and hamstring flexibility than other protocols as its similarity of criterion-related validity in women but it had better criterion-related validity in men, more practical as it required minimal preparation time and equipment. It also eliminated excessive posterior compression of the vertebral disk when performing a single leg reach (Hui & Yuen, 2000).

3.3.5.4 Instrument Used to Measure Cortisol Level

The measurement of salivary cortisol provides a non-invasive and reliable tool for investigation of physiological stress. Participants were instructed to obtain salivary samples at the same time of day to avoid variations due to the circadian rhythm (Kirschbaum & Hellhammer, 1989). During the day for saliva collection, saliva of the each participant was collected no earlier than 30 minutes after eating or drinking. The researcher gave one Salivette (SARSTEDT, Germany) to each participant at a time. The participant was instructed to remove the swab from the Salivette and then gently chew the swab for one minute. The researcher then instructed each participant to return the saturated swab back to the Salivette, and collected the Salivette from each participant. All the cortisol samples were sent to the aforementioned laboratory and frozen at 4°C prior assay. The device Cobas e601 (F. Hoffmann-La Roche Ltd., Switzerland) was used for electrochemiluminescence immunoassay. The interassay and intraassay coefficients of variation for the salivary cortisol were presented in Table 4.

Table 4
Coefficients of Variation for Salivary Cortisol

Variable	Concentration Unit	Interassay CV	Intraassay CV
Salivary cortisol	3.85 nmol/l	18.26%	8.68%
	20.22 nmol/l	7.03%	2.35%

CV coefficients of variation

3.3.5.5 Instruments Used to Measure Psychological Variables

The following scales were used to measure participant's self-esteem, perceived stress, state and trait anxiety, and depression:

1. Self-esteem

Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965) consists of 10-items, which examines the global self-esteem of individuals, and the current study adopted the Chinese version of RSES (Chang, 1999) to measure the self-esteem of each participant. The original scale is typically replaced with a Likert-type response format using a four-point scale anchored by 1 (Always Disagree) and 4 (Always Agree) (Sheasby, Barlow, Cullen, & Wright, 2000). Total score ranges from 10 to 40 with higher scores indicating stronger trait self-esteem. The reproducibility of the scale is 93%, scalability of items is 73%, and scalability of individuals is 72 % (Rosenberg, 1965). Internal consistencies in the study of Elavsky and McAuley (2007) were good (α ranged from 0.89 to 0.92 for baseline and post-intervention assessments, respectively). Chang (1999) developed Chinese version of RSES and tested the reliabilities of this Chinese version. The reliability between the English and Chinese versions of RSES as estimated by intra-class correlation coefficient is 0.90. This Chinese version yielded Cronbach's α of .85 in the study of Chang (1999).

2. Perceived stress

Perceived Stress Scale (PSS) is employed to assess the degree to which an individual appraises situations in his or her life as stressful (Cohen, Kamarck, & Mermelstein, 1983). The original version of PSS contains 14 items (PSS-14) with a 5-point Likert scale (0 = never and 4 = very often). Cohen and colleague developed another two shorter versions of PSS that consist of 10 items (PSS-10) and 4 items (PSS-4), and compared the psychometric qualities among the three versions of PSS (Cohen, &

Williamson, 1988). Results of the comparison indicated that the PSS-10 provided as an adequate a measure if perceived stress as the PSS-14, and the PSS-10 had a tighter factor structure and a slightly better internal reliability than the PSS-14. Thus, Cohen and colleague recommended use of the PSS-10 in research setting. The PSS-10 is not a diagnostic instrument, so there are no cut-offs. A lower score of the PSS-10 is indicative of lower perceived stress and the score of the scale can range from 0 to 56. The PSS-10 has been shown to be valid, with internal reliability as determined by Cronbach's α of 0.902 (Smith et al., 2008). The Chinese version of PSS-10, which was developed and validated in a local study (Yu and Ho, 2010), was adopted in Study One. This version demonstrated satisfactory reliability with Cronbach's α of 0.81 (Yu, Ho, Lamb, Woo, & Ho, 2010).

3. State anxiety and trait anxiety

State-Trait Anxiety Inventory (STAI), which is a 40-item self-report scale to evaluate state and trait anxiety (Spielberger, 1983). Respondents rate how statements described how they generally feel on a 4-point scale (1 = Not at all and 4 = Very much so). STAI state and trait scores range from 20-80, with higher scores indicating greater state and trait anxiety. The STAI is not a clinical instrument, which does not assess impairment, and thus no clinical cutoff levels exist. Cronbach's α for the state and trait subscales were 0.92 and 0.96, respectively, in the study of Mitchell, Mazzeo, Rausch, and Cooke (2007). This study adopted the Chinese version of STAI, which was translated by Tsoi, Ho and Mak (1986). This version is reliable with Cronbach's α of State and Trait scales were 0.90 and 0.81, respectively. This version was further validated by Shek (1988).

4. Depression

The Centre for Epidemiologic Studies Depression Scale (CES-D) is a self-reported scale used to measure depressive symptomatology in the general population (Radloff, 1977). The scale contains 20-items with a 4-Likert scale [0 = Rarely or none of the time (less than 1 day) and 3 = More or all of the time (5-7 days)]. The score of CES-D ranges between 0 and 60. High score indicates high level of distress. A score of 16 or more is considered as a clinically significant level of psychologically distress, but it does not necessarily mean that the participant has a clinical diagnosis of depression. The scale has high internal consistency with Cronbach's α of 0.85 (Radloff, 1977). It yielded Cronbach's α of 0.92 in the study of Mitchell et al. (2007). The Chinese version was used in this study and validated in earlier studies (Chi, 1995; Chi & Boey, 1992). The Cronbach's α of the Chinese version of CES-D in local studies were above 0.80 (Chou & Chi, 2000; Chi & Chou; 2001).

3.3.5.6 Instrument Used to Measure Health-Related Quality of Life

The MOS 36-Item Short-Form Health Survey (SF-36) (Ware et al., 1993), which is a generic assessment of health related quality of life, consists of 36 items grounded under eleven questions. SF-36 has the eight scales measuring the following eight domains:

1. Physical functioning (PF)
2. Role limitations due to physical problems (role physical, RP)
3. Social functioning (SF)
4. Bodily pain (BP)
5. General mental health (MH)
6. Role limitations due to emotional problems (role emotional, RE)

7. Vitality (VT)
8. General health perceptions (GH)

The physical health component score (PCS) and mental health component score (MCS) are two summary scores which provide overall assessment of quality of life related to physical and mental health, respectively. The internal consistency of the SF-36 ranged from 0.63 to 0.96 and the test–retest reliability ranged from 0.60 to 0.81 (Ware et al, 1993).

Study One employed the Chinese version of the SF-36, which was developed and validated for Chinese adults in Hong Kong (Lam, Gandek, Ren, & Chan, 1998; Lam, Laude, Lam, & Gandek, 1999; Lam, Fong, Lauder, & Lam, 2002; Lam, 2003). The Cronbach's α of internal reliability were above the standard of 0.7 for all scales except the SF scale (Lam et al., 1998). Lam (2003) further investigated the internal reliability of all the eight scales for patients in primary care, the reliability was above standard 0.7 for all scales.

3.3.5.7 Data Collection Forms

"Demographic Data Sheet" (See Appendix E) was designed to collect participants' demographic information such as gender, age, education level, employment status, marital status, smoking, and alcoholic intake. "Physical Fitness Assessment Record Sheet" (See Appendix F) was developed for recording the body composition, blood pressure, the results of health-related physical fitness assessment in baseline and post-intervention. The "Yoga and Health Questionnaire" (See Appendix G) was developed from the aforementioned Chinese versions of the short form of the International Physical Activity Questionnaire (IPAQ), Rosenberg Self-Esteem Scale (RSES), Perceived Stress Scale (PSS), State-Trait Anxiety Inventory (STAI), the

Centre for Epidemiologic Studies Depression Scale (CEDS), and the MOS 36-Item Short-Form Heath Survey (SF-36) in order to assess the physical activity level and various psychological variables of each participant.

3.3.6 Data Collection Procedure of Study One

All participants attended baseline and post intervention assessment sessions in the study. Each participant was required to fast in the morning on the assessment day. After registration, the researcher measured participant's resting heart rate, blood pressure, body height and weight, and waist circumference. Fasting blood sample was then taken from each participant. Each participant completed the "Demographic Data Sheet" and "Yoga and Health Questionnaire" which were checked to ensure no missing data by the researcher upon completion. The researcher conducted the Bruce Protocol, Curl-up, Push-up, and MBS tests with each participant and recorded the results in "Physical Fitness Assessment Record". In between the baseline and post-intervention assessment sessions, participants were required to strictly follow the protocols according to their group assignment. The outline of the protocols is presented in Figure 2.

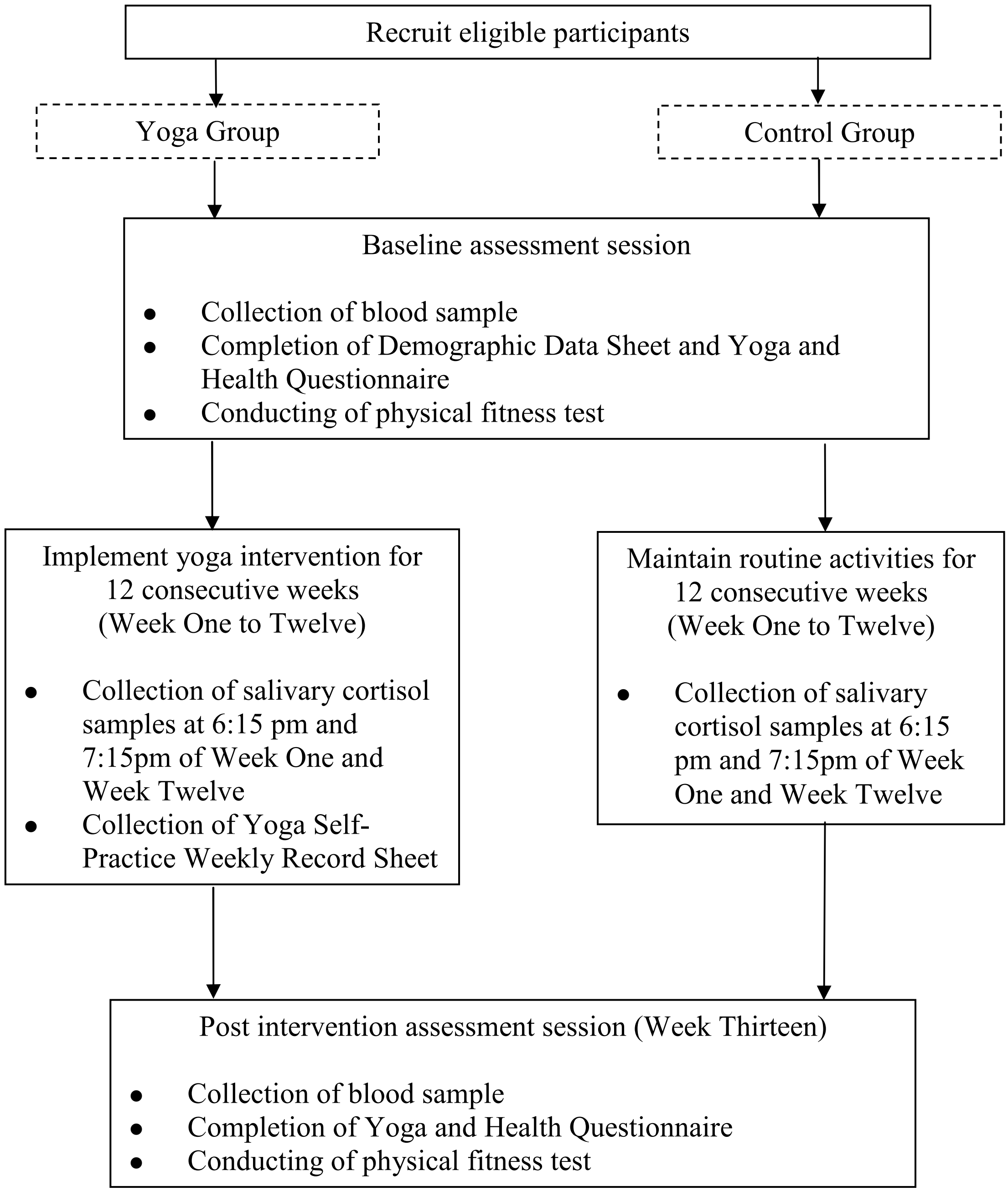


Figure 2. The flowchart of the Study One.

3.3.6.1 Protocol of Yoga Group

Participants were asked to attend the yoga program, which consisted of 12 weekly classes of one-hour duration. The number of sessions chosen was based on the number found to be efficacious in other yoga intervention studies (Moadel et al., 2007; Mclver et al., 2009). The yoga programme was conducted in the seminar room in Faculty of Medicine, The Chinese University of Hong Kong. The researcher, who is an Experienced Registered Yoga Teacher (E-RYT), has four years of Hatha yoga instructing experience, designed the yoga program and taught all classes in this study to ensure the consistency of the quality of all classes. Fifty-seven yogic poses and breathing commonly taught in fitness centres and private yoga studios were instructed and practiced throughout the program (Kappmeier & Ambrosini, 2006; Kaminoff, 2007). Modifications of some poses were suggested if participants had limitations in their flexibilities. Props such as mats, towels and blocks were used. During the class, the yoga teacher encouraged all participants to relax, pay attention to their breathing, and stretch their muscle as fully as possible without experiencing discomfort when executing all yogic poses. The description of each yogic posture was presented in Appendix H. The photo taken during yoga classes were displayed in Appendix I. The yoga teacher gave and explained “Hatha Yoga Class Handout” (see Appendix J), which presented the picture of each pose taught in each lesson, to the participants in the first ten lessons. Participants were strongly encouraged to practice daily, and to ask the yoga teacher if they found doubts about self-practice. Salivary cortisol samples were taken from each participant pre (i.e. at 6:15pm) and post (i.e. at 7:15pm) the first and the last yoga lessons (i.e. Week One & Week Twelve).

Adherence was documented via attendance records recorded by the yoga teacher at each yoga intervention session. Each participant was required to fill in "Yoga Self-Practice Weekly Record Sheet" (see Appendix K), which recorded the duration of self-practice. The completed sheets were collected in the lesson of the following week, except the sheet recorded the twelfth week were collected in post intervention assessment session. Apart from the yoga program, the yoga participants were advised to maintain their routine activities and not to begin other exercise or mind-body program during the course of the study.

3.3.6.2 Protocol of Control Group

The researcher requested participants of the control group to maintain their routine activities and not to begin any exercise, yoga or mind-body program during the course of the study. Their salivary cortisol samples were collected at the same time slots in Week One and Week Twelve as those counterparts in the yoga group.

3.3.7 Data Analysis for Study One

The researcher reviewed all the questionnaires and yoga self-practice record forms for completeness and accuracy before data entry. Ambiguous or erroneous items were clarified and corrected with the participants. Double data entry was performed to ensure data quality. Consistency checks and data cleaning were done before data analysis. The study used both per-protocol (PP) and intention-to-treat (ITT) analyses. PP analysis includes all the participants who have completed the study protocol, i.e. baseline assessment, intervention, and post-intervention assessment. PP analysis allows the researcher to see the results from those who actually adhere to the intervention. ITT analysis includes participants who completed the study protocol and those completed the baseline assessment but dropped out from the study afterward. The researcher employed ITT analysis to test the effect of allocating participants to an intervention (effectiveness), rather than the effect of their actually receiving it (efficacy) (Wright & Sim, 2003). Before conducting ITT analysis, missing follow-up data were estimated using carry-forward imputation.

The statistical analysis was conducted using SPSS 16.0 software (SPSS Inc, Chicago, Illinois). All statistical tests were two-tailed and the acceptance level of statistical significance (*p*-value) in overall analysis was .05 or less. Sample description was described; baseline characteristics, retention and program adherence, and all other outcome measures were analyzed and reported. For statistical analysis group variables on a continuous scale were expressed as mean (*M*) along with standard deviation (*SD*) and categorical data as frequency (*f*) with percentage. Distribution shape for scores on a quantitative variable was assessed by examining a histogram of the dependent variable scores. When a skewed data was found, data transformation was conducted to approximate a normal distribution. Square root transformation and base 10 reverse logarithmic transformation were conducted to positively skewed data and negatively skewed data, respectively.

For checking homogeneity of participants who completed the study and who did not completed the study, independent *t*-test (*t*) and Mann-Whitney *U* test for continuous variables and Chi-square (χ^2) test for categorical variables were used. Similar strategy was employed when checking homogeneity of the yoga group and control group. Relationships between participant's demographic, physiological, and psychological characteristics and the outcome variables were determined with correlations. By incorporating findings from homogeneity check and correlations, possible covariates were identified. Mean difference of each outcome variable between the yoga and control groups were analysed with the analysis of variance (ANOVA). In order to increase the precision in estimating the effect of interest, the analysis of covariance (ANCOVA) was used to take into account the possible confounding effects of the covariates.

Effect size (ES) was computed to show magnitude and direction of the effect of the yoga intervention relative to the control condition for each outcome variable. According to Cohen (1988), the effect size in an ANOVA family is represented by value of partial eta squared (η^2) that can range from very small (< 0.01), to small (0.01-0.05) then to medium (0.06-0.13), and finally to large (≥ 0.14).

3.3.8 Pilot Study of Study One

A pilot study was conducted to examine the feasibility of the data collection method and the study intervention, and to guarantee that the main study could be implemented smoothly and successfully according to what had proposed. Eleven volunteers, who regarded as “pilot study participants”, were willing to join the pilot study.

To test if the data collection instruments were feasible, pilot study participants' responses towards the understanding of the questionnaire and the ease of the physiological tests were examined. The time to complete the questionnaire and the physiological tests were also estimated. All pilot study participants of the pilot study found that the questionnaires were easy to understand and the physiological tests were acceptable. The total time taken for completion of the questionnaire and physiological tests was about two hours, and none of the participants found the time taken was too long. They did not find the data collection procedure unacceptable and offensive.

The feasibility of the study intervention was examined in terms of intensity and arrangement. The eleven pilot study participants were invited to join a 12-week Hatha yoga program with the same intensity as the main study. After the completion of the program, the pilot study participants were asked if they would encounter any difficulties and experience any discomforts during the pilot program. To pilot the arrangement, the instructor, time and venue were arranged exactly the same as in the main study. Any technical problems were identified and solved as soon as possible. The pilot study participants commented that the intensity of the yoga program was acceptable, some yoga poses may require their flexibility and balance, yet they believed they were able to master the poses through regular practices.

3.4 Methodology of Study Two: A Qualitative Study

In Study Two, the researcher used focus group to identify the motivations of initiating and continuing yoga practice and explore the perceived benefits and barriers of regular yoga practice.

3.4.1 Overview of Focus Group

Focus groups are important qualitative research method in researching health issue and have become increasingly popular as a data generation technique for a range of purposes since the 1980s (Green, 2007). Morgan and Krueger (1993) described that "focus group emphasizes the goal of finding out as much as possible about participants' experiences and feelings on a given topic" (p.7).

The researcher chose focus group as the research method in Study Two because of the following reasons. First, the level of structure in a focus group discussion can be varied to suit its application (Hennink, 2007). The flexible application of the focus group lends it well to incorporation into the mixed methods research design of this study. Second, the group nature of focus group permits the gathering of a large amount of information from potentially large groups of people in relatively short periods of time (Berg & Lune, 2012). Third, the group nature helps develop "natural" environment in data collection. The researcher pointed out that the natural environment might encourage the participants to share their views during the group discussion as compared to individual interview. Fourth, the researcher is interested not just in the content of knowledge, but also the study group dynamics. Morgan and Krueger (1993) emphasized that "the presence of group interaction in response to researchers' questions", makes focus group different from other qualitative methods. This characteristic allows the researcher to observe how ideas are generated or moderated during discussion, and to identify influences on group consensus or conflict and the effect of dominant or passive individuals on the group dynamic (Hennink, 2007).

The researcher also paid attention to the following potential limitations of focus group. First, a limited number of questions can be discussed during one discussion session because of the time constraint (Berg & Lune, 2012). If the researcher developed large number of questions that might take a huge amount of time to discuss thoroughly in a group setting, and as the duration of focus group is usually brief, then focus group might not be an effective way to gather information on the issue of the study. Second, socially desirable responses or group conformity may be resulted if the moderator does not facilitate the discussion carefully (Hays & Singh, 2012). The moderator has to observe the group dynamic and strive for an open and permissive atmosphere in order to make participants to feel free to express their opinions (Morgan & Krueger, 1993).

3.4.2 The Sample and Sampling of Study Two

Focus groups are frequently conducted with purposively selected samples in which the participants are recruited from a limited number of sources (Morgan, 1997; Liamputtong, 2011). Daniel (2012) described purposive sampling as a nonprobability sampling procedure in which elements are selected from the target population on the basis of their fit with the purposes of the study and the specific inclusion and exclusion criteria. The researcher selected the participants who suit the issue under investigation, and believed that they would provide the best information (Liamputtong, 2011). Compared to other nonprobability sampling procedure, purposive sampling has less selection bias, better internal validity via homogeneous sampling, and the findings are more generalizable (Daniel, 2012; Morgan, 1997).

3.4.3 Selection of Participants of Study Two

Participants were included if they were local Chinese, able to communicate in Cantonese, aged 18 or above, and not experiencing cognitive impairment or substance abuse. Participants were purposively selected based on their willingness to share their opinions toward yoga and health related issues with the researcher and other participants in the same focus group, and their yoga experiences, either regularly practice over three months or nil experience.

3.4.4 Sample Size Determination of Study Two

The number of participants in each focus group varied from four to eight, as suggested by various recommendations (Onwuegbuzie & Collins, 2007). The number of group discussions to be conducted was determined by the diversity in the information gained from the discussions and the levels of segmentation (Hennink, 2007). The study conducted fourteen groups for reaching the point of “saturation”, at which the discussions no longer generate new understanding (Glaser & Strauss, 1967), and ensuring sufficient groups to achieve saturation within each segment (Morgan, 1997).

3.4.5 Recruitment Process of Study Two

Mass mailing was sent to individuals who provided with email address in enrolment forms of Study One, and the recipients of the mass mailing were encouraged to forward the mail to their friends and relatives. The mass mailing enclosed the information sheet (Appendix L), which introduced the detail of the study, and also the enrolment form (Appendix M).

The enrolment form recorded the participants’ name, telephone numbers, email addresses (if available), gender, date of birth, age, qualification, occupation, marital status, and experience of practicing yoga. The researcher screened all enrollment forms, and classified those who met the aforementioned inclusion criteria presented as “prospective participants”. To ensure acceptance of the protocol, the prospective participants were offered a free 12-hour Hatha yoga program upon completion of focus group. The researcher invited the prospective participants to participate in the study through telephone contact.

3.4.6 Data Collection Method of Study Two

Study Two was conducted from April 2011 to January 2012. Each focus group discussion was conducted in the seminar room in Faculty of Medicine, The Chinese University of Hong Kong. The duration of each discussion session was about one hour in order to help the participants stay focused on discussion and avoid them from being tiring and boring (Liamputtong, 2011). All discussions were conducted in Cantonese, the mother tongue of all participants, and assisted in English. The discussion was recorded with one digital recorder. The guiding questions were prepared prior the discussion for the ease of facilitation of the discussion, and were developed based on the research topics. In order to explore the shared thoughts on yoga participation, the researcher used the same set of guiding questions throughout the focus groups in the study. It is desirable to maintain the uniformity of questions for research task in uncovering common thoughts (Fern, 2001). Based on the functions in the flow of the discussions, the guiding questions were divided into the four categories, namely the opening, introductory, key and ending questions. The opening question served as a warm-up session in order to integrate participants. Introductory questions, which make participants focus their attention on the research issues in a broad sense (Hennink, 2007), were asked and discussed. About two-third of the group discussion time was spent on key questions. These questions have to be asked with lots of probing in order to elicit detail and depth discussion (Krueger & Casey, 2000). The information gained from participants was essential for answering the research questions. Ending questions were asked to bring closure to the discussion to an end. The guiding questions were modified from the questions discussed in the study of Atkinson and Permuth-Levine (2009). The English and Cantonese versions of guiding questions and the time allocation on each part of the discussion are presented in Figure 3 and Figure 4, respectively.

Focus Group Discussion Parts / Guiding questions		**Categories of questions** *(Time allocation)*
Questions	***Part 1: Introduction***	Opening *(5 mins)*
1.1	How long have you been practicing yoga?	
1.2	Where have you been practicing yoga?	
1.3	Do you practice alone or with a partner or friend?	
1.4	What is your definition of yoga?	
1.5	Have you heard of yoga from somebody you know? What did he/she tell you about their experience in practicing yoga? *N.B. 1.1-1.3 are for those have practiced yoga for more than 3 months*	
	Part 2: Starting yoga practice	Introductory *(10 mins)*
2.1	What did you expect when you started to practice yoga?	
2.2	How do you make the decision to start yoga?	
2.3	What makes you continue to practice? *N.B. 2.2-2.3 are for those have practiced yoga for more than 3 months*	
	Part 3: Perceived Benefits (both physical and mental health)	Key *(40 mins)*
3.1	What health benefits, if any, do people expect when they practice yoga?	
3.2	What illnesses or health concerns might yoga help? Are there any that yoga would not help or would make worse?	
3.3	Do any of you practice yoga to help you with a specific illness or health concern? How has yoga affected this condition?	
3.4	Does yoga prevent disease? If yes, what are those diseases? Or if you can't name any diseases, are you talking about yoga improve general physical health? Can you explain your ideas more in depth?	
3.5	Do you think yoga helps people like you to sleep better?	
3.6	What do you think are some of the benefits to practicing yoga in regular basis?	
	Part 4: Perceived Barriers	
4.1	Why haven't you tried yoga before?	
4.2	Why don't people in general practice yoga?	
4.3	What is (are) the reason(s) for not continue to practice yoga?	
4.4	What expenses do you associate with yoga? How do people perceive the financial cost of yoga?	
4.5	Do you mind to share how much you have spent on for practicing yoga? What are the major expenditures?	
	Part 5: Close	Ending *(5 mins)*
5.1	Are there any other thoughts about yoga that you would like to share with us?	
5.2	Would it be ok to contact you should we have follow-up questions after this session?	
5.3	Is there anything you said which you do not want included as a quote? We will ensure they are not used.	

Figure 3. Guiding questions of Study Two (English version).

焦點小組討論 部分/引導問題		**問題的分類** *(時間分配)*
問題	***第一部分: 簡介***	引導 *(5 分鐘)*
1.1	你練左幾耐瑜伽？	
1.2	你通常係屋企練習瑜伽定係上瑜伽中心練習瑜伽定上瑜伽課程？	
1.3	係一個人練定約埋朋友一齊練？	
1.4	請講出你的瑜伽定義，係你心目中“瑜伽”係咩？	
1.5	你有無聽其他人(例如你既家人、同事、朋友)講過瑜伽？佢地的練瑜伽經驗係點？	
	註: *1.1-1.3* 題是爲那些已有練習瑜伽經驗的朋友而設	
	第二部分: 開始瑜伽練習	介紹 *(10 分鐘)*
2.1	你開始練習瑜伽前對瑜伽有咩期望?	
2.2	你點解會決定開始練習瑜伽?	
2.3	係 d 咩野令你會繼續練瑜伽?	
	註: *2.2-2.3* 題是爲那些已有練習瑜伽經驗的朋友而設	
	第三部分: 參與瑜伽的益處 (生理健康及心理健康)	主要 *(40 分鐘)*
3.1	可唔可以講下一般人認爲練習瑜伽有咩健康既好處?	
3.2	有咩病或健康問題可以透過練瑜珈會有幫助/改善？定係練瑜珈會令情況更加差?	
3.3	你有無試過利用練習瑜伽來幫助你處理某 d 疾病或健康問題？瑜伽係點樣改善呢 d 狀況呢?	
3.4	你認爲練瑜伽可唔可以預防疾病？如果可以既話，係咩病？或者如果你講唔出係咩病，你係咪講緊練瑜伽可以改善一般身體健康呢？你可唔可以解釋一下你的諗法?	
3.5	你覺得練瑜伽可唔可以令你瞓好 d?	
3.6	你覺得恆常練瑜伽有咩好處?	
	第四部分: 參與瑜伽的障礙	
4.1	你點解唔嘗試瑜伽嗎？	
4.2	你認爲一般人點解唔練習瑜伽？	
4.3	你有咩原因令你無繼續練習瑜伽？	
4.4	你認爲練瑜伽會有咩洗費？其他人點睇呢 d 洗費？	
4.5	你介唔介意分享下係練瑜伽方面你洗左幾多錢？咩是主要的開支？	
	第五部分: 總結	***結束*** *(5 分鐘)*
5.1	大家有無其他關於瑜伽既想法可以分享？	
5.2	完左呢個聚焦小組後，我們可唔可以再聯絡你，問返一d 同你係小組分享有關既跟進問題？	
5.3	你有咩係小組當中講過但你又唔想俾我們引用出來？我們會確保不會直接引用論文內。	

Figure 4. Guiding questions of Study Two (Cantonese version).

3.4.7 Data Collection Procedure of Study Two

There was only one moderator, the researcher of this study, in each focus group discussion. The moderator conducted different tasks and played different roles during various stages (pre-discussion, introduction, central discussion, and closing stages) of discussion (Hennink, 2007).

In pre-discussion stage, the moderator arrived at the venue early to arrange the seating, equipment and to welcome participants. The moderator greeted and served refreshments to each participant in order to establish a friendly atmosphere, which helped build positive rapport with participants and encouraged them to express their ideas in the later stages (Mack, Woodsong, MacQueen, Guest, & Namey, 2005). Each participant was assigned a unique code for identification during the discussion and assurance of confidentiality. The unique code was given to each participant, and all participants were reminded to identify each other with the codes assigned. If the time allowed, moderator would identify any particularly quiet or talkative participants. This identification was helpful for moderator to manage the group dynamics in later stages.

At the beginning of introductory stage, the moderator introduced herself, provided an overview of the research topic, outlined how group discussion would be proceeded, and explained ethical considerations to the participants. The detail of ethical considerations was described in section 3.5. The moderator emphasized that the opinions of all the participants in the discussion were important in order to motivate the participants and make them feel their responses are encouraged and valued. The moderator then provided guidelines for the discussion, such as allowing one participant spoke at a time for clarity in the tape-recording, encouraging disagreement in opinions, and reminding participants to respect the views of other participants. The moderator also emphasized that here were no right or wrong answers for each question to be discussed. These guidelines helped ensure the later discussion to be conducted in a smooth manner and reduce the fear of pressures toward conformity. Participants were requested to sign the consent forms (Appendix N). Before the discussion commenced, the researcher checked if the participants spoke loud enough for recording by asking the participants to share their reasons for joining the study with the group. The researcher then replayed the recording to make sure the voice of each participant was recorded clearly. This also helped participants get used to speak in front of other participants.

During central discussion stage, the moderator stayed neutral throughout the process and facilitated the discussion based on the guiding questions (Mack et al., 2005). The guiding questions were open-ended in order to seek diverse of opinions and experiences (Krueger & Casey, 2000). Some particular aspects of our research topic were probed extensively. The moderator encouraged discussion between participants while keeping discussion focused on the topic being discussed. We welcomed participants to share their personal experience voluntarily to support their opinions. Knodel (1993) suggested that such personal information could also be useful, as it helped ground the discussion in reality and could serve as a concrete referent when asking about what is typical or common. The moderator listened to the sharing of participants carefully, raised new questions to explore new issues related to the topic, and asked for clarifications for unclear areas throughout the discussion. The moderator encouraged those reticent to express their views when participants who dominated the discussion were identified. The atmosphere was positive and participants were willing to share their views.

In closing stage, the moderator summarized the key points that had been discussed in earlier stages and sought clarification on this summary. Participants were requested to identify any missing viewpoints to ensure nothing has been overlooked. The moderator thanked participants for their participation and answered to any queries.

3.4.8 Data Analysis of Study Two

The demographic characteristics of the sample were described. For statistical analysis group variables on a continuous scale were expressed as mean (*M*) along with standard deviation (*SD*) and categorical data as frequency (*f*) with percentage. For checking homogeneity of participants with and without yoga experiences, independent *t*-test (*t*) for continuous variables and Chi-square (χ^2) test for categorical variables were used. The statistical analysis was conducted using SPSS 16.0 software (SPSS Inc, Chicago, Illinois). All statistical tests were two-tailed and the acceptance level of statistical significance (*p*-value) in overall analysis was .05 or less.

Thematic content analysis was applied in this study. The researcher prepared the transcript by listening to the recorded tape carefully and repeatedly and noting the questions asked and the participants' responses after each focus group discussion. All data were first transcribed verbatim in Chinese and then translated to English. The researcher read the transcripts repeatedly to be familiar with the transcripts and get overall sense of key issues for participants (Green, 2007), then identified how to segment the data into smaller and developed a framework for segmentation (Hennink, 2007). A codebook, which was a list of codes for coding process, was developed. The codebook contained the definition of each code. The researcher referred to the codebook when coding each transcript. All sets of transcripts were coded when the coding framework was ready. The researcher coded the data for twice and re-read the categorization for twice in order to consolidate the coding and categorization of the data. Those coded data were further analyzed in respond to the research questions. The unit of analysis was a meaningful unit rather than a statement. For example, the statement "I feel relax and calm after practising yoga", was broken into two meaningful responses, including relax and clam.

3.4.9 Quality of Study Two

We describe the quality of quantitative research in terms of reliability and validity, similarly the quality of qualitative research is also described in term of reliability and validity, but these two terms carry different connotations in qualitative research. The following sections discussed the reliability and validity of the study.

3.4.9.1 Reliability of Study Two

Qualitative reliability indicates that the researcher's approach is consistent across different researchers and different projects (Gibbs, 2007, as cited in Creswell, 2009, p.190). Several procedures have been done to ensure high reliability of this study. Consistent set of semi-structured open-ended guiding questions was employed throughout the 14 focus groups. This ensured that a high degree of flexibility was given to participants to express their thoughts, yet their responses were confined within the topic that the study concerned. All focus group discussions were recorded by a digital recorder in order to minimize the possibility of missing data. All discussions were transcribed and translated by the researcher to maximize the reliability of the data collected. All sets of transcripts were checked carefully to ensure that no obvious mistakes were made during transcriptions. When coding transcript, the researcher constantly referred the codebook to ensure there were no shifts in the meaning of the codes. The accuracy of the interpretive analysis was secured because the researcher served as both the moderator of the discussion and analyst of the study. Even though cross-checking codes with other personnel (intercoder agreement) was not available due to limited resources, the researcher assessed reliability by comparing the data collected across focus group discussion sessions.

3.4.9.2 Validity of Study Two

To ensure the qualitative validity, the researcher checks for the accuracy of the findings by employing certain procedures (Gibbs, 2007, as cited in Creswell, 2009, p.190). Although an external auditor was absent in the study, rigorous research methodology safeguarded the validity of the study. The study presented detailed descriptions on the procedures of recruiting participants and conducting of the focus group discussions. This allowed replication and comparison by other researchers. The researcher also provided the justifications of the sampling method, determination of number of participants in each focus group, and determination of number of focus group discussion conducted. All the justifications were based on literatures mentioned in previous sections. The guiding question set was developed by reviewing previous studies which employed focus group to explore perceived benefits, barriers, and cues to action of yoga practice among adults (Atkinson & Permuth-Levine, 2009). This ensured the question set was able to address the research topics, and obtain relevant data for answering to the research questions. As the same moderator facilitated all the discussions, the consistency of facilitation technique was assured. The moderator gave clear instruction to all the participants at the beginning of each discussion. The instruction assured participants' confidentiality, encouraged sharing opinions, emphasized there were no right or wrong answers for all the discussion questions. Together with the rapport built between moderator and participants during pre-discussion stage, participants were motivated to express their opinion in honest manner, and the level of true of their response increased validity of the study.

3.4.10 Pilot study of Study Two

A pilot study with seven volunteers (pilot study participants) was conducted to test the feasibility of the focus group discussion. The discussion was audio taped. As the researcher had the roles of being both moderator and yoga teacher, it was important to avoid misleading questions that could guide participants to say what the researcher wanted to hear. It was also important to ensure that the participants were able to understand the guided questions. The pilot study participants indicated the vagueness of each guided question if any, and the researcher revised accordingly and where necessary. The duration for the discussion and whether the pilot study participants perceived the time burden to be too much were estimated in this pilot study. The duration of the discussion was 60 minutes and the interview time was acceptable and reasonable to the pilot study participants. The pilot study also demonstrated that the questions were discussed in a smooth sequence.

3.5 Ethical Consideration for Study One and Study Two

Ethical approvals of Study One and Study Two were obtained from two different ethics committees of The Chinese University of Hong Kong (Appendix O and Appendix P). The researcher provided each participant with a briefing session, in which the researcher explained the purpose, nature, and procedure of the study. The participants were also informed of their rights to withdraw from the study at anytime without affecting the treatments they received in the hospital. Participants of Study One were informed of any possible foreseeable risks such as wound and pain would cause with blood sample taking, and injuries would cause with inappropriate yoga practice. Participants of Study Two were informed that the discussion would be tape-recorded. The researcher asked all the participants if there were any ambiguities of the briefing, and encouraged the participants to clarify with her if there were any ambiguities. The participants were asked to sign the consent forms only if they fully understood the content of the briefing and were willing to participate in the study.

The researcher safeguarded the confidentiality and privacy of participants by using coding system for recording the data, which avoided the use of names, and keeping all information sheets that recorded the participants' name, telephone numbers, email addresses (if available), and code numbers in a locked cabinet, which only the researcher was able to access. Anonymity was also assured; participants of Study One and Study Two were reminded not to mention their names during yoga classes and the focus group discussion, respectively. They were advised that all information would be kept confidential and that their names would not be disclosed in any reports on the research, and all data collection records would be destroyed at the completion of the study.

CHAPTER 4 RESULTS OF STUDY ONE

This chapter presents the results of Study One which investigating the effect of Hatha yoga intervention program on various aspects in physical and mental health. The chapter consists of six sections. The first section describes the process involved during the recruitment of the participants. The second section describes the characteristics of the study sample. This section compares the demographic, physiological, and psychological characteristics of the participants who completed the study with who those did not complete the study. The section also determines the homogeneity of the intervention group and the control group. The third, fourth and fifth sections report the results of the primary analysis and the two subgroup analyses. The primary analysis compares the changes of the outcome variables from baseline to post-intervention between the yoga and control groups of the whole study sample, whereas the two subgroup analyses focus on the metabolic syndrome subgroup sample and the non-metabolic syndrome subgroup sample, respectively. The last section summarizes the results of Study One.

4.1 Participants' Recruitment and Adherence to the Study Protocol

The period of recruitment procedure was carried out from May 2010 to January 2011. The participants were selected following the procedures described in Chapter 3 (Section 3.3.5). A total of 823 individuals submitted enrolment forms to show their willingness of participation and were screened for eligibility for the study. Sixty-six individuals were excluded because of meeting exclusion criteria related physical health status. Thirty-nine prospective participants declined the invitation of study after knowing the detailed procedures of the study, for example some prospective participants failed to make themselves available for attending the assessments or most of the classes of yoga program. Thirty-four prospective participants could not be contacted using information provided. Since the number of prospective participants exceeded the sample size of the study, the researcher did not recruit 511 prospective participants, but invited those not enrolled in Study One to participate in Study Two.

The study recruited 173 individuals and assigned them to either the yoga (intervention) group (n = 87) and the control group (n = 86). Nineteen participants dropped out of the study. The reasons for dropping out included medical reasons that were not related to the study (n = 7), busy at work (n = 2), and missing the post-intervention assessment due to travelling (n = 2). The rest of the dropouts have not provided reasons for discontinued intervention (n = 7). Figure 5 illustrates the details of participant recruitment of the study.

The attrition rate of the overall sample was 11.0%. The attrition rates of the yoga group and the control group were 9.2% and 12.8%, respectively. In the yoga group, no injuries or adverse reactions attributed to the yoga program were identified. The attendance rate of those who completed the study was 93.6% for a total of twelve sessions. The number of sessions attended, ranging from nine to twelve sessions, had a median of eleven sessions. The reasons for not attending the yoga sessions were mainly due to sickness, travelling, attending family gathering, and going to work. Participant's average yoga self-practice duration was 165 minutes per week (about 23 minutes per day), ranging from 0 to 376 minutes per week (53 minutes per day). Amongst the 79 yoga participants, only one yoga participant reported that she did not practice after yoga class, and the reason for not practicing was due to busy for job and looking after the family.

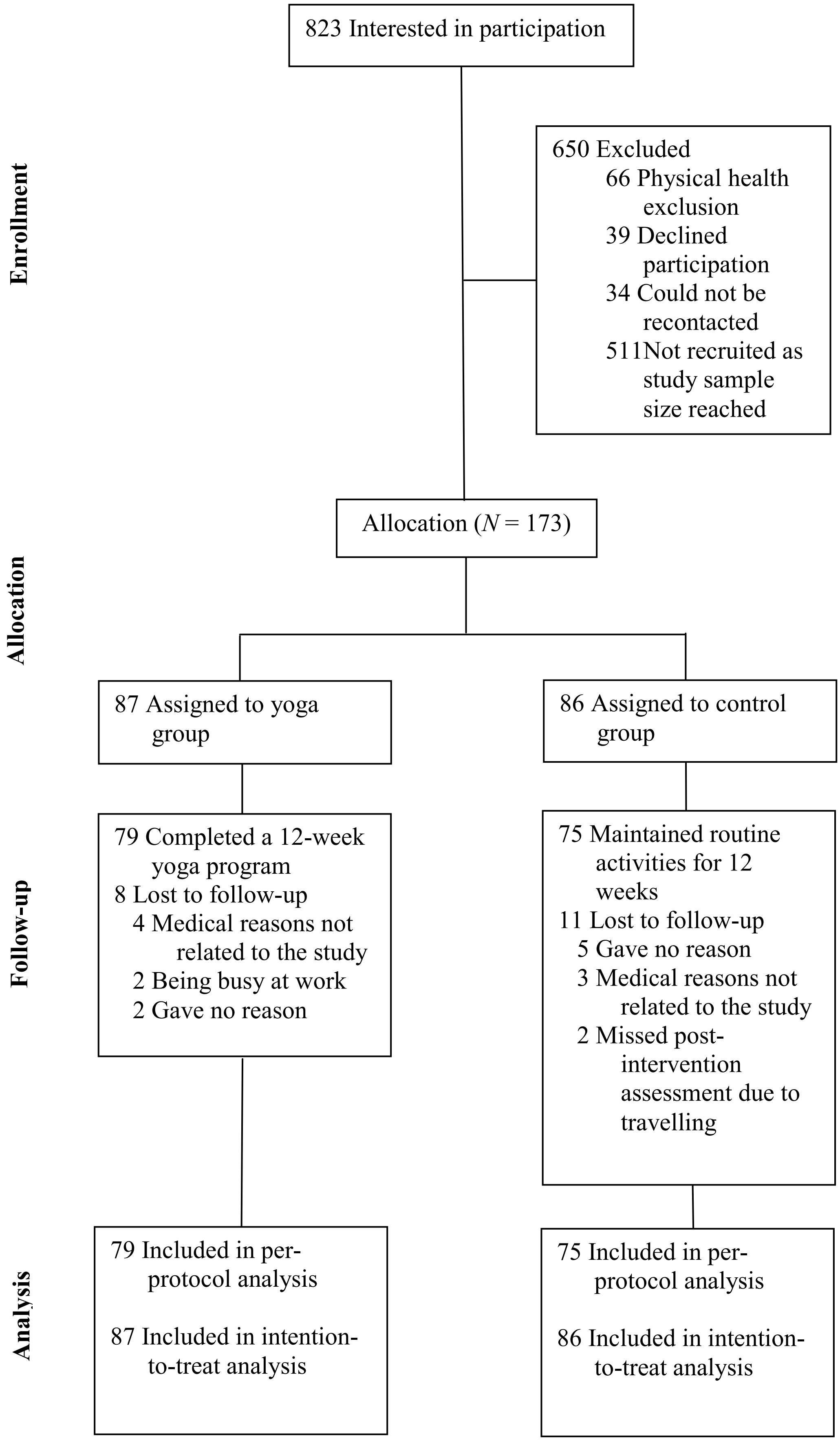


Figure 5. Recruitment of Participants of Study One.

4.2 Characteristics of the Study Sample

The study recruited 173 participants, of which 154 participants completed the study (regarded as continuing participants) and 19 were dropouts. Tables 5-7 describe the demographic, physiological, and psychological characteristics of both continuing participants and dropouts. The 154 continuing participants were aged from 30 to 71 years (M = 52.0, SD = 7.4), and nearly two-third of them (n = 97, 63.0%) were females. Most of the continuing participants were married (n = 126, 81.8%). More than half (n = 90, 58.4%) of the continuing participants attained secondary education, and about half (n = 82, 53.2%) of them engaged in full-time jobs. Regarding the continuing participants' lifestyle behaviours, most of them (n = 141, 91.6%) were non-smokers, and about half (n = 81, 52.6%) were occasional alcohol drinkers. Some of the continuing participants used medication in glucose (n = 19, 12.3%), blood pressure (n = 45, 29.2%), cholesterol (n = 22, 14.3%), and triglyceride (n = 3, 1.9%). As regards the physiological aspect, participants' average resting heart rate was 68.66 beats/minutes (bpm), whereas their average blood pressure was 130/79 mmHg. For body composition, the mean body weight and mean BMI of participants were 66.08 kg (SD = 11.87) and 25.02 kg/m^2 (SD = 3.91), respectively. The participants' average waist circumference was 88.34 cm (SD = 10.16). For biochemical measurements, the average FBG, TG, and HDL-C were 5.58 mmol/L (SD = 0.95), 1.46 mmol/L (SD = 1.01), and 1.48 mmol/L (SD = 0.41), respectively. The mean for cortisol level collected at 6:15pm in Week One was 5.13 nmol/L (SD = 3.12). Concerning their clinical background, the participants had negative average MetS z score (M = -0.81, SD = 1.42), negative score means lower risk of MetS. The participants' performance in maximal test was 28.31 ml/kg/min (SD = 6.71), and their performance in Curl-up and Push-up Tests was 20.62 times (SD = 5.18) and

4.23 times (*SD* = 6.53), respectively. The participants' performance in the flexibility test for the left leg was 49.08 cm (*SD* = 11.90) and for the right leg was 48.94 cm (*SD* = 12.31).

Concerning the psychological aspect, participants' mean self-esteem score was 21.79 (*SD* = 4.12) and mean perceived stress score was 15.98 (*SD* = 4.28). Their mean state anxiety score and trait anxiety score was 31.40 (*SD* = 8.07) and 35.20 (*SD* = 7.66), respectively. These participants got average depression score of 11.19 (*SD* = 6.33). Regarding the participants' HRQoL, the mean physical component score was 300.05 (*SD* = 52.95) and mean mental component score was 312.60 (*SD* = 65.34).

4.2.1 Comparison of the Continuing Participants and the Dropouts in the Study

The demographic, physiological and psychological characteristics of the continuing participants have been compared with those of the dropouts. No significant differences were found in all demographic and physiological characteristics between continuing participants and the dropouts. These two groups only demonstrated significant differences in the two psychological characteristics, including depression score [$t(171) = -2.03$, $p = 0.044$] and mental health domain score [$t(171) = 2.30$, $p = 0.023$]. The continuing participants had lower depression score and higher mental health domain score than the dropouts did. The results are presented in Tables 5-7.

Table 5

Demographic Characteristics of the Continuing Participants and the Dropouts in Study One (N = 173)

Characteristics	Continuing participants (n = 154)	Dropouts (n = 19)	t or χ^2	p [b]
	$M \pm SD$ or f (%)			
Age (years) [a]	52.00 ± 7.40	51.79 ± 8.13	0.12	.913
			0.02	.901
30-44	25 (16.2%)	5 (26.3%)		
45-54	73 (47.4%)	5 (26.3%)		
55-64	51 (33.1%)	9 (47.4%)		
65 or above	5 (3.2%)	0 (0%)		
Gender			0.00	.988
Male	57 (37.0%)	7 (36.8%)		
Female	97 (63.0%)	12 (63.2%)		
Marriage			2.03	.154
Single	25 (16.2%)	2 (10.5%)		
Married	126 (81.8%)	15 (78.9%)		
Widow	3 (1.9%)	2 (10.5%)		
Education level [a]			3.18	.075
No education	1 (0.6%)	0 (0.0%)		
Primary	10 (6.5%)	0 (0.0%)		
Secondary	90 (58.4%)	9 (47.4%)		
Tertiary	53 (34.4%)	10 (52.6%)		
Occupation [a]			0.02	.876
Full-time	82 (53.2%)	11 (57.9%)		
Part-time	9 (5.8%)	1 (5.3%)		
Unemployed	2 (1.3%)	0 (0.0%)		
Housewife	28 (18.2%)	2 (10.5%)		
Retired	33 (21.4%)	5 (26.3%)		
Smoking			0.36	.549
Current	3 (1.9%)	0 (0.0%)		
Quitted	10 (6.5%)	1 (5.3%)		
Never	141 (91.6%)	18 (94.7%)		
Alcohol intake			0.57	.451
Quitted	2 (1.3%)	0 (0.0%)		
Never	66 (42.9%)	7 (36.8%)		
Sometimes	81 (52.6%)	11 (57.9%)		
Always	5 (3.2%)	1 (5.3%)		
Medication use				
Glucose			1.11	.288
Yes	19 (12.3%)	4 (21.1%)		
No	135 (87.7%)	15 (78.9%)		
Blood pressure			0.07	1.000
Yes	45 (29.2%)	5 (26.3%)		
No	109 (70.8%)	14 (73.7%)		
Cholesterol			0.03	.860
Yes	22 (14.3%)	3 (15.8%)		
No	132 (85.7%)	16 (84.2%)		
Triglyceride			0.82	.375
Yes	3 (1.9%)	1 (5.3%)		
No	151 (98.1%)	18 (94.7)		

[a] The total percentage does not sum to exactly 100% due to round-off error.
[b] There were no significant differences between groups in all the characteristics at baseline.

Table 6

Physiological Characteristics of the Continuing Participants and the Dropouts in Study One (N = 173)

Characteristics	Continuing participants (n = 154)	Dropouts (n = 19)	t	p [a]
	$M \pm SD$			
MetS related				
WC (cm)	88.34 ± 10.16	92.62 ± 10.18	-1.73	.085
SBP (mmHg)	130.81 ± 18.95	126.84 ± 14.66	0.88	.381
DBP (mmHg)	79.07 ± 11.50	77.84 ± 9.05	0.45	.654
FBG (mmol/L)	5.58 ± 0.95	6.21 ± 1.72	-1.56	.136
TG (mmol/L)	1.46 ± 1.01	1.62 ± 1.31	-0.63	.529
HDL-C (mmol/L)	1.48 ± 0.41	1.37 ± 0.31	1.10	.272
MetS z score	-0.81 ± 3.21	0.47 ± 4.04	-1.60	.112
Physical activity level (IPAQ)				
(MET-minutes/week)	1732.11 ± 1614.85	1859.78 ± 1736.33	-0.31	.756
Health-related physical fitness components				
Body composition				
Body weight (kg)	66.08 ± 11.87	68.33 ± 10.85	-0.79	.433
BMI (kg/m^2)	25.02 ± 3.91	26.40 ± 3.93	-1.46	.148
Cardiorespiratory endurance				
Resting heart rate (bpm)	68.66 ± 9.59	70.68 ± 8.25	-0.88	.379
VO_{2max} (ml/kg/min)	28.31 ± 6.71	27.89 ± 7.12	0.25	.800
Muscular strength and endurance				
Curl-ups (times)	20.62 ± 5.18	20.26 ± 6.45	0.27	.785
Push-ups (times)	4.23 ± 6.53	3.84 ± 6.65	0.24	.809
Flexibility				
Left leg (cm)	49.08 ± 11.90	49.00 ± 9.10	0.03	.976
Right leg (cm)	48.94 ± 12.31	48.71 ± 8.81	0.08	.937
Cortisol level at 6:15pm (nmol/L)	5.13 ± 3.12	5.37 ± 2.69	-0.32	.753

[a] There were no significant differences between groups in all the characteristics at baseline.

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *BMI* body mass index

Table 7

Psychological Characteristics of the Continuing Participants and the Dropouts in Study One (N = 173)

	Continuing participants (n = 154)	Dropouts (n = 19)		
Characteristics	$M \pm SD$		t	p
Self-esteem (RSE)	21.79 ± 4.12	20.79 ± 3.22	1.02	.308
Perceived stress (PPS)	15.98 ± 4.28	16.83 ± 3.43	-0.81	.417
Anxiety (STAI)				
State anxiety (SA)	31.40 ± 8.07	30.47 ± 7.96	0.47	.639
Trait anxiety (TA)	35.20 ± 7.66	36.47 ± 6.99	-0.69	.491
Depression (CES-D)	11.19 ± 6.33	14.26 ± 5.27	-2.03	.044*
HRQoL (SF-36)				
Physical Functioning (PF)	87.27 ± 11.17	87.11 ± 14.46	0.06	.953
Role Physical (RP)	84.25 ± 27.11	84.21 ± 31.41	0.01	.995
Bodily Pain (BP)	67.58 ± 21.27	59.47 ± 18.57	1.59	.114
General Health Perceptions (GH)	60.94 ± 11.95	60.00 ± 12.02	0.32	.746
Physical Component Score (PCS)	300.05 ± 52.95	290.79 ± 59.05	0.71	.479
Vitality (VT)	66.56 ± 16.38	63.16 ± 11.93	0.88	.382
Social Functioning (SF)	87.01 ± 17.20	79.61 ± 16.25	1.78	.077
Role Emotional (RE)	81.60 ± 31.90	77.19 ± 36.94	0.56	.577
General Mental Health (MH)	77.43 ± 13.96	69.68 ± 13.15	2.30	.023*
Mental Component Score (MCS)	312.60 ± 65.34	289.64 ± 61.88	1.45	.148

* $p < 0.05$

4.2.2 Baseline Homogeneity of the Yoga and the Control Groups in Per-Protocol Analysis and Intention-To-Treat Analysis

Per-protocol (PP) analysis

Homogeneity of the yoga and control groups in terms of demographic, physiological and psychological characteristics at baseline was determined (see Tables 8-10). The two groups were homogeneous in majority of the measured characteristics. Only three characteristics were found to have significant differences between the two groups, of which two were physiological characteristics and one was psychological characteristic. For physiological characteristics, significant differences were found in DBP [$t(152) = -2.52$, $p = 0.013$] and BMI [$t(152) = -2.28$, $p = 0.024$]. The yoga group demonstrated significantly lower DBP and BMI than the control group did. For psychological aspect, these two groups had significant differences in physical functioning domain score [$t(152) = 2.05$, $p = 0.042$] and role emotional domain score [$t(152) = -2.12$, $p = 0.035$]. Participants in the yoga group had significantly higher physical functioning domain score and lower role emotional domain score than the control counterparts did.

Intention-to-treat (ITT) analysis

Homogeneity of the yoga and control groups in terms of demographic, physiological and psychological characteristics at baseline was determined (see Tables 11-13). Similar to the results of per-protocol analysis presented in the last section, the yoga group and the control group were homogeneous in majority of the measured characteristics. Only two characteristics were found to have significant differences between the two groups, including BMI [$t(171) = -2.48$, $p = 0.014$] and role emotional score [$t(171)= -2.67$, $p = 0.008$]. The yoga group demonstrated significant lower BMI and role emotional domain score than the control group did.

Table 8.
Demographic Characteristics of Participants in the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154)

Characteristics	Yoga group (n = 79)	Control group (n = 75)	t or χ^2	p^b
	$M \pm SD$ or f (%)			
Age (years)	52.63 ± 7.62	51.36 ± 7.76	1.06	.292
			0.93	.334
30-44	10 (12.7%)	15 (20.0%)		
45-54	38 (48.1%)	35 (46.7%)		
55-64	29 (36.7%)	22 (29.3%)		
65 or above	2 (2.5%)	3 (4.0%)		
Gender			0.01	.936
Male	29 (36.7%)	28 (37.3%)		
Female	50 (63.3%)	47 (62.7%)		
Marriage			0.84	.361
Single	12 (15.2%)	13 (17.3%)		
Married	64 (81.0%)	62 (82.7%)		
Widow	3 (3.8%)	0 (0.0%)		
Education level [a]			1.75	.186
No education	0 (0.0%)	1 (1.3%)		
Primary	5 (6.3%)	5 (6.7%)		
Secondary	43 (54.4%)	47 (62.7%)		
Tertiary	31 (39.2%)	22 (29.3%)		
Occupation			0.02	.891
Full-time	42 (53.2%)	40 (53.3%)		
Part-time	5 (6.3%)	4 (5.3%)		
Unemployed	0 (0.0%)	2 (2.7%)		
Housewife	17 (21.5%)	11 (14.7%)		
Retired	15 (19.0%)	18 (24.0%)		
Smoking [a]			0.29	.593
Current	1 (1.3%)	2 (2.7%)		
Quitted	5 (6.3%)	5 (6.7%)		
Never	73 (92.4%)	68 (90.7%)		
Alcohol intake			2.20	.138
Quitted	1 (1.3%)	1 (1.3%)		
Never	28 (35.4%)	38 (50.7%)		
Sometimes	48 (60.8%)	33 (44.0%)		
Always	2 (2.5%)	3 (4.0%)		
Medication use				
Glucose			2.54	.111
Yes	13 (16.5%)	6 (8.0%)		
No	66 (83.5%)	69 (92.0%)		
Blood pressure			3.25	.071
Yes	18 (22.8%)	27 (36.0%)		
No	61 (77.2%)	48 (64.0%)		
Cholesterol			0.11	.742
Yes	12 (15.2%)	10 (13.3%)		
No	67 (84.8%)	65 (86.7%)		
Triglyceride			0.29	.591
Yes	2 (2.5%)	1 (1.3%)		
No	77 (97.5%)	74 (98.7)		

[a] The total percentage does not sum to exactly 100% due to round-off error.
[b] There were no significant differences between groups in all the characteristics at baseline.

Table 9

Physiological Characteristics of Participants in the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154)

Characteristics	Yoga group (n = 79)	Control group (n = 75)	t	p
	$M \pm SD$			
MetS related				
WC (cm)	87.12 ± 10.61	89.62 ± 9.56	-1.54	.127
SBP (mmHg)	128.24 ± 15.94	133.51 ± 21.46	-1.72	.087
DBP (mmHg)	76.84 ± 10.48	81.43 ± 12.11	-2.52	.013*
FBG (mmol/L)	5.59 ± 0.91	5.56 ± 1.00	0.22	.828
TG (mmol/L)	1.46 ± 0.99	1.45 ± 1.03	0.04	.965
HDL-C (mmol/L)	1.51 ± 0.42	1.45 ± 0.41	0.87	.385
MetS z-score	-1.14 ± 3.24	-0.42 ± 3.25	-1.37	.174
Physical activity level (IPAQ) (MET-minutes/week)	1836.98 ± 1921.50	1631.95 ± 1274.45	0.19	.828
Health-related physical fitness components				
Body composition				
Body weight (kg)	64.39 ± 11.88	67.86 ± 11.68	-1.83	.069
BMI (kg/m^2)	24.33 ± 3.94	25.74 ± 3.77	-2.28	.024*
Cardiorespiratory endurance				
Resting heart rate (bpm)	68.25 ± 9.35	69.08 ± 9.88	-0.53	.594
VO_{2max} (ml/kg/min)	28.65 ± 6.71	27.94 ± 6.73	0.65	.515
Muscular strength and endurance				
Curl-ups (times)	20.89 ± 5.50	20.33 ± 4.86	0.66	.510
Push-ups (times)	4.71 ± 7.60	3.72 ± 5.18	0.95	.349
Flexibility				
Left leg (cm)	47.45 ± 11.90	50.80 ± 11.74	-1.76	.080
Right leg (cm)	47.27 ± 12.08	50.71 ± 12.39	-1.75	.083
Cortisol level at 6:15pm (nmol/L)	5.00 ± 2.49	5.27 ± 3.68	-0.54	.590

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *PA* physical activity; *BMI* body mass index

*p <0.05

Table 10

Psychological Characteristics of Participants in the Yoga Group and Control Group in Per-Protocol Analysis (N = 154)

Characteristics	Yoga group (*n* = 79)	Control group (*n* = 75)	*t*	*p*
	M ± *SD*			
Self-esteem (RSE)	21.91 ± 4.44	21.67 ± 3.78	0.37	.714
Perceived stress (PPS)	16.17 ± 3.88	15.83 ± 4.69	0.43	.666
Anxiety (STAI)				
State anxiety (SA)	31.71 ± 8.26	31.07 ± 7.92	0.55	.623
Trait anxiety (TA)	35.53 ± 7.77	34.85 ± 7.58	0.49	.584
Depression (CES-D)	11.92 ± 6.06	10.41 ± 6.55	1.49	.139
HRQoL (SF-36)				
Physical functioning (PF)	89.05 ± 9.24	85.40 ± 12.70	2.05	.042*
Role physical (RP)	83.23 ± 28.51	85.33 ± 25.70	-0.48	.632
Bodily pain (BP)	67.49 ± 19.49	67.67 ± 23.12	-0.05	.960
General health perceptions (GH)	60.95 ± 11.80	60.93 ± 12.18	0.01	.993
Physical component score (PCS)	300.72 ± 50.86	299.33 ± 55.41	0.16	.871
Vitality (VT)	67.22 ± 15.04	65.87 ± 17.75	0.51	.611
Social functioning (SF)	85.28 ± 18.21	88.83 ± 15.99	-1.28	.202
Role emotional (RE)	76.37 ± 34.24	87.11 ± 28.42	-2.12	.035*
General mental health (MH)	76.15 ± 13.71	78.77 ± 14.18	-1.17	.245
Mental component score (MCS)	305.02 ± 66.21	320.58 ± 63.88	-1.48	.140

*p <0.05

Table 11

Demographic Characteristics of Subjects in the Yoga Group and the Control Group in Intention-To-Treat Analysis (N = 173)

Characteristics	Yoga group (*n* = 87)	Control group (*n* = 86)	*t* or χ^2	*p* [b]
	M ± *SD* or *f* (%)			
Age (years) [a]	52.44 ± 7.15	51.52 ± 7.78	0.81	.422
			0.60	.440
30-44	13 (14.9%)	17 (19.8%)		
45-54	39 (44.8%)	39 (45.3%)		
55-64	33 (37.9%)	27 (31.5%)		
65 or above	2 (2.3%)	3 (3.5%)		
Gender			0.33	.568
Male	34 (39.1%)	30 (34.9%)		
Female	53 (60.9%)	56 (65.1%)		
Marriage			0.58	.446
Single	13 (14.9%)	14 (16.3%)		
Married	70 (80.5%)	71 (82.6%)		
Widow	4 (4.6%)	1 (1.2%)		
Education level [a]			2.59	.108
No education	0 (0.0%)	1 (1.2%)		
Primary	5 (5.7%)	5 (5.8%)		
Secondary	45 (51.7%)	54 (62.8%)		
Tertiary	37 (31.7%)	26 (30.2%)		
Occupation			0.25	.615
Full-time	48 (55.2%)	45 (52.3%)		
Part-time	5 (5.7%)	5 (5.8%)		
Unemployed	0 (0.0%)	2 (2.3%)		
Housewife	18 (20.7%)	12 (14.0%)		
Retired	16 (18.4%)	22 (25.6%)		
Smoking			0.06	.813
Current	1 (1.1%)	2 (2.3%)		
Quitted	6 (6.9%)	5 (5.8%)		
Never	80 (92.0%)	79 (91.9%)		
Alcohol intake [a]			3.09	.079
Quitted	1 (1.1%)	1 (1.2%)		
Never	30 (34.5%)	43 (50.0%)		
Sometimes	53 (60.9%)	39 (45.3%)		
Always	3 (3.4%)	3 (3.5%)		
Medication use				
Glucose			2.37	.124
Yes	15 (17.2%)	8 (9.3%)		
No	72 (82.8%)	78 (90.7%)		
Blood pressure			2.98	.084
Yes	20 (23.0%)	30 (34.9%)		
No	67 (77.0%)	56 (65.1%)		
Cholesterol			0.06	.810
Yes	12 (13.8%)	13 (15.1%)		
No	75 (86.2%)	73 (84.9%)		
Triglyceride			1.00	.317
Yes	3 (3.4%)	1 (1.2%)		
No	84 (96.6%)	85 (98.8)		

[a] The total percentage does not sum to exactly 100% due to round-off error.
[b] There were no significant differences between groups in all the variables at baseline.

Table 12

Physiological Characteristics of Subjects in the Yoga Group and the Control Group in Intention-To-Treat Analysis (N = 173)

Characteristics	Yoga group (n = 87)	Control group (n = 86)	t	p
	$M \pm SD$			
MetS related				
WC (cm)	87.43 ± 10.37	90.20 ± 9.93	-1.80	.074
SBP (mmHg)	128.59 ± 16.12	132.17 ± 20.64	-1.27	.205
DBP (mmHg)	77.30 ± 10.54	80.59 ± 11.74	-1.94	.054
FBG (mmol/L)	5.63 ± 0.90	5.66 ± 1.23	-0.24	.808
TG (mmol/L)	1.46 ± 0.96	1.50 ± 1.12	-0.28	.778
HDL-C (mmol/L)	1.49 ± 0.41	1.45 ± 0.40	0.65	.520
MetS z-score	-1.07 ± 3.16	-0.27 ± 3.45	-1.61	.112
Physical activity level (IPAQ) (MET-minutes/week)	1796.33 ± 1817.63	1701.91 ± 1430.95	0.35	.724
Health-related physical fitness components				
Body composition				
Body weight (kg)	64.68 ± 11.60	67.99 ± 11.74	-1.87	.063
BMI (kg/m^2)	24.44 ± 3.84	25.90 ± 3.90	-2.48	.014*
Cardiorespiratory endurance				
Resting heart rate (bpm)	68.49 ± 9.14	69.27 ± 9.79	-0.54	.592
VO_{2max} (ml/kg/min)	28.94 ± 6.82	27.57 ± 6.61	1.35	.180
Muscular strength and endurance				
Curl-ups (times)	20.70 ± 5.82	20.45 ± 4.79	0.31	.760
Push-ups (times)	4.85 ± 7.73	3.51 ± 4.98	1.36	.178
Flexibility				
Left leg (cm)	47.59 ± 11.45	50.58 ± 11.63	-1.71	.090
Right leg (cm)	47.43 ± 11.59	50.43 ± 12.19	-1.66	.099
Cortisol level at 6:15pm (nmol/L)	5.12 ± 2.39	5.13 ± 3.50	0.08	.936

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *BMI* body mass index

*p <0.05

Table 13

Psychological Characteristics of Participants in the Yoga Group and the Control Group in Intention-To-Treat Analysis (N = 173)

Characteristics	Yoga group (n = 87)	Control group (n = 86)	t	p
	$M \pm SD$			
Self-esteem (RSE)	21.74 ± 4.40	21.63 ± 3.65	0.18	.861
Perceived stress (PPS)	16.17 ± 3.88	15.96 ± 4.53	0.32	.747
Anxiety (STAI)				
State anxiety (SA)	31.71 ± 8.26	31.07 ± 7.92	0.23	.816
Trait anxiety (TA)	35.53 ± 7.77	34.85 ± 7.58	0.67	.505
Depression (CES-D)	12.23 ± 6.13	10.81 ± 6.39	1.49	.139
HRQoL (SF-36)				
Physical Functioning (PF)	88.74 ± 10.57	85.76 ± 12.31	1.71	.089
Role Physical (RP)	82.76 ± 28.86	85.76 ± 26.16	-0.72	.475
Bodily Pain (BP)	65.97 ± 19.91	67.41 ± 22.32	-0.45	.652
General Health Perceptions (GH)	60.69 ± 11.91	60.99 ± 12.00	-0.16	.870
Physical Component Score (PCS)	298.15 ± 53.50	299.92 ± 53.90	-0.22	.829
Vitality (VT)	66.78 ± 15.06	65.58 ± 16.88	0.49	.622
Social Functioning (SF)	84.48 ± 18.08	87.94 ± 16.21	-1.32	.188
Role Emotional (RE)	74.71 ± 35.57	87.60 ± 27.56	-2.67	.008**
General Mental Health (MH)	75.26 ± 13.85	77.91 ± 14.20	-1.24	.217
Mental Component Score (MCS)	301.24 ± 68.09	319.02 ± 61.23	-1.81	.073

**p <0.01

4.3 Primary Analysis of Study One

The primary analysis compared the changes of the outcome variables between the yoga and control groups of the whole study sample. Firstly, the baseline homogeneity tests of demographic, physiological and psychological characteristics between the yoga and control groups were conducted, and those characteristics with significant differences were noted as heterogeneous characteristics. Relationship between those heterogeneous characteristics and all the outcome variables were assessed in order to identify possible covariates of the particular variables. Those heterogeneous characteristics that significantly correlated with the particular outcome variables were identified as covariates of the particular outcome variables. To examine the effect of yoga on the outcome variables relative to the control condition, ANOVA was conducted to compare the mean changes of outcome variables from baseline to post-intervention between the yoga and control groups. If covariates for particular outcome variables were identified, additional ANCOVA was conducted in order to control the confounding effects arose from the presence of the covariates. Both per-protocol (PP) and intention-to-treat (ITT) analyses were performed. Effect size was computed to show magnitude and direction of the effect of the yoga intervention relative to the control condition for each outcome variable. According to Cohen (1988), the effect size in ANOVA (also in ANCOVA) as represented by the value of partial eta squared (η^2) can range from very small ($<$ 0.01), to small (0.01-0.05) then to medium (0.06-0.13), and finally to large ($\geq$ 0.14).

4.3.1 Relationships between Heterogeneous Characteristics and the Outcome Variables

In order to identify possible covariates, relationships between the outcome variables with those heterogeneous characteristics, which identified in the baseline homogeneity tests (presented in Sections 4.2.2), were assessed.

PP analysis

Significant differences were found in the status of DBP, BMI, physical functioning domain and role emotional domain scores at baseline between the yoga and control groups. The correlations of these four heterogeneous characteristics with 32 outcome variables were identified (see Table 14). Among these 32 outcome variables, thirteen variables (number as "1, 3, 7, 9-10, 12, 16, 17, 19-20, 27-29" in Table 14) were significantly correlated with one of these four heterogeneous characteristics, six (number as "2, 14, 18, 30-32" in Table 14) were significantly correlated with two characteristics, and only one (number as "22" in Table 14) was significantly correlated with three characteristics. Incorporating the findings from these correlation analyses and those about homogeneity of the two groups, the heterogeneous characteristics have exerted confounding effects on these 20 outcome variables, and were considered as covariates during analysis. ANOVA was adopted to determine if there was a significant difference in the change of each outcome variable between the yoga and control groups over the 12-week intervention period in this PP analysis. The additional ANCOVA was adopted to control the confounding effects of the heterogeneous characteristics on particular outcome variables.

Findings also illustrated that the rest of the 12 outcome variables (number as "4-6, 8, 11, 13, 15, 21, 23-26" in Table 14) were not significantly correlated with any of these four heterogeneous characteristics. This implies that none of these two heterogeneous characteristics exerted confounding effects on these twelve outcome variables in this PP analysis. Therefore, ANOVA was adopted to determine if there was a significant difference in the change of each outcome variable between the yoga and control groups over the 12-week intervention period.

ITT analysis

The yoga and control groups were heterogeneous in terms of the status of BMI and role emotional domain score. The correlations of these two heterogeneous characteristics with 32 outcome variables were identified (see Table 15). Among these 32 outcome variables, ten variables (number as "10, 17-20, 28-32" in Table 15) were significantly correlated with one heterogeneous characteristic, whereas two (number as "14 and 22" in Table 15) were significantly correlated with all heterogeneous characteristics. Incorporating the findings from these correlation analyses and those about homogeneity of the yoga and control groups, the heterogeneous characteristics have exerted confounding effects on these 12 outcome variables, and were considered as covariates during analysis. ANOVA was adopted to determine if there was a significant difference in the change of each outcome variable between the yoga and control groups over the 12-week intervention period in this ITT analysis. Additional ANCOVA was adopted to control the confounding effects of the heterogeneous characteristics on particular outcome variables.

Findings also illustrated that the rest of the 20 outcome variables (number as "1-9, 11-13, 15-16, 21, 23-27" in Table 15) were not significantly correlated with any of these four heterogeneous characteristics. This implies that none of the four heterogeneous characteristics exerted confounding effects on these twelve outcome variables in this ITT analysis. Therefore, ANOVA was adopted to determine if there was a significant difference in the change of each variable between the yoga and control groups over the 12-week intervention period.

Table 14

Correlations between Heterogeneous Characteristics and Outcome Variables for Per-Protocol Analysis (N = 154)

	Heterogeneous characteristics			
Outcome variables	BDBP	BBMI	BPF	BRE
1. WC	0.136	0.018	-0.242**	-0.039
2. SBP	-0.211**	0.134	-0.176*	-0.056
3. DBP	-0.411**	-0.002	0.061	0.000
4. FBG	-0.073	-0.025	-0.090	0.022
5. TG	0.055	-0.078	0.041	0.149
6. HDL-C	0.046	0.115	-0.099	0.042
7. MetS z-score	-0.169*	-0.049	-0.048	0.043
8. Physical activity level	-0.142	-0.005	-0.069	-0.065
9. Body weight	0.060	-0.197*	-0.028	-0.020
10. Body mass index	0.044	-0.184*	-0.054	-0.009
11. Resting heart rate	-0.050	-0.052	-0.023	-0.064
12. VO_{2max}	-0.202*	-0.130	0.091	-0.008
13. Curl-ups	0.039	0.036	0.079	0.008
14. Push-ups	-0.125	-0.195*	0.143	-0.177*
15. Left leg flexibility	-0.124	-0.126	0.133	-0.068
16. Right leg flexibility	-0.192*	-0.109	0.093	-0.053
17. Cortisol level	0.063	0.291**	-0.085	0.038
18. Self-esteem (RSE)	-0.236**	-0.101	-0.048	-0.173*
19. Perceived stress (PPS)	0.121	0.128	0.147	0.166*
20. State anxiety (SA)	0.081	0.072	0.064	0.230**
21. Trait anxiety (TA)	0.051	0.098	-0.131	0.118
22. Depression (CES-D)	0.180*	0.165*	0.097	0.198*
23. Physical Functioning (PF)	-0.154	-0.119	-0.476	-0.076
24. Role Physical (RP)	-0.056	-0.054	-0.133	-0.110
25. Bodily Pain (BP)	-0.099	-0.151	-0.126	-0.095
26. General Health Perceptions (GH)	-0.096	-0.058	-0.009	-0.022
27. Physical Component Score (PCS)	-0.134	-0.138	-0.247**	-0.135
28. Vitality (VT)	-0.101	-0.116	-0.154	-0.260**
29. Social Functioning (SF)	-0.063	-0.038	-0.063	-0.299**
30. Role Emotional (RE)	-0.197*	-0.082	0.001	-0.631**
31. General Mental Health (MH)	-0.193*	-0.113	-0.147	-0.241**
32. Mental Component Score (MCS)	-0.196*	-0.108	-0.084	-0.561**

WC waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome; *BDBP* diastolic blood pressure at baseline; *BBMI* body mass index at baseline; *BPF* physical functioning domain score at baseline; *BRE* role emotional domain score at baseline
* $p < 0.05$; ** $p < 0.01$

Table 15
Correlations between Heterogeneous Characteristics and Outcome Variables for Intention-To-Treat Analysis (N = 173)

Outcome variables	Heterogeneous characteristics	
	BBMI	BRE
1. WC	0.037	-0.043
2. SBP	0.136	-0.056
3. DBP	0.004	-0.002
4. FBG	-0.019	0.019
5. TG	-0.068	0.136
6. HDL-C	0.099	0.042
7. MetS z-score	-0.029	0.033
8. Physical activity level	-0.012	-0.054
9. Body weight	-0.165	-0.025
10. Body mass index	-0.153*	-0.015
11. Resting heart rate	-0.047	-0.060
12. VO_{2max}	-0.134	-0.003
13. Curl-ups	0.018	0.013
14. Push-ups	-0.203**	-0.151*
15. Left leg flexibility	-0.137	-0.054
16. Right leg flexibility	-0.123	-0.039
17. Cortisol level	0.273**	0.035
18. Self-esteem (RSE)	-0.098	-0.0159*
19. Perceived stress (PPS)	0.123	0.153*
20. State anxiety (SA)	0.074	0.211**
21. Trait anxiety (TA)	0.100	0.106
22. Depression (CES-D)	0.162*	0.180*
23. Physical Functioning (PF)	-0.114	-0.070
24. Role physical (RP)	-0.047	-0.104
25. Bodily pain (BP)	-0.140	-0.088
26. General health perceptions (GH)	-0.053	-0.022
27. Physical component score (PCS)	-0.127	-0.126
28. Vitality (VT)	-0.116	-0.238**
29. Social functioning (SF)	-0.036	-0.278**
30. Role emotional (RE)	-0.080	-0.585**
31. General mental health (MH)	-0.109	-0.223**
32. Mental component score (MCS)	-0.106	-0.519**

WC waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome; *BDBP* diastolic blood pressure at baseline; *BBMI* body mass index at baseline; *BPF* physical functioning domain at baseline; *BRE* role emotional domain score at baseline
* $p < 0.05$; ** $p < 0.01$

4.3.2 Comparison of the Mean Changes of Outcome Variables between the Yoga Group and the Control Group

4.3.2.1 Changes of Metabolic Risk Factors

Table 16 presents the comparison of the mean changes of seven metabolic risk factors (waist circumference, systolic blood pressure, diastolic blood pressure, fasting blood glucose, triglyceride, high-density lipoprotein cholesterol, and MetS z score) among participants enrolled in the yoga program versus the control group.

1. Waist circumference (WC)

In PP analysis, the yoga group showed a significantly greater decline in the mean change of WC (M = -2.90, SD = 2.54) as compared to the control group (M = -0.23, SD = 2.34), $p < 0.001$, partial $\eta^2 = 0.232$, exhibiting a very large effect size. With adjusting the confounding effect of physical functioning domain score, the yoga intervention still exerted a very large effect on the mean change of WC (partial η^2 = 0.213). Result of ITT analysis was similar to that of PP analysis, the yoga group showed greater decline in the mean change of WC (M = -2.64, SD = 2.56) than the control group did (M = -0.20, SD = 2.19), $p < 0.001$, partial $\eta^2 = 0.209$, representing a very large effect size.

2. Systolic blood pressure (SBP)

Results of both PP and ITT analyses indicated that no significant difference in the mean change of SBP between the two groups was found.

3. Diastolic blood pressure (DBP)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of DBP between the two groups.

4. Fasting blood glucose (FBG)

Results of both PP and ITT analyses revealed that a significant difference in the mean change of FBG was found. In PP analysis, the yoga group (M = -0.15, SD = 0.41) had greater reduction in FBG than the control group did (M = 0.05, SD = 0.37), p = 0.002, partial η^2 = 0.062, exhibiting a medium effect size. In ITT analysis, the yoga group (M = -0.14, SD = 0.40) had greater reduction than the control group (M = 0.05, SD = 0.36), p = 0.002, partial η^2 = 0.056, exhibiting a small-to-medium effect size.

5. Triglyceride (TG)

In PP analysis, there was a significant difference in the mean change of TG, with the yoga group (M = -0.20, SD = 0.73) demonstrating greater reduction in TG than the control group did (M = 0.01, SD = 0.47), p = 0.029, partial η^2 = 0.028, exhibiting a small effect size. Similarly, results of ITT analysis suggested the yoga group (M = -0.18, SD = 0.70) had greater reduction in TG than the control group (M = 0.01, SD = 0.44), p = 0.002, partial η^2 = 0.025, exhibiting a small effect size.

6. High-density lipoprotein cholesterol (HDL-C)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of HDL-C between the yoga and control groups.

7. MetS z score

Results of both PP and ITT analyses revealed that there was a significant difference in the mean change of MetS z score. In PP analysis, the yoga group (*M* = -0.89, *SD* = 1.31) showed significantly greater reduction in MetS z score than the control group (*M* = -0.02, *SD* = 1.07), $p < 0.001$, partial $\eta^2 = 0.077$, exhibiting a medium effect size. Also, result of ANCOVA revealed an increase in effect size (partial $\eta^2 = 0.104$) was found after adjusting for DBP at baseline. Similar results were found in ITT analysis, the yoga group (*M* = -0.79, *SD* = 1.26) demonstrated significantly greater reduction in MetS z score than the control group (*M* = -0.19, *SD* = 0.99), $p = 0.001$, partial η^2 = 0.067, exhibiting a medium effect size.

Table 16

Comparison of Changes of Metabolic Risk Factors between the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154) and Intention-To-Treat Analysis (N = 173)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	p	Effect size partial η^2	Adjusted p	Effect size partial η^2
WC (cm)										
PP [a]	87.12 ± 10.61	84.22 ± 10.11	-2.90 ± 2.54	89.62 ± 9.56	89.39 ± 9.68	-0.23 ± 2.34	.000***	0.232	.000***	0.213
ITT	87.43 ± 10.37	84.79 ± 10.02	-2.64 ± 2.56	90.20 ± 9.93	90.00 ± 10.05	-0.20 ± 2.19	.000***	0.209	/	/
SBP (mmHg)										
PP [b]	128.24 ± 15.94	123.52 ± 14.62	-4.72 ± 10.46	133.51 ± 21.46	131.16 ± 20.70	-2.35 ± 13.47	.225	0.010	.138	0.015
ITT	128.59 ± 16.12	124.30 ± 15.10	-4.29 ± 10.05	132.17 ± 20.64	130.13 ± 19.83	-2.05 ± 12.60	.197	0.010	/	/
DBP (mmHg)										
PP [c]	76.84 ± 10.48	75.92 ± 8.74	-0.91 ± 6.98	81.43 ± 12.11	80.13 ± 12.45	-1.29 ± 8.31	.757	0.001	.431	0.004
ITT	77.30 ± 10.54	76.47 ± 9.03	-0.83 ± 6.67	80.59 ± 11.74	79.47 ± 11.97	-1.13 ± 7.76	.785	0.000	/	/
FBG (mmol/L)										
PP	5.59 ± 0.91	5.44 ± 0.89	-0.15 ± 0.41	5.56 ± 1.00	5.61 ± 0.93	0.05 ± 0.37	.002**	0.062	/	/
ITT	5.63 ± 0.90	5.49 ± 0.89	-0.14 ± 0.40	5.66 ± 1.23	5.71 ± 1.18	0.05 ± 0.36	.002**	0.056	/	/
TG (mmol/L) #										
PP	1.47 ± 0.99	1.27 ± 0.65	-0.20 ± 0.73	1.46 ± 1.03	1.47 ± 1.01	0.01 ± 0.47	.029*	0.028	/	/
ITT	1.46 ± 0.96	1.28 ± 0.64	-0.18 ± 0.70	1.50 ± 1.12	1.51 ± 1.11	0.01 ± 0.44	.027*	0.025	/	/
HDL-C (mmol/L)										
PP	1.51 ± 0.42	1.54 ± 0.40	0.03 ± 0.19	1.45 ± 0.41	1.50 ± 0.40	0.05 ± 0.18	.554	0.002	/	/
ITT	1.49 ± 0.41	1.52 ± 0.39	0.03 ± 0.18	1.45 ± 0.40	1.50 ± 0.40	0.05 ± 0.17	.594	0.002	/	/
MetS z score										
PP [c]	-1.14 ± 3.24	-2.03 ± 2.87	-0.89 ± 1.31	-0.42 ± 3.25	-0.62 ± 3.22	-0.02 ± 1.07	.000***	0.077	.000***	0.104
ITT	-1.07 ± 3.16	-1.86 ± 2.87	-0.79 ± 1.26	-0.27 ± 3.45	-0.45 ± 3.44	-0.19 ± 0.99	.001**	0.067	/	/

Note. PP per-protocol analysis (yoga, n = 79; control, n = 75), *ITT* intention-to-treat analysis (yoga, n = 87; control, n = 86)
a Adjusted for physical functioning domain score at baseline.
b Adjusted for DBP at baseline and physical functioning domain score at baseline.
c Adjusted for DBP at baseline.
Log 10 reverse-transformation was applied to reduce the skewness of negatively skewed outcome variable.
Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride; *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome
*p <0.05; **p < 0.01; ***p < 0.001

4.3.2.2 Changes of Physical Activity Level and Health-Related Physical Fitness Components

Table 17 shows the comparison of the mean changes of physical activity level and four health-related physical fitness components (body composition, cardiovascular endurance, muscular strength and endurance, and flexibility) between the yoga group and the control group.

Physical activity level (PAL)

Results of both PP and ITT analyses revealed that there was no significant difference in the mean change of physical activity level between the yoga and control groups.

Health-related physical fitness components

1. Body composition

Body weight

Results of both PP and ITT analyses revealed that no significant difference in the mean change of body weight between the two groups was found.

BMI

In PP analysis, there was a marginally significant difference in the mean change of BMI between the two groups, with the yoga group (*M* = -0.34, *SD* = 0.46) experiencing greater reduction than the control group (*M* = -0.17, *SD* = 0.58), p = 0.051, partial η^2 = 0.025, exhibiting a small effect size. After adjusting for BMI at baseline, result of ANCOVA indicated a significant difference in the mean change of BMI between the two groups was found (p = 0.014), with a small effect size (partial η^2 = 0.039).

In ITT analysis, the yoga group experienced more reduction in BMI (*M* = -0.31, *SD* = 0.45) than the control group (*M* = -0.15, *SD* = 0.54), $p = 0.040$, partial $\eta^2 = 0.024$, exhibiting a small effect size. After adjusting for BMI at baseline, result of ANCOVA suggested that a significant difference in the mean change of BMI was found ($p = 0.036$), demonstrating a small effect size (partial $\eta^2 = 0.036$).

2. Cardiovascular endurance

Resting heart rate (RHR)

Result of PP analysis showed that participants experienced greater reduction in RHR in the yoga group (*M* = -2.06, *SD* = 6.88) than those in the control group did (*M* = 1.37, *SD* = 8.01), $p = 0.005$, partial $\eta^2 = 0.051$, exhibiting a small effect size. Similarly, result of ITT indicated that yoga participants showed greater reduction in RHR (*M* = -1.87, *SD* = 6.58) than those in the control participants did (*M* = 1.20, *SD* = 7.49), $p = 0.005$, partial $\eta^2 = 0.046$, exhibiting a small effect size.

VO_{2max}

In PP analysis, the yoga group showed greater increment in VO_{2max} (*M* = 2.02, *SD* = 2.74) than the control group did (*M* = -0.03, *SD* = 2.96), $p < 0.001$, partial $\eta^2 = 0.115$, representing a medium effect size. After adjusting for DBP at baseline, the yoga intervention also exerted a medium effect (partial $\eta^2 = 0.097$) on $VO_{2max.}$ In ITT analysis, the yoga group also showed greater increment in VO_{2max} (*M* = 1.81, *SD* = 2.68) than the control group did (*M* = -0.02, *SD* = 2.76), $p < 0.001$, partial $\eta^2 = 0.105$, representing a medium effect size.

3. Muscular strength and endurance

Curl-up Test

Results of PP and ITT analyses demonstrated that there was a significant difference in the mean change of sit-up test result between the yoga and control groups. In PP analysis, the yoga group had greater improvement when performing Curl-up Test (*M* = 2.97, *SD* = 4.59) than the control group did (*M* = 0.76, *SD* = 4.22), $p = 0.002$, partial $\eta^2 = 0.060$, representing a medium effect size. In ITT analysis, the yoga group had greater improvement in the result of Curl-up Test (*M* = 2.70, *SD* = 4.45) than the control group did (*M* = 0.66, *SD* = 3.95), $p = 0.002$, partial $\eta^2 = 0.056$, representing a small-to-medium effect size.

Push-up Test

In PP analysis, the yoga group had greater improvement in the Push-up Test result (*M* = 3.85, *SD* = 2.65) than the control group did (*M* = 0.24, *SD* = 2.16), $p < 0.001$, partial $\eta^2 = 0.360$, exhibiting a very large effect size. After adjusting for BMI at baseline and role emotional domain score at baseline, result of ANCOVA indicated a significant difference in the mean change of the Push-up Test result between the two groups was found ($p < 0.001$), with a very large effect size (partial $\eta^2 = 0.343$).

In ITT analysis, the yoga group experienced greater improvement when performing Push-up Test (*M* = 3.49, *SD* = 2.76) than the control group did (*M* = 0.21, *SD* = 2.01), $p < 0.001$, partial $\eta^2 = 0.319$, exhibiting a very large effect size. After adjusting for BMI at baseline and role emotional domain score at baseline, result of ANCOVA suggested that the yoga intervention exerted a very large effect on Push-up Test result (partial $\eta^2 = 0.288$).

4. Flexibility

Left leg flexibility

In PP analysis, the yoga group exhibited greater mean change of flexibility ($M = 6.78$, $SD = 4.30$) than the control group did ($M = -0.45$, $SD = 4.07$), $p < 0.001$, partial $\eta^2 = 0.430$, representing a very large effect size. In ITT analysis, the yoga group had greater mean change of flexibility ($M = 6.16$, $SD = 4.55$) than the control group did ($M = -0.40$, $SD = 3.80$), $p < 0.001$, partial $\eta^2 = 0.382$, representing a very large effect size.

Right leg flexibility

In PP analysis, the yoga group experienced a greater improvement in flexibility ($M = 7.14$, $SD = 4.23$) than the control group did ($M = -0.16$, $SD = 4.52$), $p < 0.001$, partial $\eta^2 = 0.382$, representing a very large effect size. After adjusting for diastolic blood pressure at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on flexibility (partial $\eta^2 = 0.395$). In ITT analysis, the yoga group had greater mean change of right leg flexibility ($M = 6.49$, $SD = 4.53$) than the control group did ($M = -0.14$, $SD = 4.22$), $p < 0.001$, partial $\eta^2 = 0.367$, representing a very large effect size.

Table 17

Comparison of Changes of Physical Activity Level and Health-Related Physical Fitness Components between the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154) and Intention-To-Treat Analysis (N = 173)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	p	Effect size partial η^2	Adjusted p	Effect size partial η^2
PAL (MET-minutes/week)										
PP	1836.97 ± 1912.50	2208.27 ± 1929.49	355.63 ± 2569.18	1631.95 ± 1274.45	2022.19 ± 1601.30	346.20 ± 1539.96	.980	0.000	/	/
ITT	1796.33 ± 1817.63	2129.95 ± 1845.44	313.79 ± 2413.69	1701.91 ± 1430.95	2040.52 ± 1679.21	295.43 ± 1423.24	.955	0.000	/	/
Body weight (kg)										
PP [a]	64.39 ± 11.88	63.57 ± 11.37	-0.81 ± 1.19	67.86 ± 11.68	67.36 ± 11.63	-0.51 ± 1.55	.170	0.012	.060	0.023
ITT	64.68 ± 11.60	63.94 ± 11.15	-0.74 ± 1.16	67.99 ± 11.74	67.55 ± 11.71	-0.44 ± 1.46	.140	0.013	/	/
BMI (kg/m^2)										
PP [a]	24.33 ± 3.94	23.99 ± 3.77	-0.34 ± 0.46	25.74 ± 3.77	25.57 ± 3.78	-0.17 ± 0.58	.051	0.025	.014*	0.039
ITT [a]	24.44 ± 3.84	24.14 ± 3.69	-0.31 ± 0.45	25.90 ± 3.90	25.74 ± 3.92	-0.15 ± 0.54	.040*	0.024	.036*	0.036
Resting heart rate (bpm)										
PP	68.25 ± 9.35	66.19 ± 8.30	-2.06 ± 6.88	69.08 ± 9.88	70.45 ± 10.86	1.37 ± 8.01	.005**	0.051	/	/
ITT	68.49 ± 9.14	66.62 ± 8.24	-1.87 ± 6.58	69.27 ± 9.79	70.47 ± 10.65	1.20 ± 7.49	.005**	0.046	/	/
VO_{2max} (ml/kg/min)										
PP [b]	28.65 ± 6.71	30.67 ± 6.94	2.02 ± 2.74	27.94 ± 6.73	27.91 ± 7.11	-0.03 ± 2.96	.000***	0.115	.000***	0.097
ITT	28.94 ± 6.82	30.77 ± 6.97	1.81 ± 2.68	27.57 ± 6.61	27.54 ± 6.94	-0.02 ± 2.76	.000***	0.105	/	/
Curl-ups (times)										
PP	20.89 ± 5.50	23.86 ± 3.23	2.97 ± 4.59	20.33 ± 4.86	21.09 ± 5.09	0.76 ± 4.22	.002**	0.060	/	/
ITT	20.70 ± 5.82	23.40 ± 4.20	2.70 ± 4.45	20.45 ± 4.79	21.54 ± 6.94	0.66 ± 3.95	.002**	0.056	/	/
Push-ups (times)										
PP [c]	4.71 ± 7.60	8.56 ± 8.57	3.85 ± 2.65	3.72 ± 5.18	3.96 ± 5.27	0.24 ± 2.16	.000***	0.360	.000***	0.343
ITT [c]	4.85 ± 7.73	8.34 ± 8.62	3.49 ± 2.76	3.51 ± 4.98	3.72 ± 5.07	0.21 ± 2.01	.000***	0.319	.013*	0.288
Flexibility										
Left leg (cm)										
PP	47.45 ± 11.90	54.23 ± 11.27	6.78 ± 4.30	50.80 ± 11.74	50.35 ± 11.99	-0.45 ± 4.07	.000***	0.430	/	/
ITT	47.59 ± 11.45	53.75 ± 10.96	6.16 ± 4.55	50.58 ± 11.63	50.19 ± 11.85	-0.40 ± 3.80	.000***	0.382	/	/
Right leg (cm)										
PP [b]	47.27 ± 12.08	54.41 ± 11.37	7.14 ± 4.23	50.71 ± 12.39	50.55 ± 12.50	-0.16 ± 4.52	.000***	0.414	.000***	0.395
ITT	47.43 ± 11.59	53.91 ± 11.02	6.49 ± 4.53	50.43 ± 12.19	50.29 ± 12.30	-0.14 ± 4.22	.000***	0.367	/	/

Note. PP per-protocol analysis (yoga, *n* = 79; control, *n* = 75), *ITT* intention-to-treat analysis (yoga, *n* = 87; control, *n* = 86)

a Adjusted for BMI at baseline.

b Adjusted for DBP at baseline.

c Adjusted for BMI at baseline and role emotional domain at baseline

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared; *PAL* physical activity level; *BMI* body mass index

*p <0.05; **p < 0.01; ***p <0.001

4.3.2.3 Change of Cortisol Level

A total of four samples of salivary cortisol were collected from each participant in Study One, and the detail was described in previous sections (Sections 3.3.6.1 and 3.3.6.2). Participant's cortisol level was measured twice at the baseline, and the magnitude between the two measurements is regarded as the change of cortisol level at baseline (BCort). Similarly, participant's cortisol level was measured twice at post-intervention, and the magnitude between the two measurements is regarded as the change of cortisol level at post-intervention (PCort). The difference between the change of cortisol level at baseline and the change of cortisol level at post-intervention (PCort – BCort) is regarded as the change of cortisol level in Study One (MDCort). Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of cortisol level between the yoga group and the control group (see Table 18).

Table 18
Comparison of Change of Cortisol Level between the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154) and Intention-To-Treat Analysis (N = 173)

Outcome variables	Yoga group (n = 79) $M \pm SD$	Control group (n = 75) $M \pm SD$	ANOVA p [a]	ANOVA Effect size partial η^2	ANCOVA [b] Adjusted p [a]	ANCOVA [b] Effect size partial η^2
PP						
BCort	0.93 ± 3.33	-0.90 ± 1.89				
PCort	0.58 ± 2.07	-0.46 ± 2.06				
MDCort	-0.35 ± 3.23	0.44 ± 3.16	.127	0.015	.355	0.006
	Yoga group (n = 87) $M \pm SD$	Control group (n = 86) $M \pm SD$	ANOVA p [a]	ANOVA Effect size partial η^2	ANCOVA [b] Adjusted p [a]	ANCOVA [b] Effect size partial η^2
ITT						
BCort	1.07 ± 4.16	-0.89 ± 1.87				
PCort	0.75 ± 3.35	-0.50 ± 2.03				
MDCort	-0.32 ± 3.08	0.39 ± 2.95	.127	0.014	.365	0.005

a There was no significant difference of cortisol level between the yoga and control groups
b Adjusted for BMI at baseline.
PP per-protocol analysis; *ITT* intention-to-treat analysis; *BCort* change of cortisol level at baseline; *PCort* change of cortisol level at post-intervention; *MDCort* the difference between BCort and PCort; η^2 eta-squared

4.3.2.4 Changes of Psychological Variables

Table 19 shows the comparison of the mean changes of five psychological variables (self-esteem, perceived stress, state anxiety, trait anxiety, and depression) among participants enrolled in yoga program versus the control group.

Results of both PP and ITT analyses indicated that there were no significant differences in the mean changes of self-esteem, perceived stress, state anxiety and trait anxiety between the yoga group and the control group.

Results of ANOVA (unadjusted comparison) of PP and ITT analyses revealed that there was a significant difference in depression score between the yoga group and the control group. In PP analysis, the yoga group demonstrated larger decline in depression score (M = -2.14, SD = 5.32), as compared to the control group (M = -0.27, SD = 6.19), p = 0.045, partial η^2 = 0.026, exhibiting a small effect size. In ITT analysis, the yoga participants demonstrated further reduction in depression score (M = -1.94, SD = 5.11) compared to their control counterparts (M = -0.23, SD = 5.77), p = 0.041, partial η^2 = 0.024, also exhibiting a small effect size. However, after adjusting for covariates, results of both PP and ITT analyses suggested that there was no significant difference in the mean change of depression score between the yoga group and the control group.

Table 19

Comparison of Changes of Psychological Variables between the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154) and Intention-To-Treat Analysis (N = 173)

	Yoga			Control			ANOVA		ANCOVA	
	Pre	Post	Post - Pre	Pre	Post	Post - Pre		Effect size	Adjusted	Effect size
Outcome variables	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	p	partial η^2	p	partial η^2
Self-esteem (RSE)										
PP [a]	21.91 ± 4.44	22.52 ± 3.75	0.61 ± 2.88	21.67 ± 3.78	21.64 ± 3.57	-0.03 ± 2.92	.176	0.012	.530	0.003
ITT [b]	21.74 ± 4.40	22.29 ± 3.81	0.55 ± 2.74	21.63 ± 3.65	21.60 ± 3.46	-0.02 ± 2.72	.168	0.011	.322	0.006
Perceived stress (PPS)										
PP [b]	16.12 ± 3.88	15.97 ± 3.91	-0.15 ± 3.45	15.83 ± 4.69	15.31 ± 4.31	-0.52 ± 4.34	.560	0.002	.340	0.006
ITT [b]	16.17 ± 3.88	16.03 ± 3.90	-0.14 ± 3.29	15.96 ± 4.53	15.50 ± 4.18	-0.45 ± 4.05	.574	0.002	.322	0.006
Anxiety (STAI)										
State anxiety (SA)										
PP [b]	31.71 ± 8.26	29.39 ± 7.46	-2.32 ± 7.23	31.07 ± 7.92	30.76 ± 8.53	-0.31 ± 6.66	.075	0.021	.178	0.012
ITT [b]	31.71 ± 8.26	29.33 ± 7.54	-2.10 ± 6.92	31.07 ± 7.92	30.88 ± 8.36	-0.27 ± 6.21	.068	0.019	.186	0.010
Trait anxiety (TA)										
PP	35.53 ± 7.77	33.86 ± 7.12	-1.67 ± 4.86	34.85 ± 7.58	34.35 ± 7.76	-0.51 ± 5.12	.150	0.014	/	/
ITT	35.53 ± 7.77	34.21 ± 7.40	-1.52 ± 4.65	34.85 ± 7.58	34.51 ± 7.43	-0.44 ± 4.78	.135	0.013	/	/
Depression (CES-D)										
PP [c]	11.92 ± 6.06	9.78 ± 5.52	-2.14 ± 5.32	10.41 ± 6.55	10.15 ± 6.68	-0.27 ± 6.19	.045*	0.026	.210	0.011
ITT [d]	12.23 ± 6.13	10.29 ± 5.78	-1.94 ± 5.11	10.81 ± 6.39	10.58 ± 6.52	-0.23 ± 5.77	.041*	0.024	.189	0.010

Note. PP per-protocol analysis (yoga, n = 79; control, n = 75), *ITT* intention-to-treat analysis (yoga, n = 87; control, n = 86)

a Adjusted for DBP at baseline and role emotional domain at baseline.

b Adjusted for role emotional domain at baseline

c Adjusted for DBP at baseline, body mass index at baseline, and role emotional domain at baseline

d Adjusted for body mass index at baseline and role emotional domain at baseline

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared

*p <0.05

4.3.2.5 Changes of HRQoL Domain and Summary Scores

HRQoL were determined in term of physical and mental health related quality of life. Physical health related quality of life consists of four domains, namely 1) physical functioning (PF); 2) role limitations due to physical problems (role physical, RP), 3 bodily pain (BP), 4) general health perceptions (GH). Similarly, mental health related quality of life consists of four domains, namely 1) vitality (VT), 2) role limitations due to emotional problems (role emotional, RE), 3) social functioning (SF), 4) general mental health (MH). The physical health component score (PCS) and mental health component score (MCS) are two summary scores which provide overall assessment of quality of life related to physical and mental health, respectively.

Table 20 shows the comparison of the mean changes of eight HRQoL domain scores and two summary scores between the yoga and control groups.

Physical health-related quality of life domain and summary scores

Physical functioning (PF)

Results of PP and ITT analyses revealed that there was no significant difference in the mean change of PF domain score between the two groups.

Role physical (RP)

Results of PP and ITT analyses revealed that no significant difference in the mean change of RP domain score between the yoga and control groups was found.

Bodily pain (BP)

Results of PP and ITT analyses indicated that there was no significant difference in the mean change of BP domain score between the two groups.

General health perceptions (GH)

Results of PP and ITT analyses were similar. In PP analysis, a significant difference in the mean change of GH domain score was found, with the yoga group achieving greater increment (*M* = 1.65, *SD* = 10.37) than the control group (*M* =-2.80, *SD* = 9.94), $p = 0.007$, partial $\eta^2 = 0.046$, exhibiting a small effect size. In ITT analysis, the yoga group achieved greater increment in GH domain score (*M* = 1.49, *SD* = 9.89) than the control group did (*M* = -2.44, *SD* = 9.32), $p = 0.008$, partial $\eta^2 = 0.041$, exhibiting a small effect size.

Physical component score (PCS)

In PP analysis, there was a larger increment in the mean change of PCS in the yoga group (*M* = 6.94, *SD* = 48.67), as compared to the control group (*M* = -14.12, *SD* = 44.15), $p = 0.006$, partial $\eta^2 = 0.041$, exhibiting a small effect size. However, after controlling the confounding effects of physical functioning domain score at baseline, result of ANCOVA indicated that no significant difference in the mean change of PCS between the study group. Result of ITT analysis suggested there was a larger increment in the mean change of PCS in the yoga group (*M* = 6.30, *SD* = 46.40) compared to the control group (*M* = -12.30, *SD* = 41.47), $p = 0.006$, partial η^2 = 0.043, exhibiting a small effect size.

Mental health-related quality of life domain and summary scores

Vitality (VT)

Results of PP and ITT analyses indicated that no significant difference in the mean change of VT score between the yoga and control groups was found.

Social functioning (SF)

Result of PP and ITT analyses indicated that there was a significant difference in the mean change of SF. In PP analysis, the yoga group had greater improvement in the social functioning domain score (*M* = 4.91, *SD* = 18.71) than the control group did (*M* = -5.67, *SD* = 16.61), $p < 0.001$, partial $\eta^2 = 0.083$, exhibiting a medium effect size. After adjusting for role emotional domain score at baseline, result of ANCOVA also indicated that the yoga intervention exerted a medium effect on SF domain score (partial $\eta^2 = 0.063$). In ITT analysis, the yoga group demonstrated greater improvement in SF domain score (*M* = 4.45, *SD* = 17.88) than the control group did (*M* = -4.94, *SD* = 15.61), $p < 0.001$, partial $\eta^2 = 0.073$, exhibiting a medium effect size. Similarly, after adjusting for role emotional domain score at baseline, result of ANCOVA revealed that the yoga intervention exerted a small effect on SF domain score (partial $\eta^2 = 0.052$).

Role emotional (RE)

Results of PP and ITT analyses revealed that there was no significant difference in the mean change of RE domain score between the two groups.

General mental health (MH)

Results of ANOVA of both PP and ITT analyses revealed that the yoga group experienced a significantly larger increase in MH domain score than the control group did ($p < 0.01$), exhibiting a small effect size (partial $\eta^2 < 0.06$). However, after adjusting for covariates, results of both PP and ITT analyses suggested that there was no significant difference in the mean change of MH domain score between the yoga group and the control group.

Mental component score (MCS)

Results of ANOVA of both PP and ITT analyses indicated that the yoga group experienced a significantly larger increment in MCS than the control group did ($p < 0.01$), exhibiting a small effect size (partial $\eta^2 < 0.06$). However, after adjusting for covariates, results of both PP and ITT analyses suggested that there was no significant difference in the mean change of MCS between the two groups.

Table 20

Comparison of Changes of HRQoL Domain and Summary Scores between the Yoga Group and the Control Group in Per-Protocol Analysis (N = 154) and Intention-To-Treat Analysis (N = 173)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	p	Effect size partial η^2	Adjusted p	Effect size partial η^2
Physical functioning (PF)										
PP	89.05 ± 9.24	90.51 ± 9.15	1.46 ± 8.21	85.40 ± 12.70	85.07 ± 12.15	-0.33 ± 12.15	.284	0.008	/	/
ITT	88.74 ± 10.57	90.06 ± 10.55	1.32 ± 7.83	85.76 ± 12.31	85.55 ± 12.17	-029 ± 11.33	.277	0.007	/	/
Role physical (RP)										
PP	83.23 ± 28.51	84.81 ± 25.13	1.58 ± 33.81	85.33 ± 25.70	78.00 ± 33.88	-7.33 ± 28.41	.079	0.020	/	/
ITT	82.76 ± 28.86	84.20 ± 25.89	1.44 ± 32.20	85.76 ± 26.16	79.36 ± 33.47	-6.40 ± 26.62	.083	0.017	/	/
Bodily pain (BP)										
PP	67.49 ± 19.49	69.75 ± 18.89	2.25 ± 18.69	67.67 ± 23.12	64.03 ± 21.43	-3.64 ± 21.64	.072	0.021	/	/
ITT	65.97 ± 19.91	68.01 ± 19.56	2.05 ± 17.81	67.41 ± 22.32	64.24 ± 20.79	-3.17 ± 20.23	.073	0.019	/	/
General health perceptions (GH)										
PP	60.95 ± 11.80	62.59 ± 12.03	1.65 ± 10.37	60.93 ± 12.18	58.13 ± 12.32	-2.8 ± 9.94	.007**	0.046	/	/
ITT	60.69 ± 11.91	62.18 ± 12.17	1.49 ± 9.89	60.99 ± 12.00	58.55 ± 12.17	-2.44 ± 9.32	.008**	0.041	/	/
Physical component score (PCS)										
PP [a]	300.72 ± 50.86	307.66 ± 46.03	6.94 ± 48.67	299.33 ± 55.41	285.23 ± 59.47	-14.12 ± 44.15	.006**	0.049	.065	0.022
ITT	298.15 ± 53.50	304.45 ± 49.74	6.30 ± 46.40	299.92 ± 53.90	287.62 ± 57.87	-12.30 ± 41.47	.006**	0.043	/	/
Vitality (VT)										
PP [b]	67.22 ± 15.04	71.20 ± 13.96	3.98 ± 14.13	65.87 ± 17.75	67.33 ± 16.28	1.47 ± 12.89	.250	0.009	.524	0.003
ITT [b]	66.78 ± 15.06	70.40 ± 14.25	3.62 ± 13.50	65.58 ± 16.88	66.86 ± 15.57	1.28 ± 12.03	.230	0.008	.545	0.002
Social functioning (SF)										
PP [b]	85.28 ± 18.21	90.19 ± 12.61	4.91 ± 18.71	88.83 ± 15.99	83.17 ± 19.00	-5.67 ± 16.61	.000***	0.083	.002*	0.063
ITT [b]	84.48 ± 18.08	88.94 ± 13.40	4.45 ± 17.88	87.94 ± 16.21	82.99 ± 18.68	-4.94 ± 15.61	.000***	0.073	.003*	0.052
Role emotional (RE)										
PP [c]	76.37 ± 34.24	83.97 ± 28.67	7.59 ± 37.72	87.11 ± 28.42	85.78 ± 29.09	-1.33 ± 31.21	.113	0.016	.797	0.000
ITT [b]	74.71 ± 35.57	81.61 ± 31.24	6.90 ± 35.99	87.60 ± 27.56	86.43 ± 28.18	-1.16 ± 29.13	.107	0.015	.919	0.000
General mental health (MH)										
PP [c]	76.15 ± 13.71	79.24 ± 12.09	3.09 ± 12.34	78.77 ± 14.18	77.60 ± 12.87	-1.17 ± 13.12	.039*	0.028	.174	0.012
ITT [b]	75.26 ± 13.85	78.07 ± 12.63	2.80 ± 11.78	77.91 ± 14.20	76.88 ± 13.01	-1.02 ± 12.24	.038*	0.025	.120	0.014
Mental component score (MCS)										
PP [c]	305.02 ± 66.21	321.60 ± 51.21	19.58 ± 64.61	320.58 ± 63.88	313.88 ± 64.26	-6.71 ± 53.81	.007**	0.047	.083	0.020
ITT [b]	301.24 ± 68.09	319.02 ± 56.62	17.78 ± 61.80	319.02 ± 61.23	313.17 ± 61.47	-5.85 ± 50.26	.006**	0.043	.109	0.015

Note. PP per-protocol analysis (yoga, n = 79; control, n = 75), *ITT* intention-to-treat analysis (yoga, n = 87; control, n = 86)
a Adjusted for physical functioning domain at baseline.
b Adjusted for role emotional domain at baseline.
c Adjusted for DBP at baseline and role emotional domain at baseline
Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared
*p <0.05; **p <0.01; ***p <0.001

4.4 Subgroup Analysis of Study One: Metabolic Syndrome Sample

This subgroup analysis compared changes of the outcome variables between the yoga group and the control group of the metabolic syndrome (MetS) sample. MetS sample in this subgroup analysis was defined as those participants who met at least three of the revised NCEP-ATP III clinical diagnosis criteria for Asian populations (i.e. abdominal obesity, high blood pressure, high FBG, low HDL-C, and high triglyceride) at baseline. The detail of the revised NCEP-ATP III clinical criteria has been described in Chapter 2 (Section 2.1.2). Homogeneity of the yoga and control groups in term of demographic, physiological and psychological characteristics at baseline was determined in order to check the presence of baseline differences of the outcome variables, and those characteristics with significant differences were noted as heterogeneous characteristics. Relationship between those heterogeneous characteristics and all the outcome variables were assessed in order to identify possible covariates of the particular variables. Those heterogeneous characteristics significantly correlated with the particular outcome variables were identified as covariates of the particular outcome variables. To examine the effect of yoga on the outcome variables relative to the control condition, ANOVA was conducted to compare the mean changes of outcome variables from baseline to post-intervention. If covariates for particular outcome variables were identified, additional ANCOVA was conducted in order to control the confounding effects arose from the presence of the covariates. Both per-protocol (PP) and intention-to-treat (ITT) analyses were performed. Effect size was computed to show magnitude and direction of the effect of the yoga intervention relative to the control condition for each outcome variable. Effect size of each outcome variable was reported in term of the value of partial η^2 and provided with descriptive label (i.e. “small”, “medium” or “large”).

4.4.1 Baseline Homogeneity of the Yoga and Control Groups in Per-Protocol Analysis and Intention-To-Treat Analysis

PP analysis

Homogeneity of the yoga and control groups in terms of demographic, physiological and psychological characteristics was determined (see Tables 21-23). The yoga and control groups were homogeneous in majority of the measured characteristics. Significant differences in the three physiological characteristics, namely SBP [$t(74) = -2.02$, $p = 0.047$], DBP [$t(74) = -2.71$, $p = 0.008$], and BMI ($z = -2.00$, $p = 0.045$), between the two groups were observed. The yoga group demonstrated lower SBP, DBP, and BMI than the control group did. There were no significant differences in all demographic and psychological characteristics between the two groups.

ITT analysis

Tables 24-26 present the homogeneity of the yoga and control groups in terms of demographic, physiological and psychological characteristics. Similar to PP analysis, the yoga and control groups were homogeneous in majority of the measured characteristics. Significant differences in the two physiological characteristics, including DBP [$t(85) = -2.78$, $p = 0.025$] and BMI ($z = -2.27$, $p = 0.023$), between the yoga and control groups were observed. The yoga group demonstrated lower DBP and BMI than the control group did. No significant differences in demographic and psychological characteristics were found between the two groups.

Table 21

Demographic Characteristics of MetS Participants in Per-Protocol Analysis (N = 76)

Characteristics	Yoga group (n = 39)	Control group (n = 37)	t or χ^2	p [b]
	$M \pm SD$ or f (%)			
Age (years)	53.54 ± 7.60	51.43 ± 7.44	1.22	.226
			1.04	.309
30-44	5 (12.8%)	6 (16.2%)		
45-54	17 (43.6%)	20 (54.1%)		
55-64	16 (41.0%)	10 (27.0%)		
65 or above	1 (2.6%)	1 (2.7%)		
Gender			0.02	0.682
Male	13 (33.3%)	14 (37.8%)		
Female	26 (63.7%)	23(62.2%)		
Marriage			0.03	0.855
Single	8 (20.5%)	6 (16.2%)		
Married	30 (76.9%)	31 (83.8%)		
Widow	1 (2.6%)	0 (0.0%)		
Education level			0.21	0.647
No education	0 (0.0%)	1 (2.7%)		
Primary	4 (10.3%)	3 (8.1%)		
Secondary	22 (56.4%)	22 (59.5%)		
Tertiary	13 (33.3%)	11 (29.7%)		
Occupation [a]			0.08	0.780
Full-time	19 (48.7%)	20 (54.1%)		
Part-time	4 (10.3%)	2 (5.4%)		
Unemployed	0 (0.0%)	2 (5.4%)		
Housewife	9 (23.1%)	6 (16.2%)		
Retired	7 (17.9%)	7 (18.9%)		
Smoking			0.11	0.742
Current	1 (2.6%)	2 (5.4%)		
Quitted	2 (5.1%)	1 (2.7%)		
Never	36 (92.3%)	34 (91.9%)		
Alcohol intake [a]			0.34	0.559
Quitted	1 (2.6%)	0 (0.0%)		
Never	19 (48.7%)	18 (48.6%)		
Sometimes	18 (46.2%)	17 (45.9%)		
Always	1 (2.6%)	2 (5.4%)		
Medication use				
Glucose			3.63	.057
Yes	11 (28.2%)	4 (14.0%)		
No	28 (71.8%)	33 (89.2%)		
Blood pressure			0.82	.367
Yes	16 (41.0%)	19 (51.4%)		
No	23 (59.0%)	18 (48.6%)		
Cholesterol			0.15	.701
Yes	11 (28.2%)	9 (24.3%)		
No	28 (71.8%)	28 (75.7%)		
Triglyceride			0.30	.587
Yes	2 (5.1%)	1 (2.7%)		
No	37 (94.9)	42 (97.3)		

a The total percentage does not sum to exactly 100% due to round-off error.

b There were no significant differences between groups in all the characteristics at baseline.

Table 22

Physiological Characteristics of MetS Participants in Per-Protocol Analysis (N= 76)

Characteristics	Yoga group (n = 39)	Control group (n = 37)	t	p
	$M \pm SD$			
MetS related				
WC (cm)	93.09 ± 9.91	94.07 ± 6.95	-0.50	.622
SBP (mmHg)	133.51 ± 13.99	141.81 ± 21.22	-2.02	.047*
DBP (mmHg)	79.85 ± 8.34	86.35 ± 12.33	-2.71	.008**
FBG (mmol/L)	5.90 ± 0.73	5.95 ± 1.05	-0.41^{a}	.681
TG (mmol/L)	1.89 ± 1.19	1.86 ± 1.22	-0.25^{a}	.803
HDL-C (mmol/L)	1.26 ± 0.26	1.28 ± 0.34	-0.32	.748
MetS z-score	1.37 ± 2.11	1.96 ± 2.81	-1.03	.307
***Physical activity level* (IPAQ)** (MET-minutes/week)	1951.01 ± 2311.90	1719.06 ± 1357.70	0.49	.624
Physical fitness				
Body composition				
Body weight (kg)	69.19 ± 12.95	71.39 ± 11.33	-1.21^{a}	.228
BMI (kg/m^2)	26.24 ± 4.08	27.19 ± 2.79	-2.00^{a}	.045*
Cardiorespiratory endurance				
Resting heart rate (bpm)	70.44 ± 9.68	70.73 ± 9.37	-0.13	.893
VO_{2max} (ml/kg/min)	26.39 ± 4.96	27.11 ± 5.93	-0.58	.566
Muscular strength and endurance				
Curl-ups (times)	20.08 ± 5.94	21.03 ± 4.41	-0.73	.433
Push-ups (times)	2.41 ± 4.30	3.62 ± 4.17	-1.66^{a}	.097
Flexibility				
Left leg (cm)	47.79 ± 13.08	51.30 ± 8.90	-1.36	.179
Right leg (cm)	47.10 ± 13.32	50.68 ± 10.14	-1.31	.193
Cortisol level at 6:15pm	5.75 ± 2.77	5.80 ± 4.65	-0.63^{a}	.526

a Mann-Whitney *U* test

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *BMI* body mass index

* $p < 0.05$; ** $p < 0.01$

Table 23

Psychological Characteristics of MetS Participants in Per-Protocol Analysis (N = 76)

Characteristics	Yoga group (n = 39)	Control group (n = 37)	t	p [b]
	$M \pm SD$			
Self-esteem (RSE)	21.64 ± 5.12	22.43 ± 3.01	-0.82	.417
Perceived stress (PPS)	16.59 ± 4.22	15.51 ± 4.87	1.03	.306
Anxiety (STAI)				
State anxiety (SA)	32.64 ± 9.10	30.92 ± 7.80	0.88	.380
Trait anxiety (TA)	36.05 ± 8.62	34.49 ± 7.63	0.84	.406
Depression (CES-D)	11.92 ± 6.06	10.41 ± 6.55	1.53	.130
HRQoL (SF-36)				
Physical Functioning (PF)	89.10 ± 8.57	85.00 ± 11.49	1.77	.081
Role Physical (RP)	84.62 ± 29.59	84.46 ± 26.58	-0.36[a]	.717
Bodily Pain (BP)	67.92 ± 21.84	67.57 ± 22.77	0.07	.945
General Health Perceptions (GH)	58.33 ± 11.55	58.92 ± 10.87	-0.23	.821
Physical Component Score (PCS)	299.97 ± 53.54	295.95 ± 55.97	0.32	.749
Vitality (VT)	66.54 ± 15.35	65.68 ± 16.84	0.23	.816
Social Functioning (SF)	83.01 ± 21.74	86.15 ± 17.38	-0.69	.491
Role Emotional (RE)	76.92 ± 36.80	83.78 ± 30.04	-0.58[a]	.561
General mental health (MH)	75.59 ± 16.28	79.14 ± 13.50	-1.03	.306
Mental Component Score (MCS)	302.06 ± 75.38	314.74 ± 67.30	-0.77	.443

a Mann-Whitney *U* test

b There were no significant differences between groups in all the characteristics at baseline.

Table 24

Demographic Characteristics of MetS Participants in Intention-To-Treat Analysis (N = 87)

Characteristics	Yoga group (n = 44)	Control group (n = 43)		
	$M \pm SD$ or f (%)		t or χ^2	p [b]
Age (years)	53.42 ± 7.67	51.95 ± 7.61	0.90	0.370
			0.68	0.408
30-44	6 (13.6%)	7 (16.3%)		
45-54	18 (40.9%)	21 (48.8%)		
55-64	19 (43.2%)	14 (32.6%)		
65 or above	1 (2.3%)	1 (2.3%)		
Gender			0.02	.885
Male	16 (36.4%)	15 (34.9%)		
Female	28 (63.6%)	28 (65.1%)		
Marriage			0.21	.647
Single	9 (20.5%)	6 (14.0%)		
Married	33 (75.0%)	36 (83.7%)		
Widow	2 (4.5%)	1 (2.3%)		
Education level			0.62	.430
No education	0 (0.0%)	1 (2.3%)		
Primary	4 (9.1%)	3 (7.0%)		
Secondary	23 (52.3%)	26 (60.5%)		
Tertiary	17 (38.6%)	13 (30.2%)		
Occupation [a]			0.05	.824
Full-time	22 (50.0%)	21 (48.8%)		
Part-time	4(9.1%)	3 (7.0%)		
Unemployed	0 (0.0%)	2 (4.7%)		
Housewife	10 (22.7%)	7 (16.3%)		
Retired	8 (18.2%)	10 (23.3%)		
Smoking			0.09	.770
Current	1 (2.3%)	2 (4.7%)		
Quitted	2 (4.5%)	1 (2.3%)		
Never	41 (93.2%)	40 (93.0%)		
Alcohol intake [a]			0.21	.647
Quitted	1 (2.3%)	0 (0.0%)		
Never	20 (45.5%)	19 (44.2%)		
Sometimes	21 (47.7%)	22 (51.2%)		
Always	2 (4.5%)	2 (4.7%)		
Medication use				
Glucose			3.10	.078
Yes	13 (29.5%)	6 (14.0%)		
No	31 (70.5%)	37 (86.0%)		
Blood pressure			0.92	.337
Yes	18 (40.9%)	22 (51.2%)		
No	26 (59.1%)	21 (48.8%)		
Cholesterol			0.09	.759
Yes	11 (25.0%)	12 (27.9%)		
No	33 (75.0%)	31 (72.1%)		
Triglyceride			0.29	.591
Yes	3 (6.8%)	1 (2.3%)		
No	41 (93.2)	42 (97.7)		

a The total percentage does not sum to exactly 100% due to round-off error.

b There were no significant differences between groups in all the characteristics at baseline.

Table 25

Physiological Characteristics of MetS Participants in Intention-To-Treat Analysis (N =87)

Characteristics	Yoga group (n = 44)	Control group (n = 43)	t	p
	$M \pm SD$			
MetS related				
WC (cm)	93.11 ± 9.63	94.70 ± 7.55	-0.86	.395
SBP (mmHg)	134.09 ± 14.23	140.19 ± 20.21	-1.62	.107
DBP (mmHg)	80.45 ± 8.63	85.47 ± 11.71	-2.78	.025*
FBG (mmol/L)	5.94 ± 0.74	6.17 ± 1.40	-0.07[a]	.942
TG (mmol/L)	1.87 ± 1.13	1.96 ± 1.34	0.00[a]	1.000
HDL-C (mmol/L)	1.25 ± 0.25	1.28 ± 0.33	-0.42	.673
MetS z-score	1.23 ± 2.06	2.14 ± 3.07	-1.62	.109
Physical activity level (IPAQ) (MET-minutes/week)	1869.82 ± 2171.35	1918.30 ± 1671.61	0.35	.724
Health-related physical fitness				
Body composition				
Body weight (kg)	69.07 ± 12.61	71.50 ± 11.00	-1.42[a]	.155
BMI (kg/m2)	26.25 ± 3.94	27.51 ± 3.15	-2.27[a]	.023*
Cardiorespiratory endurance				
Resting heart rate (bpm)	70.39 ± 9.27	70.53 ± 9.03	-0.08	.940
VO_{2max} (ml/kg/min)	27.01 ± 5.71	26.71 ± 5.98	2.34	.812
Muscular strength and endurance				
Curl-ups (times)	19.75 ± 6.55	21.14 ± 4.41	-0.58[a]	.560
Push-ups (times)	2.82 ± 5.52	3.53 ± 4.08	-1.64[a]	.101
Flexibility				
Left leg (cm)	47.77 ± 12.39	50.14 ± 9.16	-1.01	.315
Right leg (cm)	47.19 ± 12.61	49.49 ± 10.18	-0.94	.353
Cortisol Level at 6:15pm	5.12 ± 2.39	5.13 ± 3.50	-0.84[a]	.403

a Mann-Whitney *U* test

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *BMI* body mass index

* $p < 0.05$

Table 26

Psychological Characteristics of MetS Participants in Intention-To-Treat Analysis (N = 87)

Characteristics	Yoga group (n = 44)	Control group (n = 43)	t	p^b
	$M \pm SD$			
Self-esteem (RSE)	21.30 ± 5.08	22.35 ± 3.01	0.18	.861
Perceived stress (PPS)	16.73 ± 4.22	15.53 ± 4.64	0.32	.747
Anxiety (STAI)				
State anxiety (SA)	32.41 ± 9.20	31.05± 7.57	0.75	.453
Trait anxiety (TA)	36.41 ± 8.81	34.72 ± 7.18	0.98	.331
Depression (CES-D)	12.95 ± 7.12	10.72 ± 5.75	1.49	.139
HRQoL (SF-36)				
Physical functioning (PF)	87.95 ± 11.33	85.00 ± 11.02	0.11[a]	.105
Role physical (RP)	83.52 ± 30.95	84.30 ± 28.36	0.94[a]	.943
Bodily pain (BP)	65.45 ± 22.65	66.33 ± 21.67	-0.45	.652
General health perceptions (GH)	58.18 ± 12.11	59.30 ± 10.83	-4.55	.651
Physical component score (PCS)	295.11 ± 59.28	294.93 ± 54.59	0.02	.988
Vitality (VT)	65.68 ± 15.06	65.58 ± 16.88	0.17	.864
Social functioning (SF)	82.67 ± 20.92	84.59 ± 16.21	-0.47	.643
Role emotional (RE)	74.24 ± 37.95	84.50 ± 29.41	-1.12[a]	.263
General mental health (MH)	74.73 ± 16.32	78.05 ± 13.53	-1.03	.305
Mental component score (MCS)	297.32 ± 75.89	312.25 ± 63.84	-0.99	.324

a Mann-Whitney U test

b There were no significant differences between groups in all the characteristics at baseline.

4.4.2 Relationships between Heterogeneous Characteristics and the Outcome Variables

In order to identify possible covariates, relationships between the outcome variables with those heterogeneous characteristics, which identified in the baseline homogeneity tests (presented in Sections 4.4.1), were assessed.

PP analysis

The yoga and control groups were heterogeneous in terms of the status of DBP, SBP, and BMI. The correlations of these three heterogeneous characteristics with 32 outcome variables were identified (see Table 27). Among these 32 outcome variables, fourteen variables (number as "3, 5, 9-10, 12, 14-16, 18, 28-32" in Table 27) were significantly correlated with one of these three heterogeneous characteristics, and only two (number as "1 and 2" in Table 27) were significantly correlated with two characteristics. Incorporating the findings from these correlation analyses and those about homogeneity of the two groups, the heterogeneous characteristics have exerted confounding effects on these 16 outcome variables, and were considered as covariates during analysis. ANOVA was adopted to determine if there was a significant difference in the change of each variable between the two groups over the 12-week intervention period, and additional ANCOVA was adopted to control the confounding effects of the heterogeneous characteristics on these 16 outcome variables.

Findings also illustrated that the rest of the 16 outcome variables (number as "4, 6-8, 11, 13, 17, 19-27" in Table 27) were not significantly correlated with any of these three heterogeneous characteristics. This implies that none of the three heterogeneous characteristics exerted confounding effects on these 16 outcome variables. Thus, only ANOVA was adopted to determine if there was a significant difference in the change of each variable between the yoga and control groups over the 12-week intervention period.

ITT analysis

The yoga and control groups were heterogeneous in terms of the status of DBP and BMI. The correlations of these two heterogeneous characteristics with 32 outcome variables were identified (see Table 28). Among these 32 outcome variables, fourteen variables (number as “1-3, 12, 15-16, 18, 22, 25, 28-32” in Table 28) were significantly correlated with DBP, whereas three (number as “10-11 and 14” in Table 28) were significantly correlated with BMI. Incorporating the findings from these correlation analyses and those about homogeneity of the yoga and control groups, DBP has exerted confounding effect on the 14 outcome variables (number as “1-3, 12, 15-16, 18, 22, 25, 28-32” in Table 28) and was considered as covariates during analysis. Similarly, BMI has exerted confounding effect on the three outcome variables (number as “10-11 and 14” in Table 28). ANOVA was adopted to determine if there was a significant difference in the change of each variable between the yoga and control groups over the 12-week intervention period, and additional ANCOVA was adopted to control the confounding effects of the heterogeneous characteristics on particular outcome variables.

Findings also illustrated that the rest of the 15 outcome variables (number as “1-3, 9-10, 12, 14-16, 18, 22, 26, 28-32” in Table 28) were not significantly correlated with any of these two heterogeneous characteristics. This implies that none of the two heterogeneous characteristics exerted confounding effects on these 15 outcome variables. Therefore, only ANOVA was adopted to determine if there was a significant difference in the change of each variable between the yoga group and control group over the 12-week intervention period.

Table 27

Correlations between Heterogeneous *Characteristics and Outcome Variables for Per-Protocol Analysis of MetS Sample (N = 76)*

Outcome variables		Heterogeneous characteristics		
		BSBP	BDBP	BBMI
1.	WC	0.243*	0.251*	0.021
2.	SBP	-0.427**	-0.232*	0.218
3.	DBP	-0.183	-0.393**	0.076
4.	FBG	-0.075	-0.106	0.018
5.	TG	0.204	0.154	-0.014
6.	HDL-C	-0.321**	-0.201	-0.079
7.	MetS z-score	0.102	0.008	0.115
8.	Physical activity level	-0.090	-0.210	0.002
9.	Body weight	0.040	0.027	-0.338**
10.	Body mass index	0.076	0.049	-0.268*
11.	Resting heart rate	0.034	0.004	-0.079
12.	VO_{2max}	-0.210	-0.251*	-0.149
13.	Curl-ups	0.051	0.007	0.024
14.	Push-ups	-0.046	-0.115	-0.269*
15.	Left leg flexibility	-0.144	-0.234*	-0.114
16.	Right leg flexibility	-0.205	-0.305**	-0.134
17.	Cortisol level	-0.024	0.013	0.182
18.	Self-esteem (RSE)	-0.103	-0.275*	0.024
19.	Perceived stress (PPS)	0.155	0.135	0.199
20.	State anxiety (SA)	0.023	0.200	0.054
21.	Trait anxiety (TA)	0.023	0.138	0.133
22.	Depression (CES-D)	0.078	0.220	0.205
23.	Physical functioning (PF)	0.012	-0.210	-0.193
24.	Role physical (RP)	-0.024	-0.107	-0.132
25.	Bodily pain (BP)	0.016	0.014	-0.071
26.	General health perceptions (GH)	-0.055	-0.225	-0.059
27.	Physical component score (PCS)	-0.019	-0.155	-0.162
28.	Vitality (VT)	-0.205	-0.268*	-0.133
29.	Social functioning (SF)	-0.187	-0.272*	-0.098
30.	Role emotional (RE)	-0.132	-0.342**	-0.089
31.	General mental health (MH)	-0.200	-0.285*	-0.085
32.	Mental component score (MCS)	-0.210	-0.381**	-0.122

WC waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome; *BSBP* systolic blood pressure at baseline; *BDBP* diastolic blood pressure at baseline; *BBMI* body mass index at baseline

* $p < 0.05$; ** $p < 0.01$

Table 28

Correlations between Heterogeneous Characteristics and Outcome Variables for Intention-To-Treat Analysis of MetS Sample (N = 87)

	Outcome variables	Heterogeneous characteristics	
		BDBP	BBMI
1.	WC	0.253*	0.044
2.	SBP	-0.225*	0.210
3.	DBP	-0.382**	0.075
4.	FBG	-0.104	0.025
5.	TG	0.148	-0.003
6.	HDL-C	-0.190	-0.088
7.	MetS z-score	0.003	0.126
8.	Physical activity level	-0.200	-0.006
9.	Body weight	0.023	-0.283**
10.	Body mass index	0.043	-0.218*
11.	Resting heart rate	0.003	-0.069
12.	VO_{2max}	-0.239*	-0.150
13.	Curl-ups	0.010	0.002
14.	Push-ups	-0.103	-0.269*
15.	Left leg flexibility	-0.221*	-0.122
16.	Right leg flexibility	-0.287**	-0.142
17.	Cortisol level	0.014	0.161
18.	Self-esteem (RSE)	-0.266*	0.023
19.	Perceived stress (PPS)	0.131	0.179
20.	State anxiety (SA)	0.192	0.057
21.	Trait anxiety (TA)	0.131	0.131
22.	Depression (CES-D)	0.213*	0.191
23.	Physical functioning (PF)	-0.204	-0.173
24.	Role physical (RP)	-0.104	-0.118
25.	Bodily pain (BP)	0.12	-0.056
26.	General health perceptions (GH)	-0.217*	-0.055
27.	Physical component score (PCS)	-0.150	-0.143
28.	Vitality (VT)	-0.257*	-0.131
29.	Social functioning (SF)	-0.263*	-0.91
30.	Role emotional (RE)	-0.330**	-0.086
31.	General mental health (MH)	-0.276**	-0.079
32.	Mental component score (MCS)	-0.368**	-0.116

WC waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome; *BDBP* diastolic blood pressure at baseline; *BBMI* body mass index at baseline
* $p < 0.05$; ** $p < 0.01$

4.4.3 Comparison of the Mean Changes of Outcome Variables among the MetS Participants in the Yoga Group and the Control Group

4.4.3.1 Changes of Metabolic Risk Factors

The comparison of the mean changes of seven metabolic risk factors (waist circumference, systolic blood pressure, diastolic blood pressure, fasting blood glucose, triglyceride, high-density lipoprotein cholesterol, and MetS z score) between participants enrolled in yoga program versus the control group is presented in Table 29.

1. Waist circumference (WC)

In PP analysis, the yoga group showed a significantly further decline in the mean change of WC (M = -3.50, SD = 2.71) as compared to the control group (M = 0.18, SD = 2.15), $p < 0.001$, partial $\eta^2 = 0.366$, exhibiting a very large effect size. With controlling the confounding effects of SBP and DBP at baseline, the yoga intervention still exerted a very large effect on WC (partial $\eta^2 = 0.329$). Result of ITT analysis was similar to that of PP analysis, the yoga group showed larger decline in the mean change of WC (M = -3.10, SD = 2.78), than the control group did (M = -0.15, SD = 1.99), $p < 0.001$, partial $\eta^2 = 0.316$, representing a very large effect size. With controlling the confounding effect of DBP at baseline, the yoga intervention still exerted a very large effect on WC (partial $\eta^2 = 0.287$).

2. Systolic blood pressure (SBP)

Results of both PP and ITT analyses indicated that no significant difference in the mean change of SBP between the two groups was found.

3. Diastolic blood pressure (DBP)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of DBP between the yoga and control groups.

4. Fasting blood glucose (FBG)

Results of both PP and ITT analyses indicated that no significant difference in the mean change of FBG between the two groups was observed.

5. Triglyceride (TG)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of TG between the two groups.

6. High-density lipoprotein cholesterol (HDL-C)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of HDL-C between the yoga and control groups.

7. MetS z score

Results of both PP and ITT analyses revealed that there was a significant difference in the mean change of MetS z score. In PP analysis, the yoga group (M = -1.29, SD = 1.63) showed significantly larger decline in MetS z score than the control group (M = -0.27, SD = 1.23), p = 0.003, partial η^2 = 0.112, exhibiting a medium effect size. Similar results were found in ITT analysis, the yoga group (M = -1.09, SD = 1.54) demonstrated significantly larger reduction in MetS z score than the control group (M = -0.25, SD = 1.12), p = 0.005, partial η^2 = 0.090, exhibiting a medium effect size.

Table 29

Comparison of Changes of Metabolic Risk Factors among MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 76) and Intention-To-Treat Analysis (N = 87)

	Yoga			Control			ANOVA		ANCOVA	
	Pre	Post	Post - Pre	Pre	Post	Post - Pre		Effect size	Adjusted	Effect size
Outcome variables	*M* ± *SD*	*M* ± *SD*	*M* ± *SD*	*M* ± *SD*	*M* ± *SD*	*M* ± *SD*	*p*	partial η^2	*p*	partial η^2
WC (cm)										
PP [a]	93.09 ± 9.91	89.59 ± 9.83	-3.50 ± 2.71	94.07 ± 6.95	94.25 ± 6.52	0.18 ± 2.15	.000***	0.366	.000***	0.329
ITT [b]	93.11 ± 9.63	90.01 ± 9.63	-3.10 ± 2.78	94.70 ± 7.55	94.85 ± 7.21	0.15 ± 1.99	.000***	0.316	.000***	0.287
SBP (mmHg)										
PP [a]	133.51 ± 13.99	130.21 ± 11.50	-3.31 ± 11.09	141.81 ± 21.22	138.05 ± 21.09	-3.76 ± 14.36	.879	0.000	.536	0.005
ITT [b]	134.09 ± 14.23	131.16 ± 12.28	-2.93 ± 10.48	140.19 ± 20.21	136.95 ± 19.87	-3.23 ± 13.36	.907	0.000	.690	0.002
DBP (mmHg)										
PP [b]	79.85 ± 8.34	77.31 ± 7.21	-0.21 ± 6.50	86.35 ± 12.33	84.81 ± 13.00	-1.54 ± 9.35	.470	0.007	.741	0.002
ITT [b]	80.45 ± 8.63	80.27 ± 7.69	-0.18 ± 6.11	85.47 ± 11.71	84.14 ± 12.22	-1.33 ± 8.67	.478	0.006	.883	0.000
FBG (mmol/L)										
PP	5.90 ± 0.73	5.74 ± 0.85	-0.16 ± 0.46	5.95 ± 1.05	5.96 ± 0.92	0.01 ± 0.44	.105	0.035	/	/
ITT	5.94 ± 0.74	5.80 ± 0.85	-0.14 ± 0.43	6.17 ± 1.40	6.18 ± 1.31	0.01 ± 0.41	.101	0.031	/	/
TG (mmol/L) #										
PP	1.89 ± 1.19	1.58 ± 0.68	-0.31 ± 0.98	1.86 ± 1.22	1.84 ± 1.23	-0.02 ± 0.58	.168	0.026	/	/
ITT	1.87 ± 1.13	1.60 ± 0.66	-0.28 ± 0.93	1.96 ± 1.34	1.94 ± 1.35	-0.02 ± 0.54	.164	0.023	/	/
HDL-C (mmol/L)										
PP [c]	1.26 ± 0.26	1.35 ± 0.27	0.09 ± 0.19	1.28 ± 0.34	1.32 ± 0.32	0.04 ± 0.14	.173	0.025	.434	0.008
ITT	1.25 ± 0.25	1.33 ± 0.26	0.08 ± 0.18	1.28 ± 0.33	1.31 ± 0.32	0.03 ± 0.13	.161	0.023	/	/
MetS z score										
PP	1.37 ± 2.11	0.08 ± 1.92	-1.29 ± 1.63	1.96 ± 2.81	1.68 ± 2.85	-0.27± 1.23	.003**	0.112	/	/
ITT	1.23 ± 2.06	0.14 ± 1.96	-1.09 ± 1.54	2.14 ± 3.07	1.89 ± 3.44	-0.25 ± 1.12	.005**	0.090	/	/

Note. PP per-protocol analysis (yoga, $n = 39$; control, $n = 37$), *ITT* intention-to-treat analysis (yoga, $n = 44$; control, $n = 43$)

a Adjusted for SBP at baseline and DBP at baseline.

b Adjusted for DBP at baseline.

c Adjusted for SBP at baseline.

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride; *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome

$^{**}p < 0.01$, $^{***}p < 0.001$

4.4.3.2 Changes of Physical Activity Level and Health-Related Physical Fitness Components

Table 30 presents the comparison of the mean changes of physical activity level and four health-related physical fitness components (body composition, cardiovascular endurance, muscular strength and endurance, and flexibility) between participants enrolled in yoga program versus the control group.

Physical activity level (PAL)

Results of both PP and ITT analyses revealed that there were no significant differences in the mean change of physical activity level between the yoga and control groups.

Physical health-related fitness components

1. Body composition

Body weight

Findings of PP analysis indicated that the yoga group showed greater reduction in body weight (M = -0.97, SD = 1.41) than the control group did (M = -0.29, SD = 1.21), p = 0.027, partial η^2 = 0.064, presenting a medium effect. Similarly, findings of ITT analysis also indicated that the yoga group demonstrated great reduction in body weight (M = -0.86, SD = 1.36) than the control group did (M = -0.25, SD = 1.12), $t(85)$ = -2.28, p = 0.025, partial η^2 = 0.058, presenting a small-to-medium effect. Since BMI at baseline was identified as a covariate, an adjusted comparison was adopted to control the confounding effect of this covariate, and the results of ANCOVA of PP and ITT analyses revealed that the yoga intervention exerted a medium effect on the mean change of body weight (PP analysis: partial $\eta^2 = 0.103$; ITT analysis: partial $\eta^2 = 0.094$).

BMI

In PP analysis, there was a significant difference in the mean change of BMI between the yoga and control groups, with the yoga group (M = -0.40, SD = 0.50) experiencing larger reduction than the control group (M = -0.10, SD = 0.47), p = 0.008, partial η^2 = 0.090, exhibiting a medium size. After adjusting for BMI at baseline, result of ANCOVA indicated a significant difference in the mean change of BMI between the yoga and control groups was found (p = 0.002), with a medium effect size (partial η^2 = 0.124).

Similar results were observed in ITT analysis, the yoga group experienced more reduction in BMI (M = -0.36, SD = 0.48) than the control group (M = -0.09, SD = 0.44), p = 0.008, partial η^2 = 0.080, exhibiting a medium effect size. After adjusting for BMI at baseline, result of ANCOVA suggested that a significant difference in the mean change of BMI was found (p = 0.002), demonstrating a medium effect size (partial η^2 = 0.111).

2. Cardiovascular endurance

Resting heart rate (RHR)

Result of PP analysis showed that participants experienced larger reduction in RHR in the yoga group (M = -2.18, SD = 6.95) than those in the control group did (M = 1.16, SD = 5.56), p = 0.024, partial η^2 = 0.067, exhibiting a medium effect size. Similarly, result of ITT indicated that yoga participants showed larger reduction in

RHR (*M* = -1.93, *SD* = 6.57) than those in the control participants did (*M* = 1.00, *SD* = 5.16), $p = 0.023$, partial $\eta^2 = 0.059$, exhibiting a small-to-medium effect size.

VO_{2max}

In PP analysis, the yoga group showed greater increment in VO_{2max} (*M* = 2.26, *SD* = 2.70) than the control group did (*M* = -0.31, *SD* = 2.87), $p < 0.001$, partial $\eta^2 = 0.179$, representing a large effect size. After adjusting for DBP at baseline, the yoga intervention exerted a large effect (partial $\eta^2 = 0.142$) on $VO_{2max.}$ In ITT analysis, the yoga group also showed greater increment in VO_{2max} (*M* = 2.00, *SD* = 2.64) than the control group did (*M* = -0.27, *SD* = 2.66), $p < 0.001$, partial $\eta^2 = 0.158$, representing a large effect size. After adjusting for DBP at baseline, the yoga intervention exerted a medium-to-large effect (partial $\eta^2 = 0.130$) on $VO_{2max.}$

3. Muscular strength and endurance

Curl-up Test

Results of PP and ITT analyses demonstrated that there was a significant difference in the mean change of sit-up test result between the two groups. In PP analysis, the yoga group had greater improvement when performing Curl-up Test (*M* = 3.56, *SD* = 5.35) than the control group did (*M* = 0.41, *SD* = 2.90), $p = 0.002$, partial $\eta^2 = 0.120$, representing a medium effect size. In ITT analysis, the yoga group had greater improvement in the result of Curl-up Test (*M* = 3.16, *SD* = 5.16) than the control group did (*M* = 0.35, *SD* = 2.69), $p = 0.002$, partial $\eta^2 = 0.106$, representing a medium effect size.

Push-up Test

In PP analysis, the yoga group had greater improvement in the Push-up Test result (M = 3.64, SD = 3.02) than the control group did (M = 0.46, SD = 1.69), $p < 0.001$, partial $\eta^2 = 0.299$, exhibiting a very large effect size. After adjusting for BMI at baseline, result of ANCOVA indicated a significant difference in the mean change of the Push-up Test result between the yoga and control groups was found ($p < 0.001$), with a very large effect size (partial $\eta^2 = 0.286$).

In ITT analysis, the yoga group experienced greater improvement when performing Push-up Test (M = 3.23, SD = 3.07) than the control group did (M = 0.40, SD = 1.58), $p < 0.001$, partial $\eta^2 = 0.255$, exhibiting a very large effect size. After adjusting for BMI at baseline, result of ANCOVA suggested that the yoga intervention exerted a very large effect on Push-up Test result (partial $\eta^2 = 0.233$).

4. Flexibility

Left leg flexibility

In PP analysis, the yoga group exhibited greater mean change of left leg flexibility (M = 6.42, SD = 3.71) than the control group did (M = -1.72, SD = 4.41), $p < 0.001$, partial $\eta^2 = 0.507$, representing a very large effect size. After adjusting for DBP at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on left leg flexibility (partial $\eta^2 = 0.478$).

In ITT analysis, the yoga group had greater mean change of left leg flexibility (M = 5.69, SD = 4.06) than the control group did (M = -1.48, SD = 4.13), $p < 0.001$, partial $\eta^2 = 0.440$, representing a very large effect size. After adjusting for DBP at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on left leg flexibility (partial $\eta^2 = 0.415$).

Right leg flexibility

In PP analysis, the yoga group experienced a larger improvement in right leg flexibility (*M* = 7.28, *SD* = 3.76) than the control group did (*M* = -1.67, *SD* = 4.12), $p < 0.001$, partial $\eta^2 = 0.570$, representing a very large effect size. After adjusting for DBP at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on right leg flexibility (partial $\eta^2 = 0.533$). In ITT analysis, the yoga group had greater mean change of right leg flexibility (*M* = 6.45, *SD* = 4.24) than the control group did (*M* = -1.14, *SD* = 3.86), $p < 0.001$, partial $\eta^2 = 0.492$, representing a very large effect size. After adjusting for DBP at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on right leg flexibility (partial $\eta^2 = 0.463$).

Table 30

Comparison of Changes of Physical Activity Level and Health-Related Physical Fitness Components among MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 76) and Intention-To-Treat Analysis (N = 87)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre *M* ± *SD*	Post *M* ± *SD*	Post - Pre *M* ± *SD*	Pre *M* ± *SD*	Post *M* ± *SD*	Post - Pre *M* ± *SD*	*p*	Effect size partial η^2	Adjusted *p*	Effect size partial η^2
PAL (MET-minutes/week)										
PP	1951.01 ± 2311.90	2435.31 ± 2247.52	329.05 ± 3196.62	1719.06 ± 1357.70	2147.26 ± 1782.92	421.43 ± 1725.53	.889	0.000	/	/
ITT	1869.82 ± 2171.35	2194.69 ± 2137.31	283.35 ± 2961.75	1918.30 ± 1671.61	2317.31 ± 2009.23	351.19 ± 1578.73	.904	0.000	/	/
Body weight (kg)										
PP [a]	69.19 ± 12.95	68.22 ± 12.29	-0.97 ± 1.41	71.39 ± 11.33	71.10 ± 11.26	-0.29 ± 1.21	.027*	0.064	.005**	0.103
ITT [a]	69.07 ± 12.61	68.21 ± 12.01	-0.86 ± 1.36	71.50 ± 11.00	71.25 ± 10.94	-0.25 ± 1.12	.025*	0.058	.004**	0.094
BMI (kg/m^2)										
PP [a]	26.24 ± 4.08	25.84 ± 3.85	-0.40 ± 0.50	27.19 ± 2.79	27.08 ± 2.81	-0.10 ± 0.47	.008**	0.090	.002**	0.124
ITT [a]	26.25 ± 3.94	25.09 ± 3.73	-0.36 ± 0.48	27.51 ± 3.15	25.42 ± 3.17	-0.09 ± 0.44	.008**	0.080	.002**	0.111
Resting heart rate (bpm)										
PP	70.44 ± 9.68	68.26 ± 8.37	-2.18 ± 6.95	70.73 ± 9.37	71.89 ± 9.93	1.16 ± 5.56	.024*	0.067	/	/
ITT	70.39 ± 9.27	68.45 ± 8.09	-1.93 ± 6.57	70.53 ± 9.03	71.53 ± 9.56	1.00 ± 5.16	.023*	0.059	/	/
VO_{2max} (ml/kg/min)										
PP [b]	26.39 ± 4.96	28.65 ± 5.47	2.26 ± 2.70	27.11 ± 5.93	26.81 ± 6.84	-0.31 ± 2.87	.000***	0.179	.001**	0.142
ITT [b]	27.01 ± 5.71	29.01 ± 5.94	2.00 ± 2.64	26.71 ± 5.98	26.44 ± 6.75	-0.27 ± 2.66	.000***	0.158	.001**	0.130
Curl-ups (times)										
PP	20.08 ± 5.94	23.64 ± 3.87	3.56 ± 5.35	21.03 ± 4.41	21.43 ± 4.38	0.41 ± 2.90	.002**	0.120	/	/
ITT	19.75 ± 6.55	22.91 ± 5.33	3.16 ± 5.16	21.14 ± 4.41	21.49 ± 4.37	0.35 ± 2.69	.000***	0.106	/	/
Push-ups (times)										
PP [a]	2.41 ± 4.30	6.05 ± 5.74	3.64 ± 3.02	3.62 ± 4.17	4.08 ± 4.74	0.46 ± 1.69	.000***	0.299	.000***	0.286
ITT [a]	2.82 ± 5.52	6.05 ± 6.48	3.23 ± 3.07	3.53 ± 4.08	3.93 ± 4.60	0.40 ± 1.58	.000***	0.255	.000***	0.233
Flexibility										
Left leg (cm)										
PP [b]	47.79 ± 13.08	54.22 ± 12.94	6.42 ± 3.71	51.30 ± 8.90	49.58 ± 10.11	-1.72 ± 4.41	.000***	0.507	.000***	0.478
ITT [b]	47.77 ± 12.39	53.47 ± 12.44	5.69 ± 4.06	50.14 ± 9.16	48.66 ± 10.02	-1.48 ± 4.13	.000***	0.440	.000***	0.415
Right leg (cm)										
PP [b]	47.10 ± 13.32	54.38 ± 13.04	7.28 ± 3.76	50.68 ± 10.14	49.01 ± 10.61	-1.67 ± 4.12	.000***	0.570	.000***	0.533
ITT [b]	47.19 ± 12.61	53.65 ± 12.53	6.45 ± 4.24	49.49 ± 10.18	48.06 ± 10.43	-1.43 ± 3.86	.000***	0.492	.000***	0.463

Note. PP per-protocol analysis (yoga, *n* = 39; control, *n* = 37), *ITT* intention-to-treat analysis (yoga, *n* = 44; control, *n* = 43)

a Adjusted for BMI at baseline.

b Adjusted for DBP at baseline

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 *eta-squared*; *PAL* physical activity level; *BMI* body mass index; *RHR* resting heart rate

**p* <0.05, ***p* < 0.01, ****p* < 0.001

4.4.3.3 Change of Cortisol level

Table 31 presents the comparison of the mean changes of cortisol level among participants enrolled in yoga program versus the control group. ANOVA was adopted for an unadjusted comparison as no covariates were identified in the correlation analysis (presented in Section 4.4.2). Result of ANOVA indicated that no significant difference in the mean change of cortisol level between the yoga and control groups was observed in PP and ITT analyses.

Table 31
Comparison of Change of Cortisol level among MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 76) and Intention-To-Treat Analysis (N = 87)

Outcome variables	Yoga group (n = 39) $M \pm SD$	Control group (n = 37) $M \pm SD$	ANOVA p [a]	ANOVA Effect size partial η^2
PP				
BCort	0.50 ± 3.46	-0.77 ± 2.42		
PCort	0.91 ± 2.52	-0.51 ± 2.13		
MDCort	0.42 ± 3.33	0.26 ± 3.77	.849	0.000
	Yoga group (n = 44) $M \pm SD$	Control group (n = 43) $M \pm SD$	ANOVA p [a]	ANOVA Effect size partial η^2
ITT				
BCort	0.82 ± 4.41	-0.84 ± 2.32		
PCort	1.19 ± 3.80	-0.61 ± 2.08		
MDCort	0.37 ± 3.12	0.22 ± 3.49	.839	0.000

PP per-protocol analysis; *ITT* intention-to-treat analysis; *BCort* change of cortisol level at baseline; *PCort* change of cortisol level at post-intervention; *MDCort* the difference between BCort and PCort; η^2 eta-squared
[a] There was no significant difference of cortisol level between the yoga and control groups

4.4.3.4 Changes of Psychological Variables

Table 32 shows the comparison of the mean changes of various psychological variables (self-esteem, perceived stress, state anxiety, trait anxiety and depression) between participants enrolled in yoga program versus the control group. Results of both PP and ITT analyses indicated that there were no significant differences in the mean changes of all psychological variables between the two groups.

Table 32

Comparison of Changes of Psychological Variables among MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 76) and Intention-To-Treat Analysis (N = 87)

	Yoga			Control			ANOVA		ANCOVA	
	Pre	Post	Post - Pre	Pre	Post	Post - Pre		Effect size	Adjusted	Effect size
Outcome variables	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	p	partial η^2	p	partial η^2
Self-esteem (RSE)										
PP [a]	21.64 ± 5.12	22.08 ± 4.00	0.44 ± 3.45	22.43 ± 3.01	21.84 ± 3.44	-0.59 ± 3.07	.174	0.025	.485	0.007
ITT [a]	21.30 ± 5.08	21.68 ± 4.14	0.39 ± 3.25	22.35 ± 3.01	21.84 ± 3.38	-0.51 ± 2.85	.175	0.022	.416	0.008
Perceived stress (PPS)										
PP	16.59 ± 4.22	16.54 ± 4.41	-0.05 ± 4.22	15.51 ± 4.87	15.95 ± 4.10	0.43 ± 4.51	.630	0.003	/	/
ITT	16.73 ± 4.22	16.68 ± 4.39	-0.05 ± 3.96	15.53 ± 4.64	15.91 ± 3.95	0.37 ± 4.18	.634	0.003	/	/
Anxiety (STAI)										
State anxiety (SA)										
PP	32.64 ± 9.10	30.28 ± 7.91	-2.36 ± 7.38	30.92 ± 7.80	30.59 ± 8.46	-0.32 ± 7.95	.251	0.018	/	/
ITT	32.41 ± 9.20	30.32 ± 8.14	-2.09 ± 6.98	31.05± 7.57	30.77 ± 8.16	-0.28 ± 7.36	.242	0.016	/	/
Trait anxiety (TA)										
PP	36.05 ± 8.62	33.86 ± 7.97	-2.13 ± 5.17	34.49 ± 7.63	34.24 ± 7.24	-0.24 ± 5.49	.251	0.031	/	/
ITT	36.41 ± 8.81	34.21 ± 7.40	-1.52 ± 4.65	34.72 ± 7.18	34.51 ± 6.83	-0.21 ± 5.09	.121	0.028	/	/
Depression (CES-D)										
PP	12.51 ± 6.99	10.90 ± 5.96	-1.62 ± 5.77	10.24 ± 5.86	10.81 ± 7.23	0.57 ± 7.26	.150	0.028	/	/
ITT [a]	12.95 ± 7.12	11.52 ± 6.36	-1.43 ± 5.45	10.72 ± 5.75	11.21 ± 6.93	0.49 ± 6.72	.147	0.025	.306	0.012

Note. PP per-protocol analysis (yoga, n = 39; control, n = 37), *ITT* intention-to-treat analysis (yoga, n = 44; control, n = 43)

a Adjusted for DBP at baseline.

b There were no significant differences in the above variables between yoga and control groups.

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared

4.4.3.5 Changes of HRQoL Domain and Summary Scores

Table 33 shows the comparison of the mean changes of eight HRQoL domain scores and two summary scores between the yoga group and the control group. There were no significant differences in the mean changes of all HRQoL domain scores and summary scores, except the mean change of social functioning domain score. In PP analysis, participants in the yoga group had greater increment in social functioning domain score (M = 6.73, SD = 18.71) than participants in the control group did (M = -6.08, SD = 14.62), $p = 0.004$, partial $\eta^2 = 0.109$, representing a medium effect size. In ITT analysis, the yoga group showed also greater increment in social functioning domain score (M = 5.97, SD = 20.44), as compared to the control group (M = -5.23, SD = 13.70), $p = 0.004$, partial $\eta^2 = 0.095$, representing a medium effect size. Since DBP at baseline was identified as a covariate of mean change of social functioning domain score, ANCOVA was adopted in controlling the confounding effect of the covariate. The results of ANCOVA indicated that the yoga intervention exerted a medium effect on the mean change of social functioning domain score.

Table 33

Comparison of Changes of HRQoL Domain and Summary Scores among MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 76) and Intention-To-Treat Analysis (N = 87)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre *M* ± *SD*	Post *M* ± *SD*	Post - Pre *M* ± *SD*	Pre *M* ± *SD*	Post *M* ± *SD*	Post - Pre *M* ± *SD*	*p*	Effect size partial η^2	Adjusted *p*	Effect size partial η^2
Physical functioning (PF)										
PP	89.10 ± 8.57	89.10 ± 9.17	0.00 ± 8.11	85.00 ± 11.49	83.78 ± 13.35	-1.22 ± 10.83	.580	0.004	/	/
ITT	87.95 ± 11.33	87.95 ± 11.73	0.00 ± 7.62	85.00 ± 11.02	83.95 ± 12.70	-1.05 ± 10.03	.585	0.004	/	/
Role physical (RP)										
PP	84.62 ± 29.59	87.18 ± 22.85	2.56 ± 36.63	84.46 ± 26.58	77.70 ± 33.22	-6.76 ± 28.04	.219	0.020	/	/
ITT	83.52 ± 30.95	85.80 ± 25.52	2.27 ± 34.45	84.30 ± 28.36	78.49 ± 33.89	-5.81 ± 26.07	.221	0.018	/	/
Bodily pain (BP)										
PP	67.92 ± 21.84	65.31 ± 20.35	-2.62 ± 18.69	67.57 ± 22.77	63.22 ± 22.73	-4.35 ± 15.96	.665	0.003	/	/
ITT	65.45 ± 22.65	63.14 ± 21.12	-2.32 ± 17.59	66.33 ± 21.67	62.58 ± 21.46	-3.74 ± 14.86	.684	0.002	/	/
General health perceptions (GH)										
PP	58.33 ± 11.55	60.90 ± 12.61	2.56 ± 11.17	58.92 ± 10.87	56.76 ± 13.50	-2.16 ± 9.69	.053	0.050	/	/
ITT [a]	58.18 ± 12.11	60.45 ± 13.07	2.27 ± 10.54	59.30 ± 10.83	57.44 ± 13.20	-1.86 ± 9.00	.053	0.043	.129	0.027
Physical component score (PCS)										
PP	299.97 ± 53.54	302.49 ± 44.44	2.51 ± 53.23	295.95 ± 55.97	281.46 ±63.95	-14.49 ± 44.36	.136	0.030	/	/
ITT	295.11 ± 59.28	297.34 ± 52.43	2.23 ± 50.05	294.93 ± 54.59	282.47 ± 61.64	-12.47 ± 41.38	.140	0.025	/	/
Vitality (VT)										
PP [a]	66.54 ± 15.35	71.15 ± 15.06	4.62 ± 12.05	65.68 ± 16.84	66.49 ± 17.95	0.81 ± 12.16	.175	0.025	.476	0.007
ITT [a]	65.68 ± 15.06	69.77 ± 14.94	4.09 ± 11.43	65.58 ± 16.88	65.81 ± 16.87	0.70 ± 11.26	.167	0.022	.391	0.009
Social functioning (SF)										
PP [a]	83.01 ± 21.74	89.74 ± 11.78	6.73 ± 18.71	86.15 ± 17.38	80.07 ± 19.20	-6.08 ± 14.62	.004**	0.109	.019*	0.073
ITT [a]	82.67 ± 20.92	88.64 ± 12.30	5.97 ± 20.44	84.59 ± 16.21	79.36 ± 18.68	-5.23 ± 13.70	.004**	0.095	.015*	0.069
Role emotional (RE)										
PP [a]	76.92 ± 36.80	82.91 ± 29.49	5.98 ± 40.37	83.78 ± 30.04	85.59 ± 27.82	1.80 ± 30.37	.613	0.003	.679	0.002
ITT [a]	74.24 ± 37.95	79.55 ± 32.32	5.30 ± 38.00	84.50 ± 29.41	86.05 ± 27.44	1.55 ± 28.13	.603	0.003	.823	0.001
Mental health (MH)										
PP [a]	75.59 ± 16.28	78.77 ± 13.43	3.18 ± 12.11	79.14 ± 13.50	76.54 ± 14.55	-2.59 ± 14.12	.059	0.047	.217	0.021
ITT [a]	74.73 ± 16.32	77.55 ± 14.05	2.81 ± 11.43	78.05 ± 13.53	75.81 ± 14.29	-2.23 ± 13.11	.059	0.041	.176	0.022
Mental component score (MCS)										
PP [a]	302.06 ± 75.38	322.57 ± 53.01	20.51 ± 67.96	314.74 ± 67.30	308.68 ± 67.94	-6.06 ± 58.32	.072	0.043	.367	0.011
ITT [a]	297.32 ± 75.89	315.50 ± 58.66	18.18 ± 64.23	312.25 ± 63.84	307.03 ± 64.25	-5.22 ± 54.34	.070	0.038	.227	0.014

Note. PP per-protocol analysis (yoga, $n = 39$; control, $n = 37$), *ITT* intention-to-treat analysis (yoga, $n = 44$; control, $n = 43$)
a Adjusted for DBP at baseline.
Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared
* $p < 0.05$; ** $p < 0.01$

4.5 Subgroup Analysis of Study One: Non-Metabolic Syndrome Sample

This subgroup analysis compared changes of the outcome variables between the yoga group and the control group of the non-metabolic syndrome (Non-MetS) sample. Non-metabolic syndrome (Non-MetS) sample in this subgroup analysis was defined as those participants who met less than three of the revised NCEP-ATP III clinical diagnosis criteria for Asian populations at baseline. The detail of the revised NCEP-ATP III clinical criteria has been described in Chapter 2 (Section 2.1.2).

Homogeneity of the yoga and control groups in term of demographic, physiological and psychological characteristics at baseline was determined in order to check the presence of baseline differences of the outcome variables, and those characteristics with significant differences were noted as heterogeneous characteristics. Relationship between those heterogeneous characteristics and all the outcome variables were assessed in order to identify possible covariates of the particular variables. Those heterogeneous characteristics significantly correlated with the particular outcome variables were identified as covariates of the particular outcome variables. To examine the effect of yoga on the outcome variables relative to the control condition, ANOVA was conducted to compare the mean changes of outcome variables from baseline to post-intervention. If covariates for particular outcome variables were identified, additional ANCOVA was conducted in order to control the confounding effects arose from the presence of the covariates. Both per-protocol (PP) and intention-to-treat (ITT) analyses were performed. Effect size was computed to show magnitude and direction of the effect of the yoga intervention relative to the control condition for each outcome variable. Effect size of each outcome variable was reported in term of the value of partial η^2 and provided with descriptive label (i.e. "small", "medium" or "large").

4.5.1 Baseline Homogeneity of the Yoga and Control Groups in Per-Protocol Analysis and Intention-To-Treat Analysis

PP analysis

Homogeneity of the yoga and control groups in terms of demographic, physiological and psychological characteristics was determined (see Tables 34-36). The two groups demonstrated significant differences in six characteristics. For demographic characteristics, a significant difference was found in alcohol intake, with the yoga group having larger portion of occasional alcohol drinkers than the control group ($\chi^2 = 7.71$, $p = 0.006$). Also, the portion of participants who were taking blood pressure medications of the yoga group was significantly smaller than that of the control group ($\chi^2 = 4.49$, $p = 0.045$). For physiological characteristics, there were significant differences in WC [$t(76) = -2.01$, $p = 0.045$], body weight [$t(76) = -2.12$, $p = 0.038$], and BMI [$t(76) = -2.37$, $p = 0.021$] between the two groups. The yoga group demonstrated smaller WC, and lower body weight and BMI than the control group. For psychological characteristics, there was a significant difference in role emotional domain score ($z = -2.78$, $p = 0.009$), with the yoga group exhibiting lower role emotional score than the control group.

ITT analysis

Tables 37-39 present the homogeneity of the yoga and control groups in terms of demographic, physiological and psychological characteristics. There were significant differences in six characteristics between these two groups. Similar to PP analysis, the yoga group had significantly larger portion of occasional alcohol drinkers than the control group did ($\chi^2 = 9.53$, $p = 0.002$). Also, the portion of participants who were taking blood pressure medications of the yoga group was significantly smaller than that of the control group (χ^2 = 4.49, p = 0.045). For physiological characteristics, there were significant differences in WC [$t(84)$ = -2.14, p = 0.035] and BMI [$t(84)$ = -2.33, p = 0.022] between the two groups. The yoga group had smaller WC and lower BMI than the control group. For psychological characteristics, significant differences in role emotional domain score (z = -2.74, p = .006) and mental component score (z = -2.06, p = .039) between the two groups were found. Participants in the yoga group showed significantly lower scores in both role emotional domain and mental component score as compared to the control group.

Table 34

Demographic Characteristics of Non-MetS Participants in Per-Protocol Analysis (N = 78)

Characteristics	Yoga group (n = 40)	Control group (n = 38)	t or χ^2	p
	$M \pm SD$ or f (%)			
Age (years) [a]	53.54 ± 7.60	51.43 ± 7.44	0.26	.793
			0.14	.711
30-44	5 (12.5%)	9 (23.7%)		
45-54	21 (52.5%)	15 (39.5%)		
55-64	13 (32.5%)	12 (31.6%)		
65 or above	1 (2.5%)	2 (5.3%)		
Gender			0.08	.774
Male	16 (40.0%)	14 (36.8%)		
Female	24 (60.0%)	24 (63.2%)		
Marriage			2.26	.133
Single	4 (10.0%)	7 (18.4%)		
Married	34 (85.0%)	31 (81.6%)		
Widow	2 (5.0%)	0 (0.0%)		
Education level			2.28	.131
No education	0 (0.0%)	0 (0.0%)		
Primary	1 (2.5%)	2 (5.3%)		
Secondary	21 (52.5%)	25 (65.8%)		
Tertiary	18 (45.0%)	11 (28.9%)		
Occupation			0.20	.656
Full-time	23 (57.5%)	20 (52.6%)		
Part-time	1 (2.5%)	2 (5.3%)		
Unemployed	0 (0.0%)	0 (0.0%)		
Housewife	8 (20.0%)	5 (13.2%)		
Retired	8 (20.0%)	11 (28.9%)		
Smoking			0.22	.642
Current	0 (0.0%)	0 (0.0%)		
Quitted	3 (7.5%)	4 (10.5%)		
Never	37 (92.5%)	34 (89.5%)		
Alcohol intake [a]			7.71	.006**
Quitted	0 (0.0%)	1 (2.6%)		
Never	9 (22.5%)	20 (52.6%)		
Sometimes	30 (75.0%)	16 (42.1%)		
Always	1 (2.5%)	1 (2.6%)		
Medication use				
Glucose			0.003	1.000
Yes	2 (5.0%)	2 (5.3%)		
No	38 (95.0%)	36 (94.7%)		
Blood pressure			4.49	.045*
Yes	2 (5.0%)	8 (21.1%)		
No	38 (95.0%)	38 (78.9%)		
Cholesterol			0.001	1.000
Yes	1 (2.5%)	1 (2.6%)		
No	33 (97.5%)	31 (97.4%)		
Triglyceride			*NA*	*NA*
Yes	0 (0.0%)	0 (0.0%)		
No	40 (100.0%)	38 (100.0%)		

a The total percentage does not sum to exactly 100% due to round-off error.
NA No statistics are computed because no Non-MetS participants have medication use on triglyceride.
[*] p < 0.05; ** p < 0.01

Table 35

Physiological Characteristics of Non-MetS Participants in Per-Protocol Analysis (N = 78)

Characteristics	Yoga group (n = 40)	Control group (n = 38)	t	p
	$M \pm SD$			
MetS related				
WC (cm)	81.29 ± 7.69	85.29 ± 9.83	-2.01	.045*
SBP (mmHg)	123.10 ± 16.21	125.42 ± 18.62	-0.59	.558
DBP (mmHg)	73.90 ± 11.58	76.63 ± 9.88	-1.12	.267
FBG (mmol/L)	5.30 ± 0.98	5.18 ± 0.79	-0.61[a]	.544
TG (mmol/L)	1.05 ± 0.48	1.07 ± 0.59	-0.02[a]	.988
HDL-C (mmol/L)	1.75 ± 0.41	1.62 ± 0.41	1.49	.141
MetS z-score	-4.31 ± 3.12	-3.28 ± 2.92	-1.50	.137
Physical activity level (IPAQ) (MET-minutes/week)	1707.73 ± 1353.26	1552.30 ± 1207.71	0.49	.626
Physical fitness				
Body composition				
Body weight (kg)	59.70 ± 8.56	64.43 ± 11.10	-2.12	.038*
BMI (kg/m^2)	22.46 ± 2.76	24.34 ± 4.08	-2.37	.021*
Cardiorespiratory endurance				
Resting heart rate (bpm)	66.13 ± 8.61	67.47 ± 10.22	-0.63	.530
VO_{2max} (ml/kg/min)	30.85 ± 7.49	28.75 ± 7.42	1.24	.217
Muscular strength and endurance				
Curl-ups (times)	21.68 ± 4.98	19.66 ± 5.22	1.75	.085
Push-ups (times)	6.95 ± 9.33	3.82 ± 6.06	-1.01	.271
Flexibility				
Left leg (cm)	47.11 ± 10.78	50.33 ± 14.08	-1.14	.259
Right leg (cm)	47.43 ± 10.90	50.74 ± 14.37	-1.15	.254
Cortisol level at 6:15pm	4.26 ± 1.95	4.76 ± 2.35	-1.02	.311

a Mann-Whitney *U* test

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride; *HDL-C* high-density lipoprotein cholesterol; *BMI* body mass index

* $p < 0.05$

Table 36

Psychological Characteristics of Non-MetS Participants in Per-Protocol Analysis (N = 78)

Characteristics	Yoga group (n = 40)	Control group (n = 38)	t	p [b]
	$M \pm SD$			
Self-esteem (RSE)	22.18 ± 3.71	20.92 ± 4.31	1.38	.172
Perceived stress (PPS)	15.68 ± 3.53	16.13 ± 4.56	-0.50	.621
Anxiety (STAI)				
State anxiety (SA)	30.80 ± 7.35	31.21 ± 8.13	-0.23	.815
Trait anxiety (TA)	35.03 ± 6.90	35.21 ± 7.61	-0.11	.910
Depression (CES-D)	12.51 ± 6.99	10.58 ± 7.24	0.55	.584
HRQoL (SF-36)				
Physical functioning (PF)	89.00 ± 9.95	85.79 ± 13.93	-1.22 [a]	.221
Role physical (RP)	81.88 ± 27.73	86.18 ± 25.13	-0.79 [a]	.430
Bodily pain (BP)	67.08 ± 17.16	67.76 ± 22.77	-0.15	.883
General health perceptions (GH)	63.50 ± 11.61	62.89 ± 13.18	0.22	.830
Physical component score (PCS)	301.45 ± 48.78	302.63 ± 55.41	-0.31 [a]	.757
Vitality (VT)	67.88 ± 14.89	66.05 ± 18.82	0.48	.636
Social functioning (SF)	87.50 ± 13.87	91.45 ± 14.27	-1.62 [a]	.104
Role emotional (RE)	75.83 ± 32.01	90.35 ± 26.74	-2.63 [a]	.009**
General mental health (MH)	76.70 ± 10.83	78.42 ± 14.98	-0.58	.561
Mental component score (MCS)	307.91 ± 56.69	326.27 ± 60.72	-1.85 [a]	.064

a Mann-Whitney U test

b There were no significant differences between groups in all the characteristics at baseline.

Table 37

Demographic Characteristics of Non-MetS Participants in Intention-To-Treat Analysis (N = 86)

Characteristics	Yoga group (n = 43)	Control group (n = 43)		
	$M \pm SD$ or f (%)		t or χ^2	p
Age (years) [a]	51.42 ± 6.49	51.09 ± 8.01	0.21	.836
			0.08	.785
30-44	7 (16.3%)	10 (23.3%)		
45-54	21 (48.8%)	18 (41.9%)		
55-64	14 (32.6%)	13 (30.2%)		
65 or above	1 (2.3%)	2 (4.7%)		
Gender			0.44	.506
Male	18 (41.9%)	15 (34.9%)		
Female	25 (58.1%)	28 (65.1%)		
Marriage			0.28	.096
Single	4 (9.3%)	8 (18.6%)		
Married	37 (86.0%)	36 (83.7%)		
Widow	2 (4.7%)	1 (2.3%)		
Education level [a]			2.48	.116
No education	0 (0.0%)	0 (0.0%)		
Primary	1 (2.3%)	2 (4.7%)		
Secondary	22 (51.2%)	28 (65.1%)		
Tertiary	17 (38.6%)	13 (30.2%)		
Occupation			0.24	.626
Full-time	26 (60.5%)	24 (55.8%)		
Part-time	1 (2.3%)	2 (4.7%)		
Unemployed	0 (0.0%)	0 (0.0%)		
Housewife	8 (18.6%)	5 (11.6%)		
Retired	8 (18.6%)	12 (27.9%)		
Smoking				
Current	0 (0.0%)	0 (0.0%)	0.00	1.000
Quitted	4 (9.3%)	4 (9.3%)		
Never	39 (90.7%)	39 (90.7%)		
Alcohol intake [a]				
Quitted	0 (0.0%)	1 (2.3%)	9.53	.002**
Never	10 (23.3%)	24 (55.8%)		
Sometimes	32 (74.4%)	17 (39.5%)		
Always	1 (2.3%)	1 (2.3%)		
Medication use				
Glucose			0.00	1.000
Yes	2 (4.7%)	2 (4.7%)		
No	41 (95.3%)	41 (95.3%)		
Blood pressure			4.49	.045*
Yes	2 (4.7%)	8 (18.6%)		
No	41 (95.3%)	35 (81.4%)		
Cholesterol			0.00	1.000
Yes	1 (2.3%)	1 (2.3%)		
No	42 (97.7%)	42 (97.7%)		
Triglyceride			*NA*	*NA*
Yes	0 (0.0%)	0 (0.0%)		
No	43 (100.0%)	43 (100.0%)		

a The total percentage does not sum to exactly 100% due to round-off error.

NA No statistics are computed because no Non-MetS participants have medication use on triglyceride.

$*p < 0.05$; $**p < 0.01$

Table 38

Physiological Characteristics of Non-MetS Participants in Intention-To-Treat Analysis (N = 86)

Characteristics	Yoga group (n = 43)	Control group (n = 43)	t	p
	$M \pm SD$			
MetS related				
WC (cm)	81.61 ± 7.53	85.71 ± 10.06	-2.14	.035*
SBP (mmHg)	122.95 ± 16.14	124.16 ± 17.94	-0.33	.743
DBP (mmHg)	74.07 ± 11.41	75.72 ± 9.65	-0.72	.471
FBG (mmol/L)	5.31 ± 0.95	5.17 ± 0.78	-0.76[a]	.446
TG (mmol/L)	1.03 ± 0.47	1.05 ± 0.57	-0.004[a]	.997
HDL-C (mmol/L)	1.73 ± 0.40	1.62 ± 0.39	1.31	.195
MetS z-score	-4.29 ± 3.04	-3.37 ± 2.81	-1.47	.145
Physical activity level (IPAQ)				
(MET-minutes/week)	1709.48 ± 1310.37	1501.75 ± 1151.24	0.72	.473
Health-related physical fitness				
Body composition				
Body weight (kg)	60.19 ± 8.48	64.49 ± 11.52	-1.97	.052
BMI (kg/m^2)	22.59 ± 2.71	24.29 ± 3.94	-2.33	.022*
Cardiorespiratory endurance				
Resting heart rate (bpm)	66.56 ± 8.68	68.00 ± 10.45	-0.70	.488
VO_{2max} (ml/kg/min)	30.92 ± 7.35	28.42 ± 7.14	0.47	.115
Muscular strength and endurance				
Curl-ups (times)	21.67 ± 4.84	19.77 ± 5.11	0.50	.079
Push-ups (times)	6.93 ± 9.08	3.49 ± 5.79	-1.43[a]	.153
Flexibility				
Left leg (cm)	47.40 ± 10.55	51.02 ± 13.77	-1.37	.174
Right leg (cm)	47.66 ± 10.59	51.36 ± 13.98	-1.38	.170
Cortisol level at 6:15pm	4.57 ± 2.38	4.60 ± 2.27	-0.07	.946

a Mann-Whitney *U* test

MetS Metabolic syndrome; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride; *HDL-C* high-density lipoprotein cholesterol; *BMI* body mass index

* $p < 0.05$

Table 39

Psychological Characteristics of Non-MetS Participants in Intention-To-Treat Analysis (N = 86)

Characteristics	Yoga group (n = 43)	Control group (n = 43)	t	p
	$M \pm SD$			
Self-esteem (RSE)	22.19 ± 3.58	20.91 ± 4.10	1.54	.127
Perceived stress (PPS)	15.60 ± 3.45	16.37 ± 4.39	-0.90	.370
Anxiety (STAI)				
State anxiety (SA)	30.44 ± 7.25	31.26 ± 8.14	-0.49	.626
Trait anxiety (TA)	35.02 ± 6.91	35.19 ± 7.40	-0.11	.916
Depression (CES-D)	11.49 ± 4.89	10.91 ± 7.04	0.45	.658
HRQoL (SF-36)				
Physical functioning (PF)	89.53 ± 9.81	86.51 ± 13.56	-1.23 [a]	.219
Role physical (RP)	81.98 ± 26.91	87.21 ± 24.01	-1.09 [a]	.275
Bodily pain (BP)	66.49 ± 16.92	68.51 ± 23.15	-0.46	.645
General health perceptions (GH)	63.26 ± 11.28	62.67 ± 12.97	0.22	.825
Physical component score (PCS)	301.26 ± 47.36	304.91 ± 53.38	-0.60 [a]	.548
Vitality (VT)	67.91 ± 15.32	66.05 ± 18.05	0.52	.608
Social functioning (SF)	86.34 ± 14.64	91.28 ± 14.31	-1.93 [a]	.053
Role emotional (RE)	75.19 ± 33.41	90.69 ± 25.54	-2.74 [a]	.006**
General mental health (MH)	75.81 ± 10.94	77.77 ± 15.00	-0.69	.492
Mental component score (MCS)	305.25 ± 59.69	319.31 ± 58.68	-2.06 [a]	.039*

a Mann-Whitney *U* test

* $p < 0.05$; ** $p < 0.01$

4.5.2 Relationships between Heterogeneous Characteristics and the Outcome Variables

In order to identify possible covariates, relationships between the outcome variables with those heterogeneous characteristics, which identified in the baseline homogeneity tests (presented in Sections 4.5.1), were assessed.

PP analysis

The yoga and control groups were heterogeneous in terms of the status of alcohol intake, medication use on blood pressure (BPM), waist circumference (WC), body weight, BMI, and role emotional domain score. The correlations of these six heterogeneous characteristics with 32 outcome variables were identified (see Table 40). Among these 32 outcome variables, two variables (number as "15 and 18" in Table 40) were significantly correlated with alcohol intake, six variables (number as "23, 27-28, 30-32" in Table 40) were significantly correlated with role emotional domain score, variable no. 14 was significantly correlated with both alcohol intake and role emotional domain score, and variable no. 17 was significantly correlated with all the heterogeneous characteristics except role emotional domain score. Incorporating the findings from these correlation analyses and those about homogeneity of the two groups, the heterogeneous characteristics have exerted confounding effects on these ten outcome variables, and were considered as covariates during analysis. ANOVA was adopted to determine if there was a significant difference in the change of each variable between the two groups over the 12-week intervention period, and additional ANCOVA was adopted to control the confounding effects of the heterogeneous characteristics on these ten outcome variables.

Findings also illustrated that the rest of the 22 outcome variables (number as "1-13, 16, 19-22, 24-26, 29" in Table 40) were not significantly correlated with any of these six heterogeneous characteristics. This implies that none of the six heterogeneous characteristics exerted confounding effects on these 22 outcome variables in this PP analysis. Therefore, ANOVA was adopted to determine if there was a significant difference in the change of each variable between the yoga and control groups over the 12-week intervention period.

ITT analysis

The yoga and control groups were heterogeneous in terms of the status of alcohol intake, medication use on blood pressure (BPM), waist circumference (WC), BMI, role emotional domain and mental component scores. The correlations of these six heterogeneous characteristics with 32 outcome variables were identified (see Table 41). Among these 32 outcome variables, eight variables (number as "10, 15-16, 18-19, 22, 27, 29" in Table 41) were significantly correlated with one of these six heterogeneous characteristics, five (number as "14, 28, 30-32" in Table 41) were significantly correlated with two characteristics, and only two (number as "17 and 23" in Table 41) were significantly correlated with three characteristics. Incorporating the findings from these correlation analyses and those about homogeneity of the yoga and control groups, the heterogeneous characteristics have exerted confounding effects on these 15 outcome variables, and were considered as covariates during analysis. ANOVA was adopted to determine if there was a significant difference in the change of each variable between the two groups over the 12-week intervention period, and additional ANCOVA was adopted to control the confounding effects of the heterogeneous characteristics on these 15 outcome variables.

Findings also revealed that the rest of the 17 outcome variables (number as “1-9, 11-13, 19-22, and 24-26” in Table 41) were not significantly correlated with any of these six heterogeneous characteristics. This implies that none of the six heterogeneous characteristics exerted confounding effects on these 17 outcome variables in this ITT analysis. Therefore, ANOVA was adopted to determine if there was a significant difference in the change of each variable between the yoga and control groups over the 12-week intervention period.

Table 40

Correlations between Heterogeneous Characteristics and Outcome Variables for Per-Protocol Analysis of Non-MetS Sample (N = 78)

	Outcome variables	Heterogeneous characteristics					
		Alcohol	BPM	BWC	BBW	BBMI	BRE
1.	WC	-0.026	-0.172	-0.085	-0.034	0.057	-0.003
2.	SBP	-0.080	-0.120	0.103	0.205	0.072	-0.091
3.	DBP	0.064	-0.069	-0.072	0.011	-0.114	0.083
4.	FBG	-0.204	0.098	-0.062	0.012	-0.017	-0.019
5.	TG	0.115	-0.008	0.024	0.049	-0.077	0.029
6.	HDL-C	-0.092	-0.161	0.144	0.172	0.205	0.174
7.	MetS z-score	0.025	-0.051	-0.065	0.013	-0.117	-0.057
8.	Physical activity level	-0.53	0.153	0.036	-0.055	-0.033	-0.079
9.	Body weight	-0.011	-0.026	-0.119	-0.210	-0.124	-0.168
10.	Body mass index	-0.030	0.006	-0.136	-0.193	-0.153	-0.168
11.	Resting heart rate	-0.137	-0.030	0.053	0.078	-0.025	-0.050
12.	VO2max	0.169	0.233	-0.080	-0.004	-0.136	-0.072
13.	Curl-ups	-0.060	-0.069	0.068	0.049	0.029	0.098
14.	Push-ups	0.393**	0.203	-0.088	-0.040	-0.167	-0.314**
15.	Left leg flexibility	0.311**	0.081	0.066	0.066	-0.029	0.000
16.	Right leg flexibility	0.186	0.171	0.054	0.143	0.005	0.117
17.	Cortisol level	-0.332**	-0.048	0.369**	0.329**	0.396**	0.057
18.	Self-esteem (RSE)	0.277*	0.113	-0.133	-0.098	-0.155	-0.011
19.	Perceived stress (PPS)	0.131	0.201	-0.062	-0.063	-0.066	0.173
20.	State anxiety (SA)	-0.164	-0.090	0.021	0.043	0.114	0.096
21.	Trait anxiety (TA)	-0.117	-0.104	0.062	0.178	0.104	0.095
22.	Depression (CES-D)	-0.045	-0.086	-0.069	0.013	0.034	0.217
23.	Physical Functioning (PF)	-0.071	0.227*	0.047	0.008	0.015	-0.254*
24.	Role Physical (RP)	-0.095	0.085	0.009	-0.126	-0.007	-0.125
25.	Bodily Pain (BP)	0.074	0.090	-0.106	-0.128	-0.126	-0.117
26.	General Health Perceptions (GH)	0.083	-0.049	-0.071	-0.013	-0.142	-0.179
27.	Physical Component Score (PCS)	-0.015	0.166	-0.051	-0.148	-0.095	-0.242*
28.	Vitality (VT)	-0.085	0.138	-0.039	-0.166	-0.125	-0.255*
29.	Social Functioning (SF)	0.168	0.184	0.075	0.007	-0.021	-0.083
30.	Role Emotional (RE)	-0.002	0.150	-0.069	-0.190	-0.111	-0.597**
31.	General mental health (MH)	-0.064	0.159	-0.011	-0.071	-0.119	-0.238*
32.	Mental Component Score (MCS)	-0.004	0.204	-0.031	-0.169	-0.131	-0.498**

WC waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome; *Alcohol* alcohol intake at baseline; *BPM* medication on blood pressure at baseline; *BWC* waist circumference at baseline; *BW* body weight at baseline; *BBMI* body mass index at baseline; *BRE* role emotional domain score at baseline

* $p < 0.05$; ** $p < 0.01$

Table 41

Correlations between Heterogeneous Characteristics and Outcome Variables for Intention-To-Treat Analysis of Non-MetS Sample (N = 86)

	Outcome variables	Heterogeneous characteristics					
		Alcohol	BPM	BWC	BBMI	BRE	BMCS
1.	WC	-0.066	-0.137	-0.053	0.066	-0.002	0.011
2.	SBP	-0.109	-0.097	0.111	0.076	-0.085	-0.151
3.	DBP	0.058	-0.065	-0.059	-0.108	0.079	0.104
4.	FBG	-0.189	0.108	-0.055	-0.015	-0.017	-0.207
5.	TG	0.108	-0.013	0.025	-0.074	0.028	0.015
6.	HDL-C	-0.072	-0.168	0.130	0.199	0.164	0.056
7.	MetS z-score	0.010	-0.035	-0.045	-0.110	-0.050	-0.075
8.	Physical activity level	-0.039	0.143	0.023	0.023	-0.037	-0.072
9.	Body weight	-0.029	0.001	-0.089	-0.111	-0.156	-0.197
10.	Body mass index	-0.054	0.029	-0.106	-0.139	-0.156	-0.215*
11.	Resting heart rate	-0.130	-0.026	0.051	-0.024	-0.047	-0.105
12.	VO_{2max}	0.180	0.211	-0.090	-0.139	-0.068	0.022
13.	Curl-ups	-0.023	-0.086	0.046	0.021	0.091	0.062
14.	Push-ups	0.394**	0.170	-0.111	-0.173	-0.291**	-0.152
15.	Left leg flexibility	0.332**	0.023	0.027	-0.042	0.000	0.000
16.	Right leg flexibility	0.224*	0.118	0.015	-0.010	0.106	0.100
17.	Cortisol level	-0.326**	-0.041	0.351**	0.390**	0.054	0.152
18.	Self-esteem (RSE)	0.268*	0.104	-0.136	-0.156	-0.011	-0.145
19.	Perceived stress (PPS)	0.101	0.208	-0.048	-0.059	0.163	0.238*
20.	State anxiety (SA)	-0.162	-0.083	0.029	0.116	0.091	0.117
21.	Trait anxiety (TA)	-0.120	-0.084	0.068	0.106	0.090	0.068
22.	Depression (CES-D)	-0.060	-0.068	-0.047	0.041	0.204	0.321**
23.	Physical Functioning (PF)	-0.052	0.220*	0.037	0.012	-0.239*	-0.361**
24.	Role Physical (RP)	-0.097	0.088	0.014	-0.005	-0.118	-0.006
25.	Bodily Pain (BP)	0.073	0.084	-0.104	-0.125	-0.111	-0.173
26.	General Health Perceptions (GH)	0.077	-0.042	-0.061	-0.136	-0.169	-0.155
27.	Physical Component Score (PCS)	0.002	0.166	-0.047	-0.093	-0.228*	-0.211
28.	Vitality (VT)	-0.064	0.131	-0.045	-0.126	-0.240*	-0.509**
29.	Social Functioning (SF)	0.160	0.180	0.073	-0.020	-0.078	-0.242*
30.	Role Emotional (RE)	0.000	0.0147	-0.069	-0.110	-0.562**	-0.360**
31.	General mental health (MH)	-0.052	0.154	-0.016	-0.119	-0.224*	-0.444**
32.	Mental Component Score (MCS)	-0.008	0.198	-0.034	-0.130	-0.469**	-0.515**

WC waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride, *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome; *Alcohol* alcohol intake at baseline; *BPM* medication on blood pressure at baseline; *BWC* waist circumference at baseline; *BBMI* body mass index at baseline; *BRE* role emotional domain at baseline; *BMCS* mental component score at baseline

* $p < 0.05$; ** $p < 0.01$

4.5.3 Comparison of the Mean Changes of Outcome Variables among the Non-MetS Participants in the Yoga Group and the Control Group

4.5.3.1 Changes of Metabolic Risk Factors

Table 42 presents the comparison of the mean changes of seven metabolic risk factors (waist circumference, systolic blood pressure, diastolic blood pressure, fasting blood glucose, triglyceride, high-density lipoprotein cholesterol, and MetS z score) between participants enrolled in the yoga program versus the control group. ANOVA was adopted for an unadjusted comparison as no covariates were identified in the correlation analysis (presented in Section 4.5.2).

1. Waist circumference (WC)

In PP analysis, the yoga group showed greater reduction in the mean change of WC (M = -2.32, SD = 2.25), as compared to the control group (M = -0.63, SD = 2.47), p = 0.002, partial η^2 = 0.116, exhibiting a medium effect size. Result of ITT analysis was similar to that of PP analysis, participants in the yoga group showed greater reduction in the mean change of WC (M = -2.16, SD = 2.25), as compared to those in the control group (M = -0.56, SD = 2.33), p = 0.002, partial η^2 = 0.111, representing a medium effect size.

2. Systolic blood pressure (SBP)

Participants in the yoga group also demonstrated greater decline in SBP (M = -6.10, SD = 9.74) than those in the control group did (M = -0.97, SD = 12.59), p = 0.047, partial η^2 = 0.051, exhibiting a medium effect size. The yoga group demonstrated greater decline in SBP (M = -5.67, SD = 9.52) than the control group did (M = -0.86, SD = 11.82), p = 0.041, partial η^2 = 0.049, exhibiting a medium effect size.

3. Diastolic blood pressure (DBP)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of DBP between the yoga and control groups.

4. Fasting blood glucose (FBG)

Results of both PP and ITT analyses revealed that a significant difference in the mean change of FBG was found. In PP analysis, the yoga group had greater reduction in FBG (M = -0.14, SD = 0.37) than the control group did (M = 0.09, SD = 0.32), p = 0.004, partial η^2 = 0.107, exhibiting a medium effect size.

ITT analysis, the yoga group had greater reduction in FBG (M = -0.13, SD = 0.36) than the control group did (M = 0.08, SD = 0.31), p = 0.003, partial η^2 = 0.098, exhibiting a medium effect size.

5. Triglyceride (TG)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of TG between the two groups.

6. High-density lipoprotein cholesterol (HDL-C)

Results of both PP and ITT analyses indicated that there was no significant difference in the mean change of HDL-C between the yoga and control groups.

7. MetS z score

Results of both PP and ITT analyses revealed that there was a significant difference in the mean change of MetS z score. In PP analysis, A significant difference in the mean change of MetS *z* score was found, with the yoga group declining (M = -0.80, SD = 1.18) greater than the control group (M = -0.13, SD = 1.15), p = 0.013, partial η^2 = 0.079, exhibiting a medium effect size.

Similar results were found in ITT analysis, there was a significant difference in the mean change of MetS *z* score, with the yoga group declining (M = -0.74, SD = 1.19) greater than the control group (M = -0.11, SD = 1.12), p = 0.012, partial η^2 = 0.072, exhibiting a medium effect size.

Table 42

Comparison of Changes of Metabolic Risk Factors among Non-MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 78) and Intention-To-Treat Analysis (N = 86)

	Yoga			Control			ANOVA	
Outcome variables	Pre *M* ± *SD*	Post *M* ± *SD*	Post - Pre *M* ± *SD*	Pre *M* ± *SD*	Post *M* ± *SD*	Post - Pre *M* ± *SD*	*p*	Effect size partial η^2
WC (cm)								
PP	81.29 ± 7.69	78.97 ± 7.29	-2.32 ± 2.25	85.29 ± 9.83	84.66 ± 9.98	-0.63 ± 2.47	.002**	0.116
ITT	81.61 ± 7.53	79.45 ± 7.27	-2.16 ± 2.25	85.71 ± 10.06	85.15 ± 10.21	-0.56 ± 2.33	.002**	0.111
SBP (mmHg)								
PP	123.10 ± 16.21	117.00 ± 14.51	-6.10 ± 9.74	125.42 ± 18.62	124.45 ± 18.18	-0.97 ± 12.59	.047*	0.051
ITT	122.95 ± 16.14	117.28 ± 14.59	-5.67 ± 9.52	124.16 ± 17.94	123.30 ± 17.48	-0.86 ± 11.82	.041*	0.049
DBP (mmHg)								
PP	73.90 ± 11.58	72.30 ± 8.65	-1.60 ± 7.44	76.63 ± 9.88	75.58 ± 10.11	-1.05 ± 7.27	.743	0.001
ITT	74.07 ± 11.41	72.58 ± 8.71	-1.49 ± 7.18	75.72 ± 9.65	74.79 ± 9.78	-0.93 ± 6.83	.713	0.002
FBG (mmol/L)								
PP	5.30 ± 0.98	5.16 ± 0.85	-0.14 ± 0.37	5.18 ± 0.79	5.27 ± 0.82	0.09 ± 0.32	.004**	0.107
ITT	5.31 ± 0.95	5.18 ± 0.84	-0.13 ± 0.36	5.17 ± 0.78	5.25 ± 0.81	0.08 ± 0.31	.003**	0.098
TG (mmol/L)								
PP	1.05 ± 0.48	0.96 ± 0.44	-0.09 ± 0.33	1.07 ± 0.59	1.11 ± 0.56	0.05 ± 0.33	.079	0.040
ITT	1.03 ± 0.47	0.95 ± 0.43	-0.08 ± 0.32	1.05 ± 0.57	1.09 ± 0.54	0.04 ± 0.31	.077	0.037
HDL-C (mmol/L)								
PP	1.75 ± 0.41	1.74 ± 0.42	-0.02 ± 0.19	1.62 ± 0.41	1.68 ± 0.39	0.07 ± 0.21	.062	0.045
ITT	1.73 ± 0.40	1.71 ± 0.41	-0.02 ± 0.18	1.62 ± 0.39	1.68 ± 0.38	0.06 ± 0.20	.066	0.040
MetS z score								
PP	-4.31 ± 3.12	-5.11 ± 2.80	-0.80 ± 1.18	-3.28 ± 2.92	-3.41 ± 2.86	-0.13 ± 1.15	.013*	0.079
ITT	-4.29 ± 3.04	-5.03 ± 2.73	-0.74 ± 1.19	-3.37 ± 2.81	-3.47 ± 2.75	-0.11 ± 1.12	.012*	0.072

Note. PP per-protocol analysis (yoga, n =40; control, n = 38), *ITT* intention-to-treat analysis (yoga, n = 43; control, n = 43)
Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared; *WC* waist circumference; *SBP* systolic blood pressure; *DBP* diastolic blood pressure; *FBG* fasting blood glucose; *TG* triglyceride; *HDL-C* high-density lipoprotein cholesterol; *MetS* Metabolic syndrome
* p <0.05; ** p <0.01

4.5.3.2 Changes of Physical Activity Level and Health-Related Physical Fitness Components

Table 43 presents the comparison of the mean changes of physical activity level and four health-related physical fitness components (body composition, cardiovascular endurance, muscular strength and endurance, flexibility) among participants enrolled in yoga program versus the control group.

Physical activity level (PAL)

Results of both PP and ITT analyses revealed that there was no significant difference in the mean change of physical activity level between the yoga and control groups.

Physical health-related fitness components

1. Body composition

Body weight

Results of both PP and ITT analyses indicated that no significant difference in the mean change of body weight between the two groups was found.

BMI

Results of both PP and ITT analyses indicated that no significant difference in the mean change of BMI between the yoga and control groups was found.

2. Cardiovascular endurance

Resting heart rate (RHR)

Results of both PP and ITT analyses suggested that there was no significant difference in the mean change of RHR between the two groups.

VO_{2max}

Results of both PP and ITT analyses were similar. In PP analysis, the yoga group showed greater increment in VO_{2max} (M = 1.78, SD = 2.79) than the control group did (M = 0.24, SD = 3.06), p = 0.023, partial η^2 = 0.066, representing a medium effect size. In ITT analysis, the yoga group also showed greater increment in VO_{2max} (M = 1.65, SD = 2.73) than the control group did (M = 0.22, SD = 2.87), p = 0.020, partial η^2 = 0.063, representing a medium effect size.

3. Muscular strength and endurance

Curl-up Test

Results of PP and ITT analyses demonstrated that there was no significant difference in the mean change of sit-up test result between the yoga and control groups.

Push-up Test

In PP analysis, the yoga group had greater improvement in the Push-up Test result (M = 4.05, SD = 2.24) than the control group did (M = 0.03, SD = 2.53), p < 0.001, partial η^2 = 0.422, exhibiting a very large effect size. After adjusting for alcohol intake at baseline and mental component score at baseline, result of ANCOVA indicated a significant difference in the mean change of the Push-up Test result between the yoga group and control group was found (p < 0.001), with a very large effect size (partial η^2 = 0.303).

In ITT analysis, the yoga group showed greater improvement when performing Push-up Test (M = 3.77, SD = 2.40) than the control group did (M = 0.02, SD = 2.38), p < 0.001, partial η^2 = 0.386, exhibiting a very large effect size. After adjusting for alcohol intake at baseline and mental component score at baseline, result of

ANCOVA suggested that the yoga intervention exerted a very large effect on Push-up Test result (partial $\eta^2 = 0.265$).

4. Flexibility

Left leg flexibility

In PP analysis, the yoga group exhibited greater mean change of left leg flexibility ($M = 7.14$, $SD = 4.83$) than the control group did ($M = 0.78$, $SD = 3.32$), $p < 0.001$, partial $\eta^2 = 0.375$, representing a very large effect size. After adjusting for alcohol intake at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on left leg flexibility (partial $\eta^2 = 0.335$).

In ITT analysis, the yoga group had greater mean change in left leg flexibility ($M = 6.64$, $SD = 5.00$) than the control group did ($M = 0.69$, $SD = 3.13$), $p < 0.001$, partial $\eta^2 = 0.343$, representing a very large effect size. After adjusting for alcohol intake at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on left leg flexibility (partial $\eta^2 = 0.298$).

Right leg flexibility

In PP analysis, the yoga group experienced a greater improvement in right leg flexibility ($M = 7.01$, $SD = 4.69$) than the control group did ($M = 1.32$, $SD = 4.45$), $p < 0.001$, partial $\eta^2 = 0.284$, representing a very large effect size. In ITT analysis, the yoga group had greater mean change of right leg flexibility ($M = 6.52$, $SD = 4.87$) than the control group did ($M = 1.16$, $SD = 4.20$), $p < 0.001$, partial $\eta^2 = 0.262$, representing a very large effect size. After adjusting for alcohol intake at baseline, result of ANCOVA also indicated that yoga intervention exerted a very large effect on right leg flexibility (partial $\eta^2 = 0.235$).

Table 43

Comparison of Changes of Physical Activity Level and Health-Related Physical Fitness Components among Non-MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 78) and Intention-To-Treat Analysis (N = 86)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	p	Effect size partial η^2	Adjusted p	Effect size partial η^2
PAL (MET-minutes/week)										
PP	1707.73 ± 1353.26	1907.26 ± 1429.56	384.05 ± 1720.05	1552.30 ± 1207.71	1907.26 ± 1429.56	279.82 ± 1378.81	.790	0.001	/	/
ITT	1709.48 ± 1310.37	1953.74 ± 1480.39	348.05 ± 1638.70	1501.75 ± 1151.24	1816.86 ± 1374.81	243.95 ± 1288.39	.765	0.001	/	/
Body weight (kg)										
PP	59.70 ± 8.56	59.04 ± 8.29	-0.66 ± 0.93	64.43 ± 11.10	63.72 ± 10.95	-0.72 ± 1.82	.861	0.000	/	/
ITT	60.19 ± 8.48	59.57 ± 8.27	-0.61 ± 0.91	64.49 ± 11.52	63.86 ± 11.40	-0.63 ± 1.72	.945	0.000	/	/
BMI (kg/m^2) #										
PP	22.46 ± 2.76	22.18 ± 2.68	-0.28 ± 0.42	24.34 ± 4.08	24.09 ± 4.05	-0.24 ± 0.67	.512	0.006	/	/
ITT [a]	22.59 ± 2.71	22.33 ± 2.65	-0.26 ± 0.41	24.29 ± 3.94	24.08 ± 3.91	-0.22 ± 0.63	.456	0.007	.278	0.014
RHR (bpm)										
PP	66.13 ± 8.61	64.18 ± 7.81	-1.95 ± 6.90	67.47 ± 10.22	69.05 ± 11.66	1.58 ± 9.92	.071	0.042	/	/
ITT	66.56 ± 8.68	64.74 ± 8.06	-1.81 ± 6.67	68.00 ± 10.45	69.40 ± 11.66	1.40 ± 9.32	.070	0.039	/	/
VO2max (ml/kg/min)										
PP	30.85 ± 7.49	32.63 ± 7.69	1.78 ± 2.79	28.75 ± 7.42	28.99 ± 7.29	0.24 ± 3.06	.023*	0.066	/	/
ITT	30.92 ± 7.35	32.57 ± 7.54	1.65 ± 2.73	28.42 ± 7.14	28.64 ± 7.04	0.22 ± 2.87	.020*	0.063	/	/
Curl-ups (times)										
PP	21.68 ± 4.98	24.08 ± 2.47	2.40 ± 3.66	19.66 ± 5.22	20.76 ± 5.75	1.11 ± 5.23	.245	0.021	/	/
ITT	21.67 ± 4.84	23.91 ± 2.54	2.23 ± 3.58	19.77 ± 5.11	20.74 ± 5.58	0.98 ± 4.92	.299	0.021	/	/
Push-ups (times)										
PP [b]	6.95 ± 9.33	11.00 ± 10.12	4.05 ± 2.24	3.82 ± 6.06	3.84 ± 5.81	0.03 ± 2.53	.000***	0.422	.000***	0.303
ITT [b]	6.93 ± 9.08	10.70 ± 9.89	3.77 ± 2.40	3.49 ± 5.79	3.51 ± 5.55	0.02 ± 2.38	.000***	0.386	.000***	0.265
Flexibility										
Left leg (cm)										
PP [c]	47.11 ± 10.78	54.25 ± 9.54	7.14 ± 4.83	50.33 ± 14.08	51.11 ± 13.67	0.78 ± 3.32	.000***	0.375	.000***	0.335
ITT [c]	47.40 ± 10.55	54.03 ± 9.34	6.64 ± 5.00	51.02 ± 13.77	51.71 ± 13.37	0.69 ± 3.13	.000***	0.343	.000***	0.298
Right leg (cm)										
PP	47.43 ± 10.90	54.44 ± 9.63	7.01 ± 4.69	50.74 ± 14.37	52.05 ± 14.10	1.32 ± 4.45	.000***	0.284	/	/
ITT [c]	47.66 ± 10.59	54.19 ± 9.38	6.52 ± 4.87	51.36 ± 13.98	52.52 ± 13.68	1.16 ± 4.20	.000***	0.262	.000***	0.235

Note. PP per-protocol analysis (yoga, n = 40; control, n = 38), *ITT* intention-to-treat analysis (yoga, n = 43; control, n = 43)

Log 10 reverse-transformation was applied due to reduce the skewness of negatively skewed outcome variable.

a Adjusted for mental component score at baseline.

b Adjusted for alcohol intake at baseline and mental component score at baseline.

c Adjusted for alcohol intake at baseline.

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared; *PAL* physical activity level; *RHR* resting heart rate; *BMI body mass index*

*p <0.05, ***p < 0.001

4.5.3.3 Change of Cortisol Level

Table 44 shows the comparison of the mean change of cortisol level between participants enrolled in yoga program and the control group. Results of ANOVA (unadjusted comparison) of PP and ITT analyses revealed that there was a significant difference in cortisol level between the yoga and control groups. In PP analysis, the yoga group demonstrated a greater decline in cortisol level (M = -1.10, SD = 2.99) than the control group (M = 0.62, SD = 2.46), p = 0.007, partial η^2 = 0.091, representing a medium effect size. Similar finding was observed in ITT analysis, the yoga group experienced greater decline in the mean change of cortisol level (M = -1.02, SD = 2.90) than the control group did (M = 0.55, SD = 2.32), p = 0.007, partial η^2 = 0.084, representing a medium effect size. However, after adjusting for covariates, results of both PP and ITT analyses suggested that there was no significant difference in the mean change of cortisol level between the yoga and control groups (p < 0.05).

Table 44

Comparison of Change of Cortisol Level between the Yoga Group and the Control Group in Per-Protocol Analysis (N = 78) and Intention-To-Treat Analysis (N = 86)

Outcome variables	Yoga group (n = 40) $M \pm SD$	Control group (n = 38) $M \pm SD$	ANOVA p	ANOVA Effect size partial η^2	ANCOVA Adjusted p	ANCOVA Effect size partial η^2
PP [a]						
BCort	1.35 ± 3.21	-1.03 ± 1.18				
PCort	0.25 ± 1.47	-0.42 ± 2.02				
MDCort	-1.10 ± 2.99	0.62 ± 2.46	.007**	0.091	.241	0.019
	Yoga group (n = 43) $M \pm SD$	Control group (n = 43) $M \pm SD$	ANOVA p	ANOVA Effect size partial η^2	ANCOVA Adjusted p	ANCOVA Effect size partial η^2
ITT [b]						
BCort	1.07 ± 4.16	-0.89 ± 1.87				
PCort	0.75 ± 3.35	-0.50 ± 2.03				
MDCort	-0.32 ± 3.08	0.39 ± 2.95	.007**	0.084	.243	0.017

a Adjusted for alcohol intake at baseline, waist circumference at baseline, body weight at baseline, and BMI at baseline
b Adjusted for alcohol intake at baseline, waist circumference at baseline, and BMI at baseline
PP per-protocol analysis; *ITT* intention-to-treat analysis; *BCort* change of cortisol level at baseline; *PCort* change of cortisol level at post-intervention; *MDCort* the difference between BCort and PCort; η^2 eta-squared
** p < 0.01

4.5.3.4 Changes of Psychological Variables

Table 45 shows the comparison of the mean changes of five psychological variables (self-esteem, perceived stress, state anxiety, trait anxiety, and depression) between participants enrolled in yoga program versus the control group. Results of both PP and ITT analyses indicated that there were no significant differences in the mean changes of self-esteem, state anxiety, trait anxiety, and depression scores between the yoga and control groups.

Results of ANOVA (unadjusted comparison) of PP and ITT analyses revealed that there was no significant difference in the mean change of perceived stress score between the yoga group and the control group ($p > 0.05$). Since mental component score at baseline was identified as a covariate in ITT analysis, greater adjusted comparison was conducted. Both yoga and control groups demonstrated decline in perceived stress score after 12-week yoga intervention period. However, the control group has greater reduction in the perceived stress score (M = -1.28, SD = 3.78) much greater than the yoga group (M = -0.23, SD = 2.45), p = 0.049, partial η^2 = 0.046, also exhibiting a small effect size.

Table 45

Comparison of Changes of Psychological Variables among Non-MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 78) and Intention-To-Treat Analysis (N = 86)

	Yoga			Control			ANOVA		ANCOVA	
	Pre	Post	Post - Pre	Pre	Post	Post - Pre		Effect size	Adjusted	Effect size
Outcome variables	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$	p	partial η^2	p	partial η^2
Self-esteem (RSE)										
PP [a]	22.18 ± 3.71	22.95 ± 3.49	0.78 ± 2.20	20.92 ± 4.31	21.45 ± 3.72	0.53 ± 2.69	.655	0.003	.847	0.000
ITT [a]	22.19 ± 3.58	22.91 ± 3.38	0.72 ± 2.13	20.91 ± 4.10	21.37 ± 3.57	0.47 ± 2.53	.613	0.003	.842	0.000
Perceived stress (PPS)										
PP	15.68 ± 3.53	15.43 ± 3.30	-0.25 ± 2.54	16.13 ± 4.56	14.68 ± 4.47	-1.45 ± 4.00	.117	0.032	/	/
ITT [b]	15.60 ± 3.45	15.37 ± 3.24	-0.23 ± 2.45	16.37 ± 4.39	15.09 ± 4.40	-1.28 ± 3.78	.131	0.027	.049*	0.046
Anxiety (STAI)										
State anxiety (SA)										
PP	30.80 ± 7.35	28.53 ± 6.98	-2.28 ± 7.18	31.21 ± 8.13	30.92 ± 8.71	-0.29 ± 5.20	.168	0.025	/	/
ITT	30.44 ± 7.25	28.33 ± 6.83	-2.12 ± 6.94	31.26 ± 8.14	31.00 ± 8.66	-0.26 ± 4.88	.154	0.024	/	/
Trait anxiety (TA)										
PP	35.03 ± 6.90	33.80 ± 6.30	-1.23 ± 4.55	35.21 ± 7.61	34.45 ± 8.34	-0.76 ± 4.78	.664	0.003	/	/
ITT	35.02 ± 6.91	33.88 ± 6.83	-1.14 ± 4.40	35.19 ± 7.40	34.51 ± 8.06	-0.67 ± 4.50	.629	0.003	/	/
Depression (CES-D)										
PP	12.51 ± 6.99	8.70 ± 4.89	-2.65 ± 4.86	10.58 ± 7.24	9.50 ± 6.12	-1.08 ± 4.89	.159	0.026	/	/
ITT [b]	11.49 ± 4.89	9.02 ± 4.89	-2.47 ± 4.73	10.91 ± 7.04	9.95 ± 6.10	-0.95 ± 4.60	.137	0.026	.300	0.013

Note. PP per-protocol analysis (yoga, n = 40; control, n = 38), *ITT* intention-to-treat analysis (yoga, n = 43; control, n = 43)

a Adjusted for alcohol intake at baseline.

b Adjusted for mental component score at baseline.

Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared

* $p < 0.05$

4.5.3.5 Changes of HRQoL Domain and Summary Scores

Table 46 shows the comparison of the mean changes of eight HRQoL domain scores and two summary scores between the yoga group and the control group.

Physical health-related quality of life domain and summary scores

Physical functioning (PF)

Results of PP and ITT analyses revealed that there was no significant difference in the mean change of PF domain score between the yoga and control groups.

Role physical (RP)

Results of PP and ITT analyses revealed that no significant difference in the mean change of RP domain score between the two groups was found.

Bodily pain (BP)

Findings of PP analysis indicated that there was a marginally non-significant difference in the mean change of BP domain score, with the yoga group (M = 7.00, SD = 17.66) achieving more improvement than the control group (M = -2.92, SD = 26.22), p = 0.052, partial η^2 = 0.049, exhibiting a small effect size. Findings of ITT analysis also revealed that the yoga group had significantly more improvement in BP domain score (M = 7.00, SD = 17.66) than the control group did (M = -2.60, SD = 24.63), p = 0.049, partial η^2 = 0.045, exhibiting a small effect size.

General health perceptions (GH)

Results of PP and ITT analyses indicated that no significant difference in the mean change of GH domain score between the two groups was observed.

Physical component score (PCS)

In PP analysis, there was a greater increment in the mean change of PCS in the yoga group (*M* = 11.25, *SD* = 44.03), as compared to the control group (*M* = -13.74, *SD* = 44.55), *p* = 0.015, partial η^2 = 0.075, exhibiting a medium effect size. Result of ITT analysis also suggested the yoga group experienced greater improvement in PCS (*M* = 6.30, *SD* = 46.40) than the control group did (*M* = -12.30, *SD* = 41.47), *p* = 0.006, partial η^2 = 0.068, exhibiting a medium effect size. After adjusting for role emotional domain score at baseline, results of both PP and ITT analyses revealed that the yoga intervention exerted a small effect on the mean change of PCS ($p > 0.05$, partial η^2 <0.06).

Mental health-related quality of life domain and summary scores

Vitality (VT)

Results of PP and ITT analyses indicated that there was no significant difference in the mean change of VT score between the yoga and control groups.

Social functioning (SF)

In PP analysis, the yoga group had significantly greater improvement in the SF domain score (*M* = 3.13, *SD* = 15.44) than the control group did (*M* = -5.26, *SD* = 18.52), *p* = 0.033, partial η^2 = 0.059, exhibiting a small-to-medium effect size. In ITT analysis, the yoga group demonstrated greater improvement in SF domain score (*M* = 2.91, *SD* = 14.90) than the control group did (*M* = -4.65, *SD* = 17.47), *p* = 0.034, partial η^2 = 0.053, exhibiting a small effect size. However, after adjusting for mental component score at baseline, result of ANCOVA revealed that there was no significant difference in the mean change of SF domain score between the yoga and control groups ($p > 0.05$).

Role emotional (RE)

Results of PP and ITT analyses revealed that no significant difference in the mean change of RE domain score between the two groups was observed.

General mental health (MH)

Results of ANOVA of both PP and ITT analyses revealed that there was no significant difference in the mean change of MH domain score between the two groups.

Mental component score (MCS)

Results of ANOVA of both PP and ITT analyses indicated that the yoga group experienced a significantly greater increment in MCS than the control group did ($p < 0.01$), exhibiting a small effect size (partial $\eta^2 < 0.06$). However, after adjusting for covariates, results of both PP and ITT analyses suggested that there was no significant difference in the mean change of MCS between the yoga and control groups ($p > 0.05$).

Table 46

Comparison of Changes of HRQoL Domain and Summary Scores among Non-MetS Participants in the Yoga Group versus the Control Group in Per-Protocol Analysis (N = 78) and Intention-To-Treat Analysis (N = 86)

	Yoga			Control			ANOVA		ANCOVA	
Outcome variables	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	Pre $M \pm SD$	Post $M \pm SD$	Post - Pre $M \pm SD$	p	Effect size partial η^2	Adjusted p	Effect size partial η^2
Physical functioning (PF) #										
PP [a]	89.00 ± 9.95	91.88 ± 9.04	2.88 ± 8.16	85.79 ± 13.93	86.32 ± 10.89	0.53 ± 13.40	.122	0.031	.243	0.018
ITT	89.53 ± 9.81	92.21 ± 8.82	2.67 ± 7.89	86.51 ± 13.56	86.98 ± 10.81	0.47 ± 12.57	.121	0.028	.340	0.011
Role physical (RP)										
PP	81.88 ± 27.73	82.50 ± 27.27	0.63 ± 31.26	86.18 ± 25.13	78.29 ± 34.96	-7.89 ± 29.12	.217	0.020	/	/
ITT	81.98 ± 26.91	82.56 ± 26.47	0.58 ± 30.12	87.21 ± 24.01	80.23 ± 33.43	-6.98 ± 27.45	.227	0.017	/	/
Bodily pain (BP)										
PP	67.08 ± 17.16	74.08 ± 16.48	7.00 ± 17.66	67.76 ± 22.77	64.82 ± 20.36	-2.92 ± 26.22	.052	0.049	/	/
ITT	66.49 ± 16.92	73.00 ± 16.62	6.51 ± 17.11	68.51 ± 23.15	65.91 ± 20.20	-2.60 ± 24.63	.049*	0.045	/	/
General health perceptions (GH)										
PP	63.50 ± 11.61	64.25 ± 11.35	0.75 ± 9.58	62.89 ± 13.18	59.47 ± 11.08	-3.42 ± 10.27	.067	0.043	/	/
ITT	63.26 ± 11.28	63.95 ± 11.05	0.70 ± 9.23	62.67 ± 12.97	59.65 ± 11.09	-3.02 ± 9.71	.072	0.038	/	/
Physical component score (PCS)										
PP [a]	301.45 ± 48.78	312.70 ± 47.54	11.25 ± 44.03	302.63 ± 55.41	288.89 ± 55.39	-13.74 ± 44.55	.015*	0.075	.044*	0.053
ITT [a]	301.26 ± 47.36	311.72 ± 46.31	10.47 ± 42.53	304.91 ± 53.38	292.77 ± 54.07	-12.14 ± 42.05	.015*	0.068	.048*	0.046
Vitality (VT)										
PP [a]	67.88 ± 14.89	71.25 ± 13.00	3.38 ± 16.03	66.05 ± 18.82	68.16 ± 14.68	2.11 ± 13.69	.708	0.002	.865	0.000
ITT [c]	67.91 ± 15.32	71.05 ± 13.65	3.14 ± 15.47	66.05 ± 18.05	67.91 ± 14.28	1.86 ± 12.86	.678	0.002	.794	0.001
Social functioning (SF)										
PP	87.50 ± 13.87	90.63 ± 13.50	3.13 ± 15.44	91.45 ± 14.27	86.18 ± 18.56	-5.26 ± 18.52	.033*	0.059	/	/
ITT [d]	86.34 ± 14.64	89.24 ± 14.58	2.91 ± 14.90	91.28 ± 14.31	86.63 ± 18.17	-4.65 ± 17.47	.034*	0.053	.072	0.038
Role emotional (RE)										
PP [a]	75.83 ± 32.01	85.00 ± 28.19	9.17 ± 35.40	90.35 ± 26.74	85.96 ± 30.64	-4.39 ± 32.11	.081	0.040	.543	0.005
ITT [c]	75.19 ± 33.41	83.72 ± 30.32	8.53 ± 34.19	90.69 ± 25.54	86.82 ± 29.22	-3.88 ± 30.18	.078	0.036	.688	0.002
General mental health (MH)										
PP [a]	76.70 ± 10.83	79.70 ± 10.71	3.00 ± 12.71	78.42 ± 14.98	78.63 ± 11.09	0.21 ± 12.09	.324	0.013	.610	0.003
ITT [c]	75.81 ± 10.94	69.40 ± 8.59	-6.42 ± 11.52	77.77 ± 15.00	77.95 ± 11.66	0.19 ± 11.35	.310	0.012	.350	0.011
Mental component score (MCS)										
PP [a]	307.91 ± 56.69	326.58 ± 49.98	18.67 ± 62.03	326.27 ± 60.72	318.94 ± 60.95	-7.33 ± 49.82	.045*	0.052	.270	0.016
ITT [c]	305.25 ± 59.69	313.41 ± 52.39	8.16 ± 58.07	319.31 ± 58.68	319.31 ± 58.68	-6.48 ± 46.82	.043*	0.048	.206	0.019

Note. PP per-protocol analysis (yoga, n = 40; control, n = 38), *ITT* intention-to-treat analysis (yoga, n = 44; control, n = 43)
Square root transformation was adopted to reduce the skewness of positive-skewed outcome variable.
a Adjusted for role emotional domain score at baseline.
b Adjusted for medication on blood pressure, role emotional domain score at baseline and mental component score at baseline.
c Adjusted for role emotional domain score at baseline and mental component score at baseline.
d Adjusted for mental component score at baseline.
Pre baseline; *Post* post-intervention; *Post-Pre* change from baseline to post-intervention; η^2 eta-squared
* $p < 0.05$

4.6 Summary

This chapter presents the results of Study One concerning the physiological and psychological effects of a 12-week Hatha yoga intervention. There were 173 participants in this study, of which 87 formed the yoga (intervention) group and 86 formed the control group. Participants of the yoga group and the control group were homogeneous in term of most demographic, physiological and psychological characteristics at baseline. The relationships of heterogeneous characteristics and all outcome variables were examined by correlation analysis. Those heterogeneous characteristics that were significantly correlated with particular outcome variables were considered as the covariates of the particular outcome variables and were controlled in the analysis. The primary analysis compared the changes of the outcome variables from baseline to post-intervention between the yoga and control groups of the whole study sample. The two subgroup analyses were focus on samples with and without metabolic syndrome, respectively. Both per-protocol and intention-to-treat analyses were performed. Table 47 presents the summary of the effect sizes of outcome variables in all the analyses.

Findings of the primary analysis revealed that the yoga intervention program was found to produce beneficial effects on waist circumference, fasting blood glucose, triglyceride and metabolic syndrome z score with effect sizes ranging from small to large. Participants in the yoga group also demonstrated improvement in all four health-related physical fitness components after yoga intervention program. The yoga program was found to produce a small effect on body composition, a small-to-medium effect on cardiovascular endurance, a medium-to-large effect on muscular strength and endurance, and a very large effect on flexibility of both legs. For HRQoL domains, the yoga program has a small enhancing effect on general health perceptions domain and a small-to-medium effect on social functioning domain. However, findings did not indicate any significant effects of the yoga program on physical activity level, cortisol level, and all psychological variables.

Results of subgroup analysis with metabolic syndrome sample indicated that the yoga program exhibited a large beneficial effect on waist circumference and medium beneficial effect on MetS z score among the metabolic risk factors. The program also demonstrated medium-to-large improving effects on all health related physical fitness components. Furthermore, the yoga program demonstrated a medium positive effect on social functioning domain of HRQoL. Similar to the results of the primary analysis, these findings did not indicate any significant effects of the yoga program on physical activity level, cortisol level, and all psychological variables.

Findings of the subgroup analysis with non-metabolic syndrome sample suggested that the yoga program demonstrated improving effects on various metabolic risk factors, with a small beneficial effect on systolic blood pressure and medium effects on waist circumference, triglyceride, and MetS z score. The results also suggested that the yoga program had large enhancing effects on muscular strength and endurance, and flexibility of both legs. Moreover, the program exhibited small positive effects on bodily pain domain, physical component score, and social functioning domain (only in per-protocol analysis) among HRQoL domains. Although both yoga and control groups experienced reduction of perceived stress scale (PSS) score, the control group demonstrated further reduction than the yoga group. Findings of the subgroup analysis with non-MetS sample did not indicate any significant effects of the yoga program on physical activity level and cortisol level.

Results of the two subgroup analyses suggested that differences may exist in the magnitude of the effect of Hatha yoga program on MetS and non-MetS samples.

MetS yoga participants experienced more improvement in term of the number of outcome variables than non-MetS yoga participants. Moreover, MetS yoga participants experienced stronger beneficial effects than non-MetS yoga participants when the same outcome variables were compared.

Table 47
Summary of the Effect Sizes of Outcome Variables in Study One

	Effect sizes of outcome variables [a]					
	Primary [b]		MetS [c]		Non-MetS [d]	
Outcome variables	PP	ITT	PP	ITT	PP	ITT
Metabolic risk factors						
Waist circumference	+++	+++	+++	+++	++	++
Systolic blood pressure					+	+
Diastolic blood pressure						
Fasting blood glucose	++	++			++	++
Triglyceride	+	+				
HDL-C						
MetS z score	++	++	++	++	++	++
Physical activity level						
Health-related physical fitness components						
Body composition						
Body weight			++	++		
Body mass index	+	+	++	++		
Cardiovascular endurance						
Resting heart rate	+	+	++	++		
VO_{2max}	++	++	+++	++	++	++
Muscular strength and endurance						
Curl-ups	++	+	++	++		
Push-ups	+++	+++	+++	+++	+++	+++
Flexibility						
Left leg	+++	+++	+++	+++	+++	+++
Right leg	+++	+++	+++	+++	+++	+++
Cortisol level						
Psychological variables						
Self-esteem						
Perceived stress						+
State anxiety						
Trait anxiety						
Depression						
HRQoL						
Physical functioning						
Role physical						
Bodily pain					+	+
General health perception	+	+				
Physical component score					+	+
Vitality						
Social functioning	++	+	++	++	+	
Role emotional						
General Mental health						
Mental component score						

a + small effect size; ++ medium effect size; +++ large effect size
b Primary analysis
c Subgroup analysis of metabolic syndrome sample
d Subgroup analysis of non-metabolic syndrome sample
PP per-protocol analysis; *ITT* intention-to-treat analysis; *HDL-C* high-density lipoprotein cholesterol; *MetS* metabolic syndrome

CHAPTER 5 DISCUSSION OF STUDY ONE

The discussion chapter consists of seven sections. The first section discusses the problem encountered during participants' recruitment and the baseline characteristics of participants, with especially emphasis on the heterogeneous characteristics between the yoga and control groups. The second section discusses on the effects of the Hatha yoga program on physical and mental health. The third section discusses the strengths of this study, particularly the issues of preventing attrition and non-adherence when conducting a Hatha yoga program in the community. The fourth section focuses on the limitations of Study One. The implications of the findings of this study and the recommendations for further research are presented in fifth and sixth sections, respectively. The last section is a summary of the discussion of this study.

5.1 Study One Participants' Recruitment and Characteristics

5.1.1 Study One Participants' Recruitment

Quota sampling was employed in recruiting Study One participants and gender was considered as the quota control of the present study (see Section 3.3.1). The researcher has attempted to recruit the participants from the local community through different mass media communications (as described in Section 3.3.4). The responses from the public were noteworthy for further research. Gender of participants was the most frequently inquired issue during recruitment. Even though the study clearly stated that the study recruited both male and female participants, female inquirers concerned if the yoga classes were single-gender classes or mixed-gender classes, and some even showed their strong preferences in attending single-gender classes. Some male inquirers were concerned if the study would recruit male participants because they thought yoga was a feminine activity. The researcher asserted to the inquirers that the study offered both kinds of classes and assigned participants based on their personal preferences. There were over seven hundred women and about one hundred men submitting enrollment forms for the study, demonstrating an obvious gender difference in the interest in yoga practice. The researcher attempted to recruit as many male participants as possible in the study, so the sample would not be too female-dominated. However, about one-third of the male applicants were not recruited due to either not meeting the inclusion criteria or subsequently decline participation. As a result, the numbers of male and female participants were disproportionate, with over 60% participants being female. Disproportionate sample distributions were also commonly found in other yoga studies, with significantly more female participants than male participants (Chen et al., 2008; Chen, Tseng, Ting, & Huang, 2007; Cowen & Adams, 2005; John et al., 2007; Oken et al., 2006; Sherman et al., 2005; Smith et al., 2006). Future research may explore the gender differences in perception of yoga practice and the effects of yoga on different outcome measures.

The age limit of the participants was another frequently inquired issue. Indeed all the information about the study available to the public has stated clearly that the study targeted to recruit the individuals aged 18 or above. The researcher reasserted to those inquirers that the study were recruiting individuals who were aged 18 or above to participate in the study. Some of inquirers concerned if yoga was too physically challenging for those sedentary and older adults. The researcher explained to the inquirers that the yoga intervention was designed for beginners and sedentary individuals, and suitable for all ages. Over 800 individuals have submitted enrolment forms for joining the study, most of them were from the age group of 45-55 years old, and followed by 56-64 years old. The enquiries and concerns from the public, together with the age distribution of the applicants, provided further information of the way that the public perceived yoga in Hong Kong. Middle aged individuals were more likely to be interested in yoga or health promotion activities as they might realize their age-related physiological changes due to ageing. To our knowledge, there were only a few yoga intervention studies launching in Hong Kong at the time of the recruitment. Without previous local experience, the researcher could not anticipate the responses of the recruitment of different age groups. The recruitment experience of the study might set an example to future studies conducted in Hong Kong. Further explorations about the perceptions of yoga will be discussed in later chapters.

5.1.2 Study One Participants' Characteristics

The previous chapter has compared various baseline characteristics between the yoga group and the control group (see Section 4.2.2). Results demonstrated that the yoga and control groups shared a lot of similar baseline characteristics. Both findings of ITT and PP analyses indicated significant differences in BMI and role emotional domain scores between the two groups. PP analyses further suggested the significant difference in DBP was also found between the groups. According to the WHO Asian standard for assessing obesity in adult populations (James, Chunming, & Inoue, 2002), BMI of the yoga group and the control group were classified as "overweight" and "obese", respectively. High prevalence of obesity was also found in latest local survey. The Behavioural Risk Factor Survey April 2012 (CHP, 2013a) revealed that 36.6% of the Hong Kong population aged 18-64 were classified as overweight or obese (BMI ≥ 23.0), including 18.8% as obese. People aged 45-54 had the highest rate (51.1%) of overweight or obesity.

Findings of PP analysis indicated that the yoga group had significantly lower DBP than the control group. The two groups were considered to have prehypertension when SBP was also taken into account. During the data collection stage, the researcher realized that some participants who had prehypertension and hypertension were not taking medication to control blood pressure. They did not check their blood pressure regularly and find any symptoms, thus they were not aware of their hypertension. The above findings echoed with a recent local survey, indicating that about one in three adults in Hong Kong has hypertension and among half of them did not know about it (CHP, 2013b).

To our knowledge, local population based norms of all instruments, except SF-36, used in the study were absent. With respect to the eight domain scores of SF-36, the current figures were not perfectly in agreement with local figures (Lam et al., 1999) Discrepancies were noted in bodily pain and role emotional domains. The bodily pain domain score of the Hong Kong general adult population was 83.98 (Lam et al., 1999), whereas the bodily pain domain score of the yoga group and the control group ranged from 65.97 to 67.67 (see Tables 10 and 13, Chapter 4). With respect to the role emotional domain score, the yoga group (PP analysis: 76.37; ITT analysis: 74.71) had significantly lower score than that of the control group (PP analysis: 87.11; ITT analysis: 87.60). But the score of the yoga group was close to that the Hong Kong general adult population (71.67) as reported by Lam et al. (1999). Many factors might attribute the above discrepancies; one possible contributing factor was the difference in composition of the samples in the current study and the local survey.

The present study consisted of over 80% of participants aged 45 or above, whereas the local survey was composed of over 60% of participants aged 18-44.

All instruments measuring the psychological characteristics of this study, except CES-D, did not have "cut-off" scores (see section 3.3.5.5). Respondents who got CES-D scores of 16 or more were considered as having clinically significant level of psychologically distress (Radloff, 1977). In both ITT and PP analyses, the yoga group experienced higher depression level than the control group, but this difference was not statistically significant. Study One participants experienced certain extent of depression but the level was not clinically significant (CES-D score < 16).

5.2 Effects of the Hatha Yoga Program on Health

Study One adopted per-protocol (PP) analysis and intention-to-treat (ITT) analysis to determine the intervention's potential effects between the compliant cohort and the potential biases arising from attrition, respectively. Further discussion of the above analyses is presented in subsection 5.2.1. The findings in response to the six null hypotheses of Study One (described in Section 1.4) are presented in Chapter 4, and are discussed in the following two subsections: 5.2.2 Effects of Hatha Yoga Program on Physical Health, and 5.2.3 Effects of Hatha Yoga Program on Mental Health. The study's findings and previous evidence will be compared in each subsection.

5.2.1 Per-Protocol Analysis and Intention-To-Treat Analysis

The results from the ITT analysis were comparable to those of the PP analysis. This might imply that the attrition of Study One might not adversely influence the outcomes and thus suggesting the distribution between groups was equitable. Since the results from both ITT and PP analyses were similar, we will not discuss the results of ITT and PP analyses separately in the following subsections unless otherwise specified.

5.2.2 Effects of the Hatha Yoga Program on Physical Health

5.2.2.1 Effects of the Hatha Yoga Program on Metabolic Risk Factors

> ***Null Hypothesis 1***
> There are no significant differences in the changes of metabolic risk factors (i.e. waist circumference, blood pressure, fasting blood glucose, triglyceride, high density lipoprotein cholesterol, and MetS z score) between the yoga group and the control group.

Study One determined the effects of the 12-week Hatha yoga program on various aspects of physical and mental health of Hong Kong Chinese adults with and without MetS and non-MetS. Findings of Study One showed that the Hatha yoga program has produced beneficial effects on most metabolic risk factors.

The yoga participants significantly reduced their waist circumferences as compared to the control participants. MetS yoga participants experienced stronger beneficial effect than the non-MetS participants. The findings of waist circumference were collaborated with the findings of body weight and BMI (which will be discussed in further detail in Section 5.2.2.2). MetS yoga participants showed significantly further reduction in both body weight and BMI than MetS control participants, while there were no significant differences between non-MetS yoga participants and non-MetS control participants. The Hatha yoga program exerted a medium-to-large effect on waist circumference. The yoga participants experienced further reduction in waist circumference as compared to the control participants. Decreased waist circumference may have probably been due to weight loss and training of abdominal muscles through executing yoga poses. Previous studies examining the effect of yoga intervention on waist circumference yielded mixed results. Telles et al. (2010)

recruited 47 Indians (aged 17-68 years), who had BMI < 30 kg/m^2, to participate in an intensive 6-day residential yoga program. Participants of Telles et al.'s study had significant reduction in waist circumference after the program ($p < 0.01$). Hegde et al. (2011) conducted a three-month yoga intervention involving 123 DM 2 patients. No significant difference in waist circumference between the yoga group and standard care control group ($p = 0.903$). Seventy-five older women with restless legs syndrome were randomly assigned to receive either an eight-week yoga ($n = 38$) or educational film ($n = 37$) programs (Innes & Selfe, 2012). There was no significant difference in waist circumference between the two groups. Littman et al. (2012) recruited 63 breast cancer survivors with BMI ≥ 24 kg/m^2 and randomly assigned to either a six-month yoga intervention ($n = 32$) or waitlist control group ($n = 31$). Waist circumference decreased 3.1cm (95% CI, -5.7 and -0.4) more among women in the yoga intervention compared with the control group. Despite of mixed results in earlier studies, Study One with stringent study design and larger sample size ($N = 173$) may provide stronger evidence of yoga use in reducing waist circumference, preventing and managing central obesity.

A small favourable effect of the Hatha yoga program on systolic blood pressure (SBP) was only found in non-MetS subgroup. No significant difference in the effect of the program on blood pressure between the yoga and control groups was found in both total cohort and MetS subgroup. Accumulating evidence has suggested the favourable effect of yoga intervention on blood pressures of healthy individuals (Chen et al., 2008; Cowen & Adams, 2005; Harinath et al., 2004) and individuals with different ailments (Cade et al., 2010; Innes & Selfe, 2012; Lee et al., 2012; Pal et al., 2011; Sivasankaran et al., 2006; Yang et al., 2011). Harinath et al. (2004) suggested significant reduction in systolic, diastolic, and mean arterial pressure indicates a trend of gradual shift of autonomic equilibrium toward relative parasympathodominance because of reduction of sympathetic activity. Our study did not duplicate the significant changes of blood pressure observed in those earlier studies. The non-significant finding of the change of cortisol level of Study One (presented in Section 5.2.2.4) may have implied that the Hatha yoga program failed to reduce the activation and reactivity of the SNS and the HPA axis. Thus, this could be a possible reason for no significant difference of the change of blood pressure between the yoga and control groups.

The Hatha yoga program exerted medium enhancing effects on fasting blood glucose. A significant reduction in fasting blood glucose (FBG) was found in the total cohort and non-MetS subgroup. Consistent with our findings, Lee et al. (2012) recruited 16 healthy obese postmenopausal Korean women to participate in a 16-week yoga intervention and a significant decline in FBG ($p < 0.05$) was observed. Hegde et al. (2011) showed a three-month yoga intervention significantly decreased FBG in DM 2 patients ($p < 0.001$). A RCT consisted of 77 DM 2 patients in the Hatha yoga exercise group that were matched with similar number DM 2 patients in the exercise and control groups. After 6-month yoga intervention, the concentration of FBG in the Hatha yoga group declined by 29.48% ($p < 0.0001$). The results of this study and other previous studies indicated that fasting blood glucose was reduced after yoga intervention, and suggested that the reduced fasting blood glucose may in turn help reduce the severity of hyperglycemia.

A small beneficial effect of the Hatha yoga program on triglyceride was found in the total cohort, but was not found in the two subgroups. No significant difference in the effect of the program on the change of HDL-C between the yoga and control groups was found in the total cohort and the two subgroups. The observed changes in TG and HDL-C of our study were not well coincided with those found in previous studies (Bijlani et al., 2005; Gorden et al., 2008; Lee et al., 2012; Madanmohan et al., 2012; Manchanda et al., 2000; Pal et al., 2011). The findings of these previous studies suggested yoga interventions improved participants' TC, TG, LDL-C, and HDL-C. There may have many possible factors contributing to the discrepancies between the findings of Study one and these previous studies. We found that the interventions of those previous studies were more intensive than our Hatha yoga program in term of the duration of intervention, the duration of each yoga session, and the frequency of yoga session. These previous studies had either longer duration of intervention, longer yoga session, and more yoga session per week. The potential dose-response association between the yoga intervention and the changes of TC, TG, LDL-C, and HDL-C may exist and warrant future research.

MetS yoga participants and non-MetS yoga participants experienced beneficial effects of the Hatha yoga program on the above discussed metabolic risk factors differently in term of the magnitudes of the effects. Despite of this difference, the Hatha yoga program exerted a moderate beneficial effect on MetS z score to both MetS and non-MetS yoga participants. The Hatha yoga program may, therefore, be helpful in reducing metabolic risk. The intensity of Hatha yoga meets the recommended intensity of physical activity for improving and maintaining health and cardiovascular fitness remains speculative (Hagins et al., 2007). Conversely, Johnson et al. (2007) suggested that lower-intensity exercise may be more effective in improving MetS. Thus, Hatha yoga may be a better option for individuals who are unfit, sedentary, or both, to lower their MetS risk and for those who have established MetS to improve their conditions in a safe and gentle way.

5.2.2.2 Effects of the Hatha Yoga Program of Physical Activity Level

Null Hypothesis 2
There is no significant difference in the change of physical activity level between the yoga group and the control group.

There was no significant difference in the change of physical activity level (PAL) between the yoga group and the control group. Both groups demonstrated similar increment in PAL after the 12-week Hatha yoga program. The lack of significant difference in the change of PAL between the two groups is surprising as there were significant improvements in most of the health related physical fitness component outcome measures after the yoga intervention. It is believed that the improvement may be due to an increase of PAL. The yoga group participants were requested to provide weekly self-practice log, and the participants were found to practice for on average 165 minutes per week (about 23 minutes/day). But most participants reported that they practiced yoga poses separately during self-practice as they found it difficult to practice yoga poses in sequence without the yoga teacher's guidance. They found their self-practice was less physically challenging than the yoga sessions of the present yoga intervention. The PAL of self-practice might not be well captured, as IPAQ was not able to estimate the PAL of any activity with low intensity, duration shorter than 10 minutes, or both. Thus, the PAL of self-practice might be underestimated by IPAQ.

5.2.2.3 Effects of the Hatha Yoga Program on Health-Related Physical Fitness

Null Hypothesis 3
There is no significant difference in the change of health-related physical fitness (i.e. body composition, cardiovascular endurance, muscular strength and endurance, and flexibility) between the yoga group and the control group.

Study One revealed that the 12-week Hatha yoga program might significantly improve participants' health-related physical fitness. Findings of both the primary analysis and the MetS subgroup analysis indicated that significant differences in the changes of all four health-related physical fitness components (i.e. body composition, cardiovascular endurance, muscular strength and endurance, and flexibility) between the yoga group and the control group were found. Similar findings were also found in non-MetS subgroup analysis, but there was no significant difference in body composition between the yoga and control groups. The study advanced the knowledge of the effect of the Hatha yoga program on health-related physical fitness to the existing findings and further provided with the quantified information of the strength of the effect (i.e. effect size) of the Hatha yoga intervention on each health-related physical fitness component.

Body composition

Findings of MetS subgroup analysis revealed that the Hatha yoga program produced a moderate effect on body weight reduction and resulted in a moderate reduction in BMI for the participants. Though the yoga program only produced a marginally significant effect on body weight reduction in the total cohort, a small reduction effect on BMI was found in the yoga group of the total cohort. Recent studies that determined body composition by calculating BMI yield similar results. Forty-seven Indians (aged 17-68 years) with BMI more than 30 kg/m^2 participated in an intensive 6-day residential yoga program, which resulted in a decrease in BMI by 1.6% (Telles et al., 2010). Hegde et al. (2011) conducted a three-month yoga intervention involving 123 DM 2 patients. The patients assigned to receive either standard care or standard care along with additional yoga. Compliance with the intervention was defined as attendance for at least three days per week at the yoga centre for three months. Results of the study suggested a significant decrease in BMI ($p < 0.001$). Sixteen healthy obese postmenopausal Korean women were recruited to participate in a 16-week yoga intervention and a significant decline in BMI ($p < 0.05$) was observed (Lee et al., 2012). However, there were no significant differences in the changes of body weight and BMI between the non-MetS yoga and non-MetS control groups in Study One. The differences in the changes of body weight and BMI in response to the Hatha yoga program between MetS and non-MetS subgroups were unclear and needed further research.

Cardiovascular endurance

The participants' cardiovascular function and endurance, as measured by resting heart rate and VO_{2max}, respectively, significantly changed as a result of the Hatha yoga program. Reduction of resting heart rate was found might imply that the yoga program has exerted a small effect to the total cohort and moderate effect to MetS subgroup. A small-to-moderate beneficial effect of the Hatha yoga program on VO_{2max} was also found in the total cohort and the two subgroups. Though our findings were supported with evidence from previous yoga studies, interpretation of the existing findings was limited by small sample size. For instance, Trans et al. (2001) recruited 10 healthy young adults (18-27 years old) were to participate in an eight-week Hatha yoga program. A maximal treadmill exercise test was conducted to measure VO_{2max} of each participant. Their results found that absolute and relative

VO_{2max} increased by 7% and 6%, respectively ($p < 0.01$). Reduction of resting heart rate and enhancement of VO_{2max} were observed in patients with CVD. Sivasankaran et al. (2006) recruited 10 with history and 23 without known history of CAD to participate in a six-week of yoga intervention. Resting heart rate decreased by 9 beats/minute (p < 0.01) was shown in the total cohort. A RCT with 19 chronic heart failure patients (yoga, n = 9; control, n = 10) was conducted to determine the effect of an eight-week yoga intervention on inflammation and exercise capacity (Pullen et al., 2008). VO_{2max} was measured with a graded exercise test. VO_{2max} was significantly improved in the yoga group as compared to the control group ($p = 0.02$). Enhancement of cardiovascular endurance found in our study may be attributed to increased muscular endurance, and better economy of breathing resulting from practicing yoga breathing techniques. The control and muscular endurance of intercostal muscles may also be improved by practicing yoga breathing on regular basis. The underlying mechanism may need to be explored systematically in the future.

Muscular strength and endurance

Our findings revealed that the Hatha yoga program significantly improved participants' muscular strength and endurance. Push-up and Curl-up Tests were conducted to measure the participants' muscular strength and endurance of upper-body muscles and the abdominal muscles, respectively (CSEP, 2003, as cited in ACSM, 2010b). The yoga intervention exerted a large enhancing effect on muscular strength and endurance of upper body muscles. It also exerted a small-to-medium favourable effect on muscular strength and endurance of the abdominal muscles. The results were reasonable as some yoga poses practised in the Hatha yoga program were arm-supporting poses for training participants' upper body muscles. In addition, proper postural alignment was emphasized and poor postures were identified from the participants during the yoga practice sessions. Excessive lumbar lordosis was commonly found among female participants. The participants usually had very weak abdominal muscles, and thus failed to maintain the proper spinal alignment. Thoracic kyphosis was also commonly observed among the participants. This poor alignment was probably due to having very tight shoulder muscles, weak upper back muscles, or both. The participants were required to coordinate and engage their muscles in order to maintain proper postural alignment when executing the yoga poses. The participants were also reminded to be aware of their postures in daily life, resulting in an increased use of muscles for remedy of their poor postural alignment.

Findings of our study were consistent with earlier evidence even though different instruments were used to assess the muscular strength and endurance in different studies. Cowen and Adams (2005) recruited 11 healthy adults (20-58 years old) to participate in a six-week Hatha yoga class and measured participant's upper body dynamic muscular strength and endurance with a push-up test, whereas participant's truck dynamic muscular strength and endurance was measured with a partial curl-up test. Significant improvement was only found in truck dynamic muscular strength and endurance ($p < 0.05$; +58%) in their study. Gaurav (2011) conducted a RCT to determine the effect of Hatha yoga training on health related physical fitness variables. Thirty college students (aged 18 – 24 years) were randomly assigned to the yoga group (n = 15) and the control group (n = 15). The yoga group participants were invited to participate in an eight-week yoga training program. A one-minute sit-up test was used to measure participant's muscular strength of abdominal muscles. Result indicated that muscular strength of abdominal muscles significantly improved in the yoga group as compared with the control group ($p < 0.01$). Chen et al. (2008) used chair-stand test to evaluate the senior participants' lower limb muscular endurance. Lower limb muscle endurance had significantly enhanced after the 24-week yoga intervention was found in the yoga group as compared to the control group ($p < 0.05$). Though the efficacy of yoga practice in improving muscular strength and endurance may not be comparable with other resistant training, yoga may encourage and allow those unfit, sedentary, or senior individuals to build up muscular strength and endurance in a relatively gentle way.

Flexibility

We found that the Hatha yoga program produced a very large enhancing effect on flexibility of both legs in the whole cohort and the two subgroups. This significant increased range of motion may be attributed to the static stretching nature of yoga poses (Tran et al., 2001), as stretching exercises are often recommended to improve flexibility and optimize the efficiency of movement (Powers & Howley, 2012). However, it is difficult to compare the earlier evidence with our findings as the flexibilities of different muscle groups were measured and different instruments were used across the studies. Since yoga poses are common in static stretching nature, it is worthwhile to incorporate the findings from earlier studies and Study One for better understanding on the effect of yoga practice on flexibility in general. Trans et al. (2001) measured ankle flexibility, shoulder elevation, truck extension, and truck flexion with a goniometer, results of their study indicated that the yoga program could increase ankle flexibility ($p < 0.01$), shoulder elevation ($p < 0.001$), truck extension ($p < 0.001$), and truck flexion ($p < 0.05$). Cowen and Adams (2005) measured participant's truck flexibility with a sit and reach box, and a significant improvement of truck flexibility ($p < 0.05$; +14%) of the participants after the yoga class was observed. Tekur et al. (2008) investigated the effect of a one-week intensive yoga program on spinal flexibility in chronic low back pain individuals ($N = 80$). Spinal flexibility was measured using a dial-type goniometer. Significant improvement in spinal flexion ($p = 0.008$; effect size = 0.146), spinal extension ($p = 0.002$; effect size = 0.251), and left lateral flexion ($p = 0.006$; effect size = 0.171) were observed in the Tekur et al.'s (2008) study. In general, yoga practice can significantly improve flexibility of healthy adults and even those with chronic low back pain. Suggestions for future research include using standardized instrument in measuring the flexibility for better comparison across studies, and further exploration of the potential applications in rehabilitation programs for clinical populations particularly those with musculoskeletal problems.

5.2.2.4 Effects of the Hatha Yoga Program on Cortisol Level

Null Hypothesis 4 There is no significant difference in the change of cortisol level between the yoga group and the control group.

There was no significant difference in the change of cortisol level between the yoga group and the control group in the primary analysis and the two subgroup analyses. We also realized that the cortisol level increased for the Hatha yoga session ($p \geq 0.05$), whereas the cortisol level decreased slightly for the control condition ($p \geq 0.05$). Our findings were not in line with the potential mechanisms of yoga-induced physio-pyschological changes that we discussed previously (Section 2.6). It was possibly due to the content of the Hatha yoga program of Study One, consisting of yoga poses and yogic breathing, was bodily practice in nature. In accordance to the General Adaptation Syndrome (GAS) discussed previously (Section 2.2.2), a wide range of stressful events such as burns, bone breaks, and heavy exercise led to predictable increase in cortisol (Powers & Howley, 2012). As our participants had no previous yoga experience, some participants, especially those sedentary ones, might find the yoga practice bodily challenging when executing those yoga poses that were new to them. This unfamiliar situation might be considered as a stressful event for the novice yoga participants. Though the yoga participants might perceive the yoga practice challenging, the intensity of the yoga practice was low-to-moderate. Existing literature indicated that only exercise of high intensity and long duration results in significant elevations of salivary cortisol (Jack, Sowash, Anning, McGloughlin, & Andres, 2002). The non-significant increase of cortisol level of the yoga group was in line with the literature.

The results of Study One in this research area clearly failed to replicate the findings of the earlier studies (Michalsen et al., 2005; West et al., 2004). There were several differences between Study One and the earlier studies (Michalsen et al., 2005; West et al., 2004) that could account for the differences in reported findings. The most apparent possibility was that the participants in the study of Michalsen et al. (2005) had yoga experience of more than three months. They might have higher mastery of yoga poses and be familiar with yoga practice. Thus, the yoga session might not be a stressful event to the participants and did not trigger the increase of cortisol level. Conversely, West et al. (2004) did not provide the information about the yoga experience of their participants. It is worthwhile to purse future research for comparing the cortisol responses between individuals with different lengths of yoga experiences.

Another major difference between these two previous studies and our study was the duration of the yoga session. Both Michalsen et al. (2005) and West et al. (2004) adopted a 90-minute yoga session and collected participants' salivary cortisol before and after the yoga session. The duration of the yoga session of these two studies was longer than ours. It is warranted to conduct further studies to explore the relationship of the duration of the yoga intervention and the response of cortisol level.

5.2.3 Effects of the Hatha Yoga Program on Mental Health

5.2.3.1 Effects of the Hatha Yoga Program on Psychological Variables

> ***Null Hypothesis 5***
> There are no significant differences in the changes of psychological variables (i.e. self-esteem, perceived stress, state anxiety, trait anxiety, and depression) between the yoga group and the control group.

The findings of the primary analysis and the MetS subgroup analysis revealed that there were no significant differences in the changes of psychological variables between the yoga group and the control group in the whole study sample and MetS sample, respectively. For non-MetS sample, findings of PP analysis were in line with those of the primary and MetS subgroup analyses, but findings of ITT analysis indicated that a significant difference in the change of perceived stress score between the two groups was found. Despite of statistically non-significant results, the yoga group demonstrated further improvements in self-esteem, depression, and state and trait anxiety as compared to the control group. We also realized that the yoga group showed a non-significant decline in perceived stress score in the primary analysis and the two subgroup analyses. Surprisingly, the non-MetS control group demonstrated a further decline in perceived stress score as compared to the non-MetS yoga group. The reason for this surprising finding is not clearly understood and future research is warranted.

There is preliminary scientific evidence that yoga may exert beneficial effects on self-esteem, perceived stress, anxiety, and depression, but the interpretations of the evidence was limited by the methodological problems as discussed in previous chapter (Chapter 2). There are two possible reasons for the discrepancies between the existing evidence and the present findings. First, the yoga style practised in the yoga intervention of this study was Hatha yoga, which was the physical aspect of tradition yoga practice. Since Hatha yoga was not accompanied by any lifestyle changes that may affect psychological functioning, which is an accompany characteristics in tradition yoga practice. This may have acclaimed for the insufficient effects on these psychological outcome variables. Also, many existing literature did not clearly state the yoga styles of the yoga interventions. Absence of this information may make comparison between the existing evidence and the present findings difficult. Second, the effects of Hatha yoga interventions can be varied from one to another as the choice of yoga poses and the approach of practising yoga poses can be greatly diverged across the studies. Dozens of classically identified yoga poses exist, and there are numerous variations in the way that yoga poses can be practised (Sherman et al., 2005). Also, if an individual practices a single yogic posture separately, improvements in muscular strength, flexibility, and posture may be achieved, whereas improved cardiorespiratory fitness may be found when the individual practices poses continuously and intensively (Lau et al., 2012). Again, many existing literature did not provide detail of the yoga intervention. Limited information makes replication of the Hatha yoga intervention in future research and extension work difficult.

With a stringent study design, Study One has advanced the knowledge of the effects of a short-term yoga intervention on self-esteem, perceived stress, anxiety and depression. Further studies with longer yoga intervention are worthwhile to pursued to confirm the possible effects of a Hatha yoga intervention on the above psychological variables and to add information for exploration of the underlying mechanisms. More rigorous research in determining the efficacy of yoga in management of stress, anxiety, and depression are needed prior to advocating for the routine use of yoga as a treatment.

5.2.3.2 Effects of the Hatha Yoga Program on Health-Related Quality of Life

Null Hypothesis 6
There is no significant difference in the change of health-related quality of life between the yoga group and the control group.

Findings of Study One revealed that the Hatha yoga program exerted a small-to-moderate enhancing effect on social functioning of the participants. These findings were coincident with the findings of the study that has used yoga to improve HRQoL of individuals with other ailments using SF-36 (Smith et al., 2006). It was not surprising as the yoga class setting was group-based with small class size that provided an opportunity for participants to socialize with each other; especially for those shared with common interests and characteristics (e.g. yoga and health conscious).

A small significant enhancing effect of yoga on general health perception was found in the primary analysis but not found significant in the two subgroup analyses. The difference is possibly due to the sensitivity of the instrument used is not sufficient to detect the change of the outcome variable for smaller sample size. The yoga group participants perceived better physical health after the 12-week Hatha yoga program might due to their actual experiences of improvement of health status, such as the improved health-related physical fitness and reduced metabolic risk factors that we found in this study.

There were significant differences in the changes of bodily pain domain score and physical component score between the yoga group and the control group of the non-MetS sample. The non-MetS yoga participants had further improvement in these two scores than their control counterparts. However, no significant differences in the changes of these two scores were found between the two groups in the MetS sample. The difference between the two samples is possibly due to the differences in the sample characteristics between the two subgroups, for instance, the MetS participants had more metabolic risk factors than non-MetS participants. The chronic conditions experienced by the MetS participants, such as hypertension, hyperglycemia, and dyslipidemia, may not be altered easily in short duration, and hence the MetS yoga participants may not perceive any changes in their chronic conditions after the yoga intervention.

It is not possible to compare the different components of SF-36 and other instruments directly, yet it is meaningful to note the closeness of the findings in different populations. For example, Moadel et al. (2007) used FACT to assess HRQoL of 128 breast cancer patients using a 12-week yoga intervention (1.5-hour session/week). The findings of their study suggested that yoga is associated with beneficial effects on social functioning among breast cancer patients. The yoga interventions of Study One and Moadel et al. (2007) were similar in term of the duration of the yoga intervention (12 weeks) and frequency of the yoga sessions (one session per week), and thus suggesting a significant beneficial effect on social functioning would be resulted with a sufficiently long yoga intervention (12 weeks or over). In addition, Rakhshani and colleagues (2010) adopted WHOQoL-100 to assess the effect of a 16-week yoga intervention (1-hour session, three times a week) on HRQoL of pregnant women. Of the six domains of WHOQoL-100, between group analysis revealed significant improvements in the yoga group compared to the control group in the physical, psychological, social, and environmental domains (all $p \leq 0.001$). Therefore, based on these results, we may deduce that the duration of the yoga intervention and the frequency of the yoga session might influence the effect of the yoga intervention on HRQoL. Future research may explore dose-response association of yoga and its effects on HRQoL.

5.3 Strengths of Study One

This study has several prominent features:

1. Large Sample size

The sample size was adequately large (*N* = 173) to reduce the possibility of type I and type II errors.

2. Qualified yoga teacher

The qualifications and teaching experiences of the yoga teacher were crucial to the Hatha yoga program. First, the qualifications and teaching experiences of the yoga teacher of this study were listed in recruitment material, so that participants could have better understanding and confidence to the yoga teacher and the quality of the yoga program. Second, the yoga teacher is a certified teacher of yoga, Pilates, and group fitness, together with her strong academic background in Sport Science, the tailor-made yoga program was carefully and thoroughly designed to suit participants with different fitness level and physical functioning. Modifications of yoga poses were advised to participants with special needs in order to encourage participants to continue their practice. These were helpful in lowering the attrition and maintaining high attendance rate of the participants.

3. Use of self-practice record sheet as a reflection

As mentioned in Chapter 3 (Section 3.3.6.1), the researcher (also the yoga teacher of the yoga program) designed a “Yoga Self Practice Weekly Record Sheet” (see Appendix K, regarded as “record sheet”) and distributed the record sheet to the yoga participants in each yoga lesson. The yoga participants were encouraged to practice yoga in their free time and record their duration of practice on the “record sheet”.

The participants were required to submit their "record sheet" in the next lesson. The yoga teacher encouraged participants to have daily yoga practice and suggested participants to think about time management in their daily life. The researcher found that some participants commented their duration of practice when they submitted the "record sheet" to the yoga teacher. For example, some participants who did not practice after the yoga class provided the reasons for not practising or practising less than before. Their responses revealed that they treasured and were responsible to their participation of this study. The "record sheet" did not only record how long participants have practised yoga, but also serve as a reflection instrument of their lifestyle modification, which revealed their effort made to integrate yoga in their daily life.

4. High adherence

It is important to maintain good adherence as the treatment effect may be diluted by noncompliance. The present study demonstrated a relatively lower attrition rate (11.0%) as compared to overseas studies with similar intervention design (22.0%, Moadel et al., 2007; 15.3%, Smith et al., 2007). The yoga group participants also persisted in attending the yoga program and showed a remarkable attendance rate (93.6% for a total of twelve sessions). A number of strategies, which may have contributed to the high adherence, were implemented in the present study. First, the yoga teacher recorded the attendance records of the participants personally. If there were absentees, the teacher would contact the absentees to inquire their reasons for absence, and encourage the absentees to attend the next class. Second, the yoga teacher prepared "Hatha Yoga Class Handout" (regarded as "the handout", see Appendix J) and distributed to participants by the end of the first ten classes as a reinforcer. According to the teacher's personal experience, many beginners reflected that they forgot how to execute the yoga poses after class. The handout can reduce the participants' barrier of self-practice. Third, participants were not required to prepare special clothing and equipment for the yoga classes, but were provided with yoga mats and props during the classes. The participants were also suggested to use the towels and pillows, which were available at most participants' homes, as yoga props to assist their self-practice at home. Thus, related financial considerations were eliminated. Forth, the venue of the yoga programme was highly accessible by wide ranges of public transports. Convenient transportation leading to the venue can reduce participants' environmental barrier of attending the yoga classes. Finally, the study was thoroughly planned to make the intervention study successfully implemented, this might help establish a positive impression to the participants, and thus reinforce their commitment to the current study.

5.4 Limitations of Study One

Findings of Study One need to be interpreted in the light of several potential limitations:

1. Non-randomized study design

The researcher used non-randomized study design in order to achieve maximum adherence with the intervention. This study design might introduce a selection bias by indication between the yoga group and the control groups. Also, a few baseline physiological and psychological characteristics were found to be statistically significant. The follow-up correlation analyses of those heterogonous characteristics and outcome variables were performed. Those heterogeneous characteristics significantly correlated with the particular outcome variables were identified as covariates of the particular outcome variables. The additional ANCOVA was conducted in order to control the confounding effects arose from the presence of the covariates.

2. Use of a waitlist control condition

Since the present study adopted a waitlist control condition, unequal contact time between the yoga group participants and the control group participants during the 12-week intervention period had incurred. This condition might, therefore, limit the ability to evaluate whether the significant effects found in this study were due to the Hatha yoga program alone or related to other nonspecific factors. However, it was also difficult to adopt either a placebo or an alternative control condition matching the nature of yoga practice in the present study. Since yoga is now increasingly recognized in Hong Kong and participants might therefore be aware that they were practising yoga, it is impossible to develop a scientifically legitimate placebo (John et al., 2007; Visceglia, & Lewis, 2011). Due to limited resources, the study could not afford to hire other professionals to conduct an active control condition, which matched the nature of yoga practice and the contact time between the two groups, to control this limitation. Moreover, the study of Sabina et al. (2005) adopted an active control group, yet the study reported that the yoga intervention and the active control condition were too similar and as such exerted similar effects on outcome measures. Thus, caution should be taken in designing an active control condition in order to avoid the above situation.

3. Open label study

Due to limited resources, the study could not afford to hire other research staff in conducting the study. The researcher was not blinded to the study's content as she solely involved in all tasks of whole research process including participant recruitment, data collection, and teaching yoga classes. Thus, blinding the researcher could not be achieved under this circumstance. Also, it has been noted blinding in yoga intervention studies is problematic (Carter, 2003; Cohen et al., 2011; Manson, Tovey, & Long, 2002; Ritenbaugh, Verhoef, Fleishman, & Boon, 2003). Participants might be aware that they were practising yoga as aforementioned in previous limitation, and thus they cannot be blinded in the research and intervention process.

4. Other possible confounding effects

Though covariate adjustments were done in the data analysis and participants were requested to maintain their routine activities, the study could not exclude other confounding effects on the results of this study such as medication use, menopausal state, diet, and sleep. It is difficult to determine the relative effects of yoga and the medication use. However, as there was no change in the medical management protocol that had already stabilized the clinical status of our participants, thus the confounding effect of medication use on the results of this study could be minimized. On the other hand, the study consisted of largely females and individuals who aged 45 or above. Some of the participants might have been experiencing different stages of menopause and related signs and indications when participating in Study One. Therefore, the potential confounding effects of menopausal state on the outcome variables of Study One cannot be ruled out. Also, lifestyle factors, such as diet and sleep, may influence one's health and impose effects on the outcome variables of this study. The possible confounding effects of lifestyle factors on outcome variables could not be ruled out due to absence of lifestyle assessment.

5. No long-term follow-up data

Due to limited resources, the duration of intervention was limited to 12 weeks and only baseline and post-intervention assessments were conducted. The effects of yoga, particularly on mental health, may not be seen until after that period, or it may have positive or negative changes with prolong practice. The durability of the yoga effects could not be explored without long-term follow-up data. In attempt to remedy this limitation, a qualitative analysis of how the experienced participants (who practicing yoga for over three months) experienced their yoga practice, including motivation, benefits and barriers of yoga practice, were reported in Study Two.

6. Generalizability

The sample was self-selected, it is possible that Study One participants were more health-conscious and interested in yoga, as compared to the general population. Thus, participants were more motivated to purse lifestyle modification through yoga practice for health promotion. Participants were 30-71 years old, so individuals aged 72 or above were under-represented. Over 60% of participants were female, it remains unclear whether a sample including more male participants would have altered the findings. Caution should be taken in generalizing the findings of Study One to a broader population.

7. Failure of capturing other lifestyle changes

All participants of this study were requested not to begin any exercise during the course of the study as the researcher attempted to control the effect to only yoga. However, from the health promotion point of view, starting yoga program may in turn promote physical active lifestyle, which people may be encouraged to participate in more physical activities not limiting to yoga (e.g. more walking). Thus, the results of the present study were not able to capture other lifestyle changes and the related benefits.

5.5 Implications of the Findings of Study One

Mixed methods approach was adopted in the whole study. Study One and Study Two were the quantitative and qualitative components of the whole study, respectively. Study One examined the effects of Hatha yoga intervention on physical and mental health. Perhaps it is the only community-based study that assessed the effects of the Hatha yoga intervention on physical and mental health of Hong Kong Chinese.

Study One enriched the existing understanding of the effects of yoga on various aspects of physical and mental health and provided evidence that participation in a structured yoga intervention program might reduce metabolic risk factors, improve health-related physical fitness, and enhance some of the health-related quality of life domains in individuals with and without metabolic syndrome (MetS). The low-to-moderate intensity characteristics of yoga, together with the aforementioned beneficial effects, made yoga a recommended physical activity option for the sedentary individuals. Favorable effects on metabolic risk factors in both individuals with and without MetS of this investigation offered support for the use of yoga as a primary and secondary prevention of MetS, and it therefore should be considered as a complementary and alternative treatment option.

The study recruited a sufficiently large sample as compared with other studies mentioned in the literature review (Chapter 2). Study One findings were, therefore, relatively more representative which could enhance the understanding of the short-term effect of a yoga intervention in local community, and could be transferred to the communities that have similar prevalence of yoga use as Hong Kong. The high adherence of Study One could also serve as a good template for future research. Since high attrition rates were frequently reported in other yoga intervention studies, the experience of Study One, including thoroughly planned study design and the strategies of implementation, could be useful for minimizing the attrition in future research. Findings of Study One suggested that it is feasible to conduct a yoga intervention study in local community. The knowledge gained from Study One may also be transferable to other CAM research and applicable to other lifestyle modification programs.

From the social policy perspective, the evidence of Study One not only increase individuals' confidence and motivation in the use of yoga for health improvement, but also can provide useful insight to guide community action for health promotion and disease prevention. Further understanding of community perception and acceptance of yoga practice may be required for future strategic planning of promoting yoga practice in the community to increase people physical activity level. Study Two explored the perceptions of yoga practice in Hong Kong, and its findings were presented and discussed in Chapters 6 and 7. The integrated findings of Study One and Study Two will be concluded and the implications of the whole study will be addressed in Chapter 8.

5.6 Recommendations for the Future Research

In response to the limitations of Study One, future research should adopt randomized control design with an active control to improve reliability and validity of the findings. Though it is impossible to blind participants to their allocation, blinding the assessors of the studies might help reduce observer biases. For better capturing the lifestyle data, it is suggested to adopt instruments which assess lifestyle factors such as dietary assessment questionnaire, sleep diary, activity log, accelerometer for measuring physical activity level, etc. Future research should make the effort in recruiting male participants by providing more information about yoga in recruitment material in order to minimize the preconception of yoga (e.g. yoga is a feminine activity), thus the findings could be more generalized to the male population.

The present sample consisted of largely middle-aged participants; the findings of this study might not be well generalized to the other age range population such as older adults. Low functional capacity, muscle weakness, and deconditioning are more common in older adults than in any other age group (ACSM, 2010b). ACSM (2010b) suggested that an exercise prescription for the older adults should include aerobic, muscular strengthening, and flexibility exercises, and for those frequent fallers or people with mobility problems should additionally include balance, agility, and proprioceptive training. Given the favourable effects of yoga on health-related physical fitness components were found in Study One, it is noteworthy to examine the effectiveness of yoga on maintaining or improving functional capacity of older adults in future research.

Growing research evidence indicated the potential beneficial effects of practising yoga for a short period of time [e.g. eight-week yoga program in Innes et al.'s (2012) study, three-month yoga intervention in Michalsen et al.'s (2005) study, and one-week residential intensive yoga intervention in Terku et al.'s (2008) study]. Effort should be made in evaluating long-term effects of yoga in future related research (e.g. intervention period ≥ 12 months). It is suggested that more follow-up data could be collected for evaluating the durability effects of long-term yoga practice. For example, data can be collected at 3-, 6-, 9-, and 12-month of follow-ups in a 12-month yoga intervention study. The purposes of conducting more follow-up tests are threefold. First, the data collected in the first follow-up test (3-month of follow up) could provide the researcher information of the short-term effect of the yoga intervention on the outcome variables. Second, echoed with the limitation mentioned in previous section (Section 5.4), the effects of yoga on outcome variables might not be significantly observed until after a longer intervention period. Third, given that a significant short-term effect of yoga on an outcome variable was found, further follow-up tests are needed to explore long-lasting effect of yoga on the outcome variable, whether a plateau or continuous changing effect was found over a period of yoga practice. Furthermore, studies might include a longer intervention period to determine a long-term acceptability of participants, thus can investigate whether yoga could be integrated as a sustainable activity into participants' daily life.

Findings of Study One revealed that the yoga intervention produced beneficial effects on various metabolic risk factors of both MetS and non-MetS participants. Metabolic syndrome is common and is associated with an increased risk for CVD (Wilson, D'Agostino, Parise, Sullivan, & Meigs, 2005) and lack of studies of the effect of yoga intervention on secondary prevention for coronary heart disease (CHD) was addressed in a recent review (Lau et al., 2012). Thus, the potential effects of yoga intervention on primary and secondary prevention of CVD might be investigated in future research.

Favourable effects of Hatha yoga were found in Study One, but we did not evaluate the potential underlying mechanisms of these effects. Whether a different yoga style would have reaped similar effects may worth further investigations. Future studies, with longer intervention duration (over 12 weeks) or higher frequency of yoga practise sessions, using more biochemical variables might shed light on understanding the mechanisms. Optimal effects could be determined by comparing across various yoga styles.

5.7 Summary

This chapter discussed the quantitative findings of Study One which determined the effects of Hatha yoga program on physical and mental health of Hong Kong Chinese adults with and without metabolic syndrome. The findings may provide more and stronger evidence of the application of yoga in promoting health-related physical fitness and quality of life. The positive effects of the Hatha yoga program on reducing metabolic risk factors may support the use of yoga as a complementary preventive measure for metabolic syndrome. The study design was thoroughly planned and resulted in high adherence of the study. Despite of the limitations, the successful experiences of Study One may be helpful for designing similar research in the future. Further studies should adopt longer intervention periods for evaluating the long lasting effects of the yoga intervention on different aspects of health. The therapeutic potential and clinical importance of yoga is also worth more detailed research. Study One is not only a single short-term intervention study with its own practical significance, but is also part of the whole study adopting mixed method approach. Chapters 6 and 7 will present the results and discussion of Study Two. Results of both Study One and Study Two will be interpreted integrally and the implications of the whole study will be presented in Chapter 8.

CHAPTER 6 RESULTS OF STUDY TWO

Study Two aims to explore the motivations, perceived benefits and barriers of yoga practice of individuals with and without yoga experiences through focus group method. The chapter consists of four sections. The first section describes the process of recruiting the participants of the study. The second section describes the demographic characteristics of the study sample. The third section reports the findings of the focus group discussions and the last section summarizes the results of Study Two.

6.1 Recruitment of Study Two Participants

The period of recruitment was from March 2011 to December 2011. The participants were selected following the procedures described in Chapter 3 (Section 3.4.5). A total of 100 individuals who have submitted enrolment forms to show their willingness of participation in the study were screened for eligibility for the study. None of them were excluded. Before the consent forms were signed, these 100 individuals were regarded as prospective participants. Amongst these 100 prospective participants, fourteen of them were absent from the focus group discussion sessions, which they have committed to attend, and they did not provide with reasons for their absence. The rest of the 86 prospective participants attended the focus group discussion sessions and signed the consent forms before the start of the discussion.

6.2 Characteristics of Study Two Sample

The 86 prospective participants who signed the consent forms were recruited for this study. Each participant joined one of the 14 focus groups (on average six participants for each group), and all participants completed the discussion.

The study sample consisted of 42 participants who had practiced yoga for at least three months (regarded as EXP participants) and the other 44 participants who had never practiced yoga (regarded as NIL participants). Table 48 describes the demographic characteristics of the EXP participants and the NIL participants.

The EXP participants aged ranging from 30 to 66 years (M = 51.31, SD = 7.08), and the number of year of yoga experience ranged from three months to five years (M = 1.14, SD = 1.44). Over 70% of the EXP participants were females (n = 32, 76.2%), attained secondary education (n = 31, 73.8%), and married (n = 33, 78.6%). Nearly half of them (n = 20, 47.6%) engaged in full-time jobs. The NIL participants aged ranging from 25 to 60 years (M = 44.52, SD = 10.36), and most of them (n = 40, 90.9%) were females. More than half (n = 23, 52.3%) of the NIL participants attained secondary education, and were married (n = 26, 59.1%). Thirty-four NIL participants (77.3%) engaged in full-time jobs.

For the five measured demographic characteristics (i.e. age, sex, education level, marital status, and occupation), significant differences in age, education level and occupation were found between both EXP and NIL groups. The EXP group was significantly older than the control group [$t(84) = -3.56$, $p = 0.001$]. The EXP group had larger portion of participants attaining secondary school education than the NIL group ($\chi^2 = 4.26$, $p = 0.039$). The NIL group has a significantly larger portion of participants engaging in full-time occupation as compared to the EXP group (χ^2 =

8.93, p = 0.003). There were no significant differences in sex and marital status between the two groups.

Table 48
Demographic Characteristics of the EXP Participants (n = 42) and the NIL Participants (n = 44)

Outcome variables	EXP (n = 42) $M \pm SD$ or f (%)	NIL (n = 44) $M \pm SD$	t or χ^2	p
Experience of yoga (years)	1.14 ± 1.44	Not applicable	/	/
Age (years)	51.31 ± 7.08	44.52 ± 10.36	-3.56	.001**
			6.97	.008**
25-44	5 (11.9%)	16 (36.4%)		
45-54	25 (59.5%)	21 (47.7%)		
55-64	10 (23.8%)	7 (15.9%)		
65 or above	2 (4.8%)	0 (0.0%)		
Sex			2.42	0.12
Male	10 (23.8%)	4 (9.1%)		
Female	32 (76.2%)	40 (90.9%)		
Education			4.26	.039*
Secondary	31 (73.8%)	23 (52.3%)		
Tertiary	11 (26.2%)	21 (47.7%)		
Marital status			3.40	.065
Single	8 (19.0%)	17 (38.6%)		
Married	33 (78.6%)	26 (59.1%)		
Widowed	1 (2.4%)	1 (2.3%)		
Occupation [a]			8.93	.003**
Full-time	20 (47.6%)	34 (77.3%)		
Part-time	2 (4.8%)	3 (6.8%)		
Retired	7 (16.7%)	2 (4.5%)		
Housewife	13 (31.0%)	5 (11.4%)		

[a] The total percentage does not sum to exactly 100% due to round-off error.
EXP individuals who had practice yoga for at least three months
Nil individuals who had never practiced yoga
* $p < 0.05$; ** $p < 0.01$

6.3 Findings of Study Two

Thematic content analysis was applied in this study and the detail was described in the Section 3.4.8. Since the study aims to explore the motivations, perceived benefits and barriers of yoga practice of individuals with and without yoga experience, the results of the study attempted to answer the central questions of the study which have mentioned in Section 1.4, Chapter 1:

4. What are the motivations of yoga practice? Do individuals with and without yoga experience have different motivations of yoga practice?
5. How do individuals with and without yoga experience perceive the benefits of regular yoga practice? Do they perceive differently?
6. How do individuals with and without yoga experience perceive the barriers of regular yoga practice? Do they perceive differently?

The findings of Study Two are presented in the following three parts: motivations of initiating yoga practice (Section 6.3.1), perceived benefits of yoga practice (Section 6.3.2), and barriers of yoga practice (Section 6.3.3).

6.3.1 Motivations of Yoga Practice

At the beginning of the discussion, both EXP and NIL participants were asked to discuss their motivations of yoga practice. Participants' responses in motivation of yoga practice were coded and analyzed as meaningful units and categorized into themes and sub-themes. A total of 116 raw responses (EXP: 63 responses; NIL: 53 responses) were condensed from the discussion of the participants in the 14 focus groups. On average, each EXP participant gave 1.5 responses and each NIL participant gave 1.2 responses. The EXP participants gave more number of responses than the NIL participants.

These 116 raw responses on the motivations of initiating yoga practice were classified into four major themes, including 1) physical health concern, 2) word of mouth, 3) mass media, and 4) emotional concerns. The participants' responses in motivations of initiating yoga practice are presented in Table 49.

The first theme of motivations of initiating yoga practice was "physical health concerns", which meant that an individual started and continued to practice yoga because of concerning one's physical health status. Participants believed that practicing yoga might help improve their physical health status. This theme was most discussed among the EXP participants, with 34 out of 63 raw responses (n = 27). Most EXP participants were motivated to initiate and continue the yoga practice in attempting to cope with some diseases and physical health ailments, one EXP participant with chronic neck pain has lessened her pain by practicing yoga:

"I've suffered from neck pain for years…Recently, I've found one yoga pose… called "Belly twist", once I do that pose, I feel that my neck muscle tightness has been gone! This pose helps reduce my neck pain! I've got very tight leg muscles too… After practicing yoga, I found that my muscle tightness has gone. My muscular strength and range of movement have been improved! All these benefits have been motivating me to continue my yoga practice."

[Female, 50 years old, practicing yoga for three months]

"Physical health concerns" was also frequently noted among the NIL participants, with 15 out of 42 raw responses (n = 13). One of the NIL participants indicated her motivations of initiating yoga practice:

"I want to practice yoga to help reduce my body weight…I'm not physical active and I've got knee pain when I went upstairs…I hope yoga (practice) can help remedy my situation."

[Female, 47 years old, no yoga experience]

The second theme of motivations of initiating yoga practice is "word of mouth", which means an individual hears about yoga from relatives, friends or health professionals. This theme was most expressed by the NIL participants (31 out of 53 raw responses, n = 23), and frequently expressed by the EXP participants (17 out of 63 raw responses, n = 11). One EXP participant was advised to practice yoga as a rehabilitation exercise by her physiotherapist:

"I'd like to try (practicing yoga) for long time, but there are a lot of different styles of yoga, thus I don't know how to get start. Also it (tuition fee of a yoga class) is expensive, and I encountered an accident (got injured), my physiotherapist has encouraged me to practice yoga for stretching and strengthen my muscle."

[Female, 47 years old, practicing yoga for nine months]

A NIL participant heard about benefits of yoga practice from her friends who have practiced yoga:

"Many of my friends have been practicing yoga, they said that they kept sweating during practice. They regarded yoga as a kind of exercise in low intensity but it (practicing yoga) could make them sweat. They also said that they felt calm after practice."

[Female, 28 years old, no yoga experience]

The third theme of motivations of initiating yoga practice is "mass media". Participants got information about yoga through newspaper, magazine, television programs, and even from internet resources such as watching video clips from YouTube. A few of the EXP participants (n = 5) and the NIL participants (n = 3) reported that they were motivated by the yoga demonstration shown in media. An EXP participant and a NIL participants were impressed with the yoga demonstrations in television programs:

"I've seen it (yoga demonstration) on TV, I found that it (yoga) amazing! How to do that (yoga poses)? I did attempt to follow (the demonstration) to do (those yoga poses), but I failed! I thought I did exercise regularly, I didn't believe that I failed to do (those yoga poses), I hoped I could do so! So I took a yoga course, and I found that I failed to do a lot of yoga poses, as my shoulders were too tight! My yoga teacher always reminds us to engage the core muscle when standing upright, so I remind myself (to engage the core muscles), and I found it really works!"

[Male, 57 years old, practicing yoga for three months]

"I watched someone demonstrated some yoga poses in a TV program, those poses were steady and elegant…staying in the same pose for a few minutes…and (yoga poses) require good balance. Every pose is elegant. I believe practicing yoga must bring some health benefits. Reduce your stress and impatience by doing those poses. You need to focus on the poses and relax yourself completely. I believe that yoga would be very nice."

[Female, 48 years old, no yoga experience]

The fourth theme of motivations of initiating yoga practice is "emotional concerns". Similar to "physical health concerns", "emotional concerns" means an individual initiate yoga practice because of concerning their emotions. A few of the EXP participants (n = 5) and the NIL participants (n = 3) mentioned choosing yoga practice to improve their mental health. An EXP participant and a NIL participant shared their similar motivation to initiate yoga practice:

"I started practicing yoga because I want to do a kind of exercise which is slower…Yoga can help me calm down and release my stress, as I found it effective so I continue to practice yoga. I can practice yoga whenever I want to… practice at home or yoga centre."

[Female, 42 years old, practicing yoga for three years]

"I hope that I can be healthier…in term of…mental aspect…er…increase my concentration (through practicing yoga)"

[Female, 53 years old, no yoga experience]

Table 49

Participants' Responses in Motivations of Yoga Practice (N = 86)

Responses	EXP (n = 42)		NIL (n = 44)	
	No. of responses	No. of respondents	No. of responses	No. of respondents
Motivations of yoga practice	63		53	
1. Physical health concerns	34 (54.0%)	27	15 (28.3%)	13
2. Word of mouth	17 (27.0%)	11	31 (58.5%)	23
3. Mass media	5 (7.9%)	5	4 (7.5%)	3
4. Emotional concerns	7 (11.1%)	5	3 (5.7%)	3

EXP individuals who had practice yoga for at least three months
Nil individuals who had never practiced yoga

6.3.2 Perceived Benefits of Yoga Practice

The EXP participants and the NIL participants raised 740 raw responses on the perceived health benefits of yoga practice, of which 536 responses were classified as perceived physical health benefits and the other 204 responses were classified as perceived mental health benefits. The findings of perceived benefits of yoga practice on physical health and mental health are presented in Section 6.3.2.1 and Section 6.3.2.2, respectively.

6.3.2.1 Perceived Benefits of Yoga Practice on Physical Health

Participants' responses in perceived benefits of yoga on physical health are summarized in Table 50. A total of 536 raw responses (EXP: 367 responses; NIL: 169 responses) were condensed from the discussion of the participants in the 14 focus groups. On average, each EXP participant gave 8.7 responses and each NIL participant gave 3.8 responses. The total number of responses given by the EXP participants was twice more than by the NIL participants. Moreover, the number of perceived physical health benefits of the EXP participants (all 32 benefits listed in Table 50) was higher than that of the NIL participants (23 of 32 benefits listed in Table 50). These two discrepancies may due to the EXP participants have experienced the effects of yoga practice, and they were therefore able to describe the benefits in more detail ways.

The 536 responses of perceived physical health benefits of yoga practice were classified into the following three major themes: 1) health promotion, 2) disease prevention, and 3) enhancement of physical fitness components. These three main themes were further divided into several sub-themes and discussed as follows.

<u>Theme 1: Health promotion</u>

The researcher identified 383 responses (EXP: 267 responses; NIL: 116 responses) in Theme 1 and these responses were further divided into four sub-themes, namely "musculoskeletal system related", "cardiorespiratory system related", "promoting healthy lifestyle", and "other physical health benefits".

1.1 Musculoskeletal system related

Regardless of the yoga experiences, participants expressed several beneficial effects of yoga practice on musculoskeletal system, including reduced muscle tightness, resolved joint problems, reduced back pain, and resolved muscle sore. A few of participants considered yoga as a rehabilitation exercise for musculoskeletal injuries. "Reduced muscle tightness" (EXP, n = 21; NIL, n = 10) and "resolved joint problems" (EXP, n = 15; NIL, n = 7) were the two most common responses noted by the participants. Two EXP participants expressed how they have benefited from their yoga practice and thus motivated them to continue practicing yoga regularly:

"I've been suffering from rheumatoid arthritis over 20 years, I've been treated for long time, but I haven't taken medication for a period of time as my condition (rheumatoid arthritis) hasn't got worse. However, deformations of my joints have been found and my joints have become very stiff…So I always go to have massages and learn many activities which can stretch my muscles, such as Tai Chi…But after I've practiced yoga for four months, I found that yoga (practice) helped me stretch my muscles effectively, and my joints have become less stiff…Even my massage therapist said to me in my last massage visit, "Your shoulder muscles are more relax than before, what have you done?" I told him that I've been practicing yoga recently, and he encouraged me to continue to practice yoga as it is beneficial to my condition."

[Male, 59 years old, practicing yoga for four months]

"I found that my joint problems have been improved after practicing yoga, as once I stopped practicing yoga, my joint problem recurred! I felt my pain (from joints) has been reduced after practicing yoga… Because I always shrug my shoulders in my workplace, I've found that my shoulder muscles were not as tight as before and my pain recurs less frequently."

[Female, 45 years old, practicing yoga for three months]

Although the NIL participants had no yoga experience, they perceived yoga would be beneficial by hearing from friends' experiences, a NIL participant reported:

"My classmate in the aerobics course told me that she has suffered from back pain earlier. She started to practice yoga, and she found that some yoga poses can make her feel better and help lengthen her spine. It's so amazing!"

[Female, 56 years old, no yoga experience]

1.2 Cardiorespiratory system related

A total of 47 responses (EXP: 32 responses; NIL: 15 responses) were identified in this sub-theme. Some EXP and NIL participants commented that yoga can help improve their blood circulation (EXP, n = 11; NIL, n = 9) and breathing control (EXP, n = 7; NIL, n = 5). One EXP participant realized that her blood circulation has been greatly improved after practicing yoga on a regular basis:

"I feel that my blood circulation has a great improvement (after starting yoga practice), and I also found that I have better sleep now…Because I was so lazy and sedentary, my blood circulation was so poor…I faced a lot of stress from my work, and from other problems…so that I was not able to sleep well and even woke up a few time. But after practicing yoga, I found that my hands and foot no longer cold in the winter, the effect of yoga is very obvious!"

[Female, 47 years old, practicing yoga for one year]

Another EXP participant experienced deep breathing through yoga practice:

"I found yoga improving my breathing…I played badminton and yoga all the time. I found that my breathing rate was very quick when playing badminton, but when I breathe during yoga practice, I felt that I had deeper breaths, and the air could be kept inside (the lungs) longer time, that (deep breathing) couldn't happen when playing badminton."

[Female, 49 years old, practicing yoga for five years]

A NIL participant shared her impression toward her friend who has been practicing yoga for long time:

"My friend has been practicing yoga for a period of time…I am not sure exactly how long she has practiced, but she always look good with healthy red face and energetic…I think practicing yoga can make one's (blood) circulation better, and feel vital… yoga seems to be less vigorous (in term of intensity)"

[Female, 48 years old, no yoga experience]

1.3 Promoting physically active lifestyle

Some participants in both EXP and NIL groups considered yoga as a kind of physical exercise with low-to-moderate intensity. They claimed that they were either too old or too sedentary, or both, and they found yoga less vigorous than other sporting activities, thus they were able to sustain in yoga practice instead of other sport activities. One EXP participant compared her perceived exertions experienced in yoga practice with in a badminton game.

"I think yoga is a moderate exercise, not a very vigorous one…Why did I start practicing yoga…At first, I think yoga is an exercise, which is suitable for people at my age (57 years old) to do so. I think it (yoga) is different from other (sporting activities)…Playing badminton hurts my elbow!"

[Female, 57 years old, practicing yoga for three years]

Some participants found that there were fewer perceived barriers of yoga practice than other activities, and believed that they could maintain a physically active lifestyle by regular yoga practice. An EXP participant practiced yoga as she wanted to stay physically active:

"I do exercise quite often, but then I changed my job…um…my work schedule made me difficult to have my friends playing badminton with me…I really wanted to keep doing exercise…also I wanted to improve my concentration and flexibility. So I started (yoga practice)…"

[Female, 47 years old, practicing yoga for three months]

One NIL participant found that she had fewer barriers to initiate yoga practice:

"I hope I can practice yoga at home after I have learnt yoga poses. I can practice (yoga) alone and I don't have to waste time to find my friends to practice with me."

[Female, 49 years old, no yoga experience]

1.4 Other physical health benefits

Apart from the perceived physical health benefits mentioned in previous sub-themes, both EXP participants and NIL participants also agreed that by practicing yoga on a regular basis could improve their quality of sleep, overall physical health status, body shape, digestive system, and prevent injury. "Enhanced quality of sleep" was the most discussed benefits among the EXP participants (*n* = 17) and the NIL participants (*n* = 12). Some participants have explained why they believed practicing yoga might lead to enhanced quality of sleep. First, participants believed that practicing yoga was similar to doing other sport activities, they were tired after yoga practice and hence it was easier for them to fall asleep and get a deeper sleep. Second, participants felt more relax after practicing yoga and they believed that relaxation help improve their sleep quality. An EXP participant applied the breathing technique, which she acquired in her yoga class, to help her fall asleep when she failed to sleep:

"Before the end of the yoga class, we practiced breathing by lying on the mat…expanding my abdomen when inhaling, exhaling with my abdomen flattened. I found this breathing technique helpful, as I suffer from insomnia sometimes, once I do that (breathing technique), I then fall asleep gradually, I feel it (breathing technique) is good!"

[Female, 51 years old, practicing yoga for one year]

Another EXP participant, who suffered from serious constipation, found a better bowel movement after she learned the following technique in the yoga class:

"My yoga teacher asked me to drink 1-2 cups of warm water, and then perform three twisting yoga poses…I found that I can easily to slip it (stool) out now! It's very effective!"

[Female, 53 years old, practicing yoga for four years]

Though the NIL participants had no firsthand yoga experiences, the experiences of their family members and friends were valuable sources of information that influenced how the NIL participants perceived benefits of yoga practice. One NIL participant shared how yoga practice improved her niece's health status:

"I found that my niece looks fitter after yoga practice…She has suffered from peptic ulcer, and she now looks much more energetic! She studied abroad and has a lot of stress now (after returned to Hong Kong). She thinks yoga may help her reduce stress so she started practice yoga…She is very determined and practices yoga once a week. She told me that she has experienced fewer and less severe stomache than before."

[Female, 47 years old, no yoga experience]

The EXP participants further addressed a wide range of perceived health benefits, including improvement in posture, body awareness, renal function, menstrual symptoms, and performance in sports activities. A few older participants noted that risk of falls and injuries from falls have been reduced as their balance abilities have been improved through practicing yoga. An EXP participant shared the positive changes occurred after he started yoga practice and his understanding of yoga:

"When I was a beginner of yoga practice, I thought yoga was an exercise…But after I immersed myself in yoga, practice made me have more and better understanding to my body. My health has improved gradually. Yoga can help improve my body awareness. Once I do some wrong postures, my body will keep reminding me to adjust until I return to the right ones…Yoga is not only a way to stretch your muscles, it's (this view is) too superficial, once you continue (to practice yoga), you will find it's (yoga is) profound, it's effective (improve health)."

[Male, 65 years old, practicing yoga for five years]

Theme 2: Disease prevention

A total of 40 responses (EXP: 24 responses; NIL: 16 responses) were categorized into Theme 2. The EXP participants and the NIL participants had different perceptions of this theme in term of the number of perceived benefits and the number of respondents of each benefit. In term of the number of perceived benefits, the EXP participants noted more perceived benefits than the NIL participants. Both EXP participants and NIL participants noted the following three perceived benefits, including "improved immune response", "prevention of back pain", and "prevention of heart diseases". In addition, the EXP participants noted another three perceived benefits, which included "improved lipid profiles", "prevention of hypertension", and "prevention of hyperglycaemia".

In term of number of respondents of each perceived benefits, "improved immune response" was the most cited benefits within this theme among the NIL participants. The number of respondents discussed this benefit of the NIL group (*n* =12) was triple of that of the EXP group (*n* = 4). Most of the NIL respondents regarded yoga as an exercise, two NIL participants commented:

"I think…this (the effect of practice yoga) would be more or less the same as the effects of doing other exercise...I think (practicing) yoga may be good for my immune system and other parts of my body…"

[Female, 49 years old, no yoga experience]

"About (disease) prevention…I think yoga is an exercise, regular exercise can strengthen my body…Making my muscle stronger and bones better, so when I get older later, I may not have too many health problems."

[Female, 59 years old, no yoga experience]

On the contrary, the EXP participants were able to share their experiences in a more specific way, an EXP participant described how yoga helped remedy her body condition:

"Degenerations were found in some of my spine…I have poor neck muscular strength…My doctor always advices me to do some exercises to help improve the situation…discomforts might occur when I did those exercises… But now (after practicing yoga), some yoga poses reminded me to maintain a proper posture… I can control my muscle better than before and have greater muscle power to maintain a proper posture without pain."

[Female, 55 years old, practicing yoga for three months]

Theme 3: Enhancement of physical fitness components

The researcher categorized 113 responses (EXP: 76 responses; NIL: 37 responses) into Theme 3. Participants of both EXP and NIL groups perceived enhancing effects of yoga practice on three health-related physical fitness components (i.e. flexibility, muscular strength and endurance, and body composition) and two skill-related physical fitness components (i.e. balance and agility). The EXP participants experienced improvement in some of the physical fitness components and other benefits:

"To me…yoga is a moderate exercise… During this three-year practice, yoga has improved...Especially my flexibility and balance…I feel that I'm stronger and healthier than before…Also, it (yoga) is a very good stretching exercise!"

[Male, 51 years old, practicing yoga for three year]

"I found it (yoga practice) helped me lose my weight! I've my waist circumference reduced, and I now can wear those trousers that I bought before I had put on weight! I've got a better body shape…Some (yoga) poses require quite a lot of arm strength and endurance, these (yoga poses) help me train my arms (muscular strength and endurance of my arms)…"

[Female, 48 years old, practicing yoga for two years]

"Better flexibility" was the most cited response in Theme 3, many NIL participants commented people who practice yoga regularly were very flexible, a NIL participant stated:

"I always go to the fitness centre…I see other practice yoga in the centre…I found those practice yoga folded themselves easily! They can fold (the upper body) forward and their noses can touch their thighs! I think practice yoga can improve the flexibility! I am very stiff and I hope that I can be more flexible by yoga practice."

[Female, 59 years old, no yoga experience]

Table 50

Participants' Responses in Perceived Benefits of Yoga on Physical Health (N = 86)

Responses		EXP (*n* = 42) No. of responses	EXP (*n* = 42) No. of respondents	NIL (*n* = 44) No. of responses	NIL (*n* = 44) No. of respondents
Perceived physical health benefits		367		169	
Health promotion		**267**		**116**	
1. Musculoskeletal system related [a]		*112*		*36*	
1.	Reduced muscle tightness	45 (40.2%)	21	11 (30.6%)	10
2.	Resolved joint problems	26 (23.2%)	15	7 (19.4%)	7
3.	Reduced back pain	22 (19.6%)	10	6 (16.7%)	4
4.	Improved musculoskeletal system	11 (9.8%)	9	10 (27.8%)	7
5.	Rehabilitation exercise for musculoskeletal injuries	3 (2.7%)	3	2 (5.6%)	2
6.	Resolved muscle sore	5 (4.5%)	4	0 (0.0%)	0
2. Cardiorespiratory system related		*32*		*15*	
1.	Improved blood circulation	16 (50.0%)	11	10 (66.7%)	9
2.	Improved breathing control	16 (50.0%)	7	5 (33.3%)	5
3. Promoting physically active lifestyle		*20*		*7*	
1.	Considering yoga is not a vigorous exercise that older/sedentary people were able to sustain	10 (50.0%)	8	4 (57.1%)	4
2.	Fewer perceived barriers of yoga practice	10 (50.0%)	9	3 (42.9%)	3
4. Other physical health benefits [a]		*103*		*58*	
1.	Enhanced quality of sleep	29 (28.2%)	17	14 (24.1%)	12
2.	Improved overall physical health status	14 (13.6%)	12	24 (41.4%)	14
3.	Better body shape	7 (6.8%)	6	11 (19.0%)	5
4.	Improved digestive system	9 (8.7%)	6	6 (10.3%)	4
5.	Injury prevention	5 (4.9%)	3	3 (5.2%)	2
6.	Better posture	18 (17.5%)	7	0 (0.0%)	0
7.	Improved body awareness	7 (6.8%)	5	0 (0.0%)	0
8.	Improved renal function	5 (4.9%)	4	0 (0.0%)	0
9.	Enhanced sports performance	4 (3.9%)	3	0 (0.0%)	0
10.	Improved menstrual symptoms	3 (2.9%)	2	0 (0.0%)	0
11.	Reduced risk of falls and injuries from falls	2 (1.9%)	2	0 (0.0%)	0
Disease prevention [a]		**24**		**16**	
1.	Improved immune response	5 (20.8%)	4	14 (87.5%)	12
2.	Prevention of back pain	6 (25.0%)	4	1 (6.3%)	1
3.	Prevention of heart diseases	2 (8.3%)	2	1 (6.3%)	1
4.	Improved lipid profiles	7 (29.2%)	3	0 (0.0%)	0
5.	Prevention of hypertension	2 (8.3%)	2	0 (0.0%)	0
6.	Prevention of hyperglycaemia	2 (8.3%)	1	0 (0.0%)	0
Enhancement of physical fitness components [a]		**76**		**37**	
1.	Better flexibility	32 (42.1%)	16	20 (54.1%)	16
2.	Increased muscular strength and endurance	16 (21.1%)	12	5 (13.5%)	4
3.	Improved body composition	12 (15.8%)	7	5 (13.5%)	4
4.	Better balance	12 (15.8%)	8	3 (8.1%)	2
5.	Better agility	4 (5.3%)	4	4 (10.8%)	3

[a] The total percentage does not sum to exactly 100% due to round-off error.

EXP individuals who had practice yoga for at least three months

Nil individuals who had never practiced yoga

6.3.2.2 Perceived Benefits of Yoga Practice on Mental Health

Participants' responses in perceived benefits of yoga practice on mental health are summarized in Table 51. A total of 204 raw responses (EXP: 123 responses; NIL: 81 responses) were condensed from the discussion of the participants in the 14 focus groups. On average, each EXP participant gave 2.9 responses and each NIL participant gave 1.8 responses. The total number of responses given by the EXP participants was about 1.6 times more than by the NIL participants. Also, the EXP participants perceived two more kinds of mental health benefits than the NIL participants (listed in Table 51). The EXP participants and the NIL participants perceived the mental health benefits of yoga practice in similar ways.

Participants perceived a wide range of mental health benefits of yoga practice as listed in Table 51. "Relaxing the mind", "increased calmness", and "reduced stress" were the frequently noted perceived mental health benefits by participants regardless of their yoga experience. One EXP participant shared how she applied the breathing skill acquired in yoga practice to her daily life:

"I felt relaxed after attending yoga class…The abdominal breathing is very applicable! Even I'm not attending yoga class, when I feel very nervous, I will use abdominal breathing to help me…Abdominal breathing did make me feel better…When I was stressed…I felt muscles near my neck and shoulder tightened…I then applied abdominal breathing…After a while of breathing in this way, I felt more calm…and relaxed…"

[Female, 41 years old, practicing yoga for four months]

Another EXP participant expressed how yoga practice improved her mental health:

"One year ago, I found that my stress at work was too great that I was not able to stand by anymore…I was not able to sleep at night…I quitted my job as my doctor said if I failed to relax myself, he would prescribe me some psychiatric medications…I don't want to take any medications…So I searched any ways could help me…Since then I practice yoga everyday, I don't know how to explain these changes…but once I sit on the yoga mat, I feel calm…I feel relax and comfortable when I practise yoga! Especially performing "corpse pose", I can completely immerse myself…feeling of lightness and peace…I'm so relaxed that I always fall asleep when performing this pose, and my yoga teacher needs to wake me up!"

[Female, 58 years old, practicing yoga for one year]

One EXP participant considered yoga as a "mind-body exercise" and noted how yoga helped her balance her mind and body:

"I think yoga improved my balance and agility…Second (improvement) is concentration, I'm piano teacher and practice yoga everyday for hours…indeed, playing piano requires very high concentration, and I feel quite tired mentally…When I feel tired (after playing piano), I practice yoga for a while. I found my mind relaxed during practicing yoga, and bodily movements of yoga allow my brain to take a break…I feel refreshed after yoga practice…I think mind and body are interacting with each other, and once you got the balance (of mind and body), you can work for hours with high concentration."

[Female, 46 years old, practicing yoga for six months]

Table 51

Participants' Responses in Perceived Benefits of Yoga on Mental Health (N = 86)

Responses		EXP (*n* = 42)		NIL (*n* = 44)	
		No. of responses	No. of respondents	No. of responses	No. of respondents
Perceived mental health benefits [a]		123		81	
1.	Relaxing the mind	26 (21.1%)	16	18 (22.2%)	10
2.	Increased calmness	18 (14.6%)	11	12 (14.8%)	7
3.	Reduced stress	14 (11.4%)	11	10 (12.3%)	7
4.	Increased vitality	11 (8.9%)	6	12 (14.8%)	5
5.	Improved concentration	9 (7.3%)	6	6 (7.4%)	5
6.	Improved overall mental health	6 (4.9%)	5	11 (13.6%)	6
7.	Spiritual growth	10 (8.1%)	6	4 (4.9%)	4
8.	Improved mood	13 (10.6%)	7	2 (2.5%)	2
9.	Balancing mind and body	6 (4.9%)	5	3 (3.7%)	2
10.	More optimism	2 (1.6%)	1	3 (3.7%)	2
11.	Less competitive spirit	5 (4.1%)	3	0 (0.0%)	0
12.	Opportunity to socialize	3 (2.4%)	3	0 (0.0%)	0

[a] The total percentage does not sum to exactly 100% due to round-off error.
EXP individuals who had practice yoga for at least three months
Nil individuals who had never practiced yoga

6.3.3 Perceived Barriers of Yoga Practice

Participants' responses in perceived barriers of yoga practice were coded and analyzed as meaningful units and categorized into themes and sub-themes. A total of 260 raw responses (EXP: 122 responses; NIL: 138 responses) were condensed from the discussion of the participants in the 14 focus groups. On average, each EXP participant gave 2.9 responses and each NIL participant gave 3.1 responses. Majority of the EXP participants shared their barriers in continuing their yoga practice, whereas the NIL participants noted their difficulties in initiating their practice. The NIL participants gave more responses than the EXP participants.

These 260 raw responses on the perceived barriers of yoga practice were classified into following themes: 1) time, 2) adverse effects, 3) cost, and 4) negative preconceptions. The participants' responses in perceived barriers of yoga practice are presented in Table 52.

Theme 1: Time constraints

A total of 39 responses (EXP: 19 responses; NIL: 20 responses) were categorized into Theme 1. Some participants of the EXP group and the NIL group reported that they were busy at work or for further study (n = 8, for each group) and had to look after their children (n = 3, for each group), therefore, it was difficult for them to continue or initiate yoga practices. Both EXP and NIL participants addressed that the time constraints was not only a barrier of yoga practice, but also a barrier of doing other kinds of exercises:

"I am too busy at work, I don't do any exercises!"
[Female, 56 years old, no yoga experience]

"(Busy at) Work and also (looking after) my daughter… I'm too tired to do any exercises, I just want to sit down to watch TV and rest…"
[Female, 47 years old, four months]

Theme 2: Adverse effects

There were 23 responses (EXP: 9 responses; NIL: 14 responses) were categorized into Theme 2. The number of the NIL respondents (*n* = 13) is nearly twice as many as the number of the EXP respondents (*n* = 7). Injuries during yoga practice reported by news or friends scared off some NIL respondents (*n* = 7) from yoga practice. Furthermore, the NIL respondents (*n* = 6) described yoga practice was a dangerous activity, and they worried that their joint problems would be worsen when practiced yoga. One NIL participant was shocked by her colleague's experience:

"My colleague practiced yoga in yoga centre… One day, she wore a cervical collar at work, and I asked her what had happened. She told me that she got injured during (yoga) practice, I'm scared (off by my colleague's experience)!"

[Female, 49 years old, no yoga experience]

Though none of the EXP participants believed that yoga practice would worsen their health situations, a few of the EXP participants (*n* = 4) reported that they got minor muscle injuries during yoga practice. Such sprain occurred when performing balancing poses or strain occurred due to over-stretching the muscles. One EXP participant reported her injury occurred in yoga practice and considered this as a good learning experience:

"I did hurt when (yoga) practice…I practiced at home, and I attempted to perform a pose that I was not quite confident with…I did that pose successfully…but then I wanted to stretch much deeper than I could do…indeed I shouldn't do so as I knew that I couldn't stretch further than I could do…But I didn't listen to my body and attempt to do so…so I hurted myself… In fact, my (yoga) teacher reminded us not to push ourselves further if we don't find it comfortable to do so for thousands times. Since then I know I should practice yoga in a more progressive way, and pay more attention to my body."

[Female, 42 years old, practicing yoga for three years]

Theme 3: Cost

Across the discussion groups, eight NIL participants expressed that they hesitated to start yoga practice because they found that taking yoga class at yoga centres or fitness centres were too expensive. None of the EXP participants indicated that cost was a perceived barrier of yoga practice.

A number of participants in both EXP and NIL groups showed their concern on the expenses of yoga practice in the long run. Participants were asked to briefly list out the expenses of yoga practice, comment on those expenses by stating if the expenses were affordable or expensive, and provide the amounts of those expenses if they knew. Nearly thirty percent of participants (EXP, n = 12; NIL, n = 13) indicated that yoga mats were necessary items for self-practice at home and which were affordable. Four participants (EXP, n = 1; NIL, n = 3) quoted the expense of a yoga mat ranged from $90 to less than $200 Hong Kong dollars. Only a few of the participants (EXP, n = 2; NIL, n = 1) commented that the clothing specially designed for yoga practice were costly, and six EXP participants expressed that those clothing were not worth buying because they believed that there were no difference in the effect of yoga practice between wearing sportswear and those specially designed clothing. Participants commented on the expense of taking a 1-hour yoga class in term of service providers. For the expense of taking yoga class offered by LCSD and community centres, some participants (EXP, n = 10; NIL, n = 3) expressed that the expense was affordable. LCSD and community centres offered yoga courses, which consist of weekly yoga class for several weeks, were paid in full for the whole course. Those 13 respondents estimated the expense of taking a 1-hour yoga class offered by LCSD and community centres were from 5 to100 Hong Kong dollars.

For the expense of taking yoga classes at yoga centres and fitness centres, participants frequently mentioned that the operation of most yoga centres and fitness centres made them hard to estimate the expense of taking a 1-hour yoga class at these kinds of studios. According to participants' discussions across the groups, many yoga centres and fitness centres offered yoga classes for their members. An individual is required to pay annual membership fee for taking yoga classes at the yoga centre for a year. Though participants failed to estimate the expense of taking a 1-hour yoga class as the number of yoga classes taken would be varied by individuals in this case, a number of participants (EXP, *n* = 7; NIL, *n* = 11) generally perceived that the membership fee was a huge expense. A NIL participant noted:

"Those studios…Some of my colleagues have joined, (the memberships of yoga centres) are expensive…You have to pay the annual membership fees in full or by credit card instalments…Either way is the same, you have to deposit a great amount of money when you start yoga practice! Let say…if I got injury after joining (the membership of the studios), and couldn't enrol any classes and I couldn't get back the amount I had already paid for…"

[Female, 28 years old, no yoga experiences]

Theme 4: Negative preconceptions

The researcher identified 197 responses (EXP: 94 responses; NIL: 103 responses) in Theme 4 which was further divided into three sub-themes, namely "negative impression of yoga", "obstacles in yoga practice", and "other negative preconceptions".

4.1 Negative impression of yoga

There were 44 raw responses (EXP: 11 responses; NIL: 33 responses) cited in this subtheme. The EXP participants perceived fewer negative impressions than the NIL participants (EXP: 2 impressions; NIL: 5 impressions). Across the discussion groups, some EXP participants expressed that many negative impressions of yoga were eliminated by deeper understanding of yoga after they have initiated their practice. This explained the reason for low number of the EXP respondents in this subtheme. "Female dominated" got the highest number of the EXP respondents (n = 4) in this subtheme and surprisingly there were no NIL respondents responding to this negative impression. A male EXP respondent expressed his impression of yoga practice:

"Men believe that yoga is "women only"…This is a trend that yoga is female dominated…You can see all those models in posters (of yoga centre) were woman!"
[Male, 59 years old, practicing yoga for four months]

Another female EXP respondent worked hard to persuade her husband to practice yoga with her, and she found this perception hindered some males from yoga practice:

"I found that promotion of yoga is not enough, most people in Hong Kong recognized that yoga is for women…This (preconception) made lots of men not try to practice yoga. Though many yoga teachers are men, still lots of men believe that majority of participants are women, and thus fewer men participate in yoga."
[Female, 43 years old, practicing yoga for six months]

The NIL participants had several negative impressions of yoga which discouraged them from yoga practice. Some participants believed that it was difficult to practice yoga (EXP, n = 2; NIL, n = 11), and a few of them found yoga was a challenging activity, especially for those lacking flexibility (EXP, n = 0; NIL, n = 5). A NIL respondent was scared off by the demonstrations of some advanced yoga poses:

"I found yoga is difficult (to practice), I saw some (yoga) demonstrations before, the demonstrators were able to lift their legs up to touch their heads! Very difficult!"
[Female, 47 years old, no yoga experience]

Another NIL respondent concerned that her poor flexibility would make her difficult to practice yoga:

"Because I'm too stiff, performing yoga pose would be painful for me, so hard for me. I think yoga is suitable for somebody who has got very good flexibility."
[Female, 26 years old, no yoga experience]

4.2 Obstacles in yoga practice

A total of 86 raw responses (EXP: 58 responses; NIL 28 responses) were identified in this sub-theme. Six obstacles in yoga practice were identified. One obstacle was cited by an EXP participant, i.e. lack of personal space for self-practice at home. The other five obstacles were cited by both EXP participants and NIL participants, including 1) high reliance on yoga teachers' guidance, 2) lack of self-motivation to practice yoga at home, 3) poor environment of practice venue, 4) difficulty for finding someone to accompany, and 5) difficulty for practicing yoga in mixed level yoga classes.

All EXP participants indicated that their first experiences of yoga practice were attending yoga classes. More than half of them (n = 26) addressed that they continued their practice by attending yoga classes, and some of them (n = 13) indicated that they practiced at home on their own sometimes, but they preferred taking yoga class to self-practice as they encountered several difficulties in self-practice. An EXP participant noted several obstacles that she faced when self-practice:

"I did practice at home…Indeed I fail to focus on my (yoga) practice…there are other family members at home, I seldom have personal time at home…My parents may disturb me…The time they don't disturb me is always the time I have to sleep! It (Home practice) can't compare with attending yoga class…you can practice yoga with others and also the environment…the music…the most important is that the yoga teacher will guide me…I don't need to think during practice just focus on my pose… I did think of being a qualified yoga teacher so that I plan the practice sequence for myself…However, when you practice…it is hard to remember the

sequence and I forget how to do the poses...So…I think it'd better to attend yoga classes and be guided by yoga teachers."

[Female, 48 years old, practicing yoga for two years]

For EXP participants with less yoga experiences, they expressed their needs of attending yoga classes, as they have not mastered the yoga poses, which they learnt from the classes, and they found the environment of the classes was more motivating. An EXP participant compared self-practice at home with attending yoga classes:

"It's important to have a teacher to guide me, as I don't know how to start with when I try to practice on my own…also I don't know if I perform the pose correctly, I'm worried to get hurt (during self-practice), I feel better with the teacher's guidance…It's more motivating to practice with friends…I'm lazy… if I prefer watching TV to self-practice…I need my teacher to push me!"

[Male, 49 years old, practicing yoga for six months]

Even though the NIL participants have no yoga experience, they also perceived some obstacles that the EXP participants perceived. A EXP participant and a NIL participant shared similar views on a yoga class designed for participants of all levels:

"I went to a fitness centre… A lots of people attended this (yoga) class, about 50 people practicing yoga in a room, and there was only one yoga teacher...I am a beginner, I need more attention from my teacher…The teacher demonstrated the pose, and we followed suit…She failed to take care all of us! It's just too many (students) for her…She just demonstrated poses and didn't care us even we were not able to follow…"

[Female, 47 years old, practicing yoga for nine months]

"I went to the yoga centre that my niece usually goes to, as I think that my niece go there, (the yoga centre is) it's reliable…When I went there, the staff advised me to take the same class with my niece. My niece has been practiced (yoga) for a period of time, but I have no yoga experience, I'm a beginner…How could I take the same class with my niece who practiced for long time? I thought that I couldn't follow… so at the end I didn't take the class in the studio…this experience scared me off!"

[Female, 47 years old, no yoga experience]

4.3 Other negative preconceptions

A total of 67 raw responses (EXP: 25 responses; NIL 42 responses) were identified in this sub-theme. The following five negative preconceptions were mostly discussed by participants of the EXP and the NIL groups: 1) negative impression to yoga centres, 2) insufficient knowledge about yoga, 3) negative impression to yoga teacher, 4) belief that it is difficult to find a "good" yoga teacher, and 5) failure in enrolling yoga classes provided by LCSD or community centres. The NIL group gave more responses to this subtheme than the EXP group as the number of respondents of each negative preconception in this subtheme of the NIL group was higher than that of the EXP group.

Among the five negative preconceptions, participants (EXP, *n* = 4; NIL, *n* = 11) frequently shared their negative impressions to yoga centres. Most of them mentioned that there were sudden closure of some yoga centres in Hong Kong, and many members of those yoga centres failed to have refunds for their prepaid membership fees of the yoga centres. Many participants showed their worries about the risk of loss due to sudden closure of yoga centres. Some of them found the sale techniques of yoga centres were annoying. Two NIL participants shared their views and experiences:

"I failed to find a yoga centre which suits me...well…I'm not sure if I will be interested in yoga…All (yoga centres) I found require me to join 1-year membership…I don't really know what yoga is, and (yoga centres) require me to pay (membership) for a year…this makes me feel bad…"

[Male, 34 years old, no yoga experience]

"My friend was a member of one yoga centre, she told me how bad those salespersons (of the yoga centre) were…She went there at daytime as there were lots of people at night…Though she bought the package (membership), she can't go at night as always "full house" at night…those salespersons were…they always asked my friends to take other packages like private classes, need to pay for extra amount (of money)…I don't like their sales techniques…they even called my friend sometimes for selling other packages to her...She told me that once she renewed the

membership for a few month, another salesperson called her to ask her to extend the membership for another two years…that's annoying!"

[Female, 53 years old, no yoga experience]

Some participants (EXP, *n* = 4; NIL, *n* = 9) indicated that they have difficulty in enhancing their knowledge about yoga and the lack of knowledge about yoga made them difficult to know what yoga was, which yoga styles were suitable for them, which service providers were reliable, and whether the yoga teachers qualified to teach. One EXP participant compared the development of yoga with the development of other sports in Hong Kong:

"I'm not sure if there's a yoga association which supervises all yoga centres or service providers, just like Hong Kong Football Association and Hong Kong Amateur Athletic Association [the researcher's note: these two associations are members of the Sports Federation and Olympic Committee of Hong Kong, China (SF & OC)]. Under the supervision of SF & OC, things could be more standardized and the source of information could be more reliable…I found there are lots of yoga styles and studios, everyone (studio) is the best one…I don't know how to differentiate all those information…I don't know how someone be qualified as a yoga teacher…where can I find a reliable yoga teacher?"

[Male, 53 years old, practicing yoga for three months]

Another NIL participant also shared on how insufficient of yoga knowledge hindered her to initiate yoga practice:

"I don't know how to get start (yoga practice)…many (service providers) were profit-making! Also, I don't know much about the yoga teacher qualification framework…I've better understanding about the qualification framework of other professions, but how's about yoga? I'm really not sure about it, I don't know which international or local organization is overseeing the (yoga) teacher qualification…How to know if someone is qualified to teach?"

[Female, 51 years old, no yoga experience]

With the concerns of the previous two negative preconceptions, some participants indicated that they preferred enrolling those yoga classes offered by reliable service providers with comparatively lower cost, such as LCSD or community centers, to those offered by private sectors. However, some participants expressed that they have negative impression toward yoga teachers (EXP, n = 3; NIL, n = 4), believed it was difficult to find a "good" teacher (EXP, n = 4; NIL, n = 2) in community centres, and failed to enrol in the classes offered by LCSD. One EXP participant shared her dissatisfaction toward a yoga teacher and her disappointment in seeking a "good" teacher:

"Well…those yoga centres which listing the qualifications of the yoga teachers are relatively expensive…I can't afford that much…So I tried those classes offered by a community centre…but the experience was terrible! The teacher asked us to take a rest after we performed one pose all the time! Well…most of the classmates were middle aged, but doesn't mean that we need to "rest" so frequently…"

[Female, 48 years old, practicing yoga for nine months]

A NIL participant cited the barriers that made her failed to initiate her yoga practice:

"We can't enrol those (yoga classes) offered by LCSD as the places are allocated by balloting! For example, you may successfully enrol this time, but you may not be so lucky to enrol next time… I haven't practiced yoga before, some of my colleagues who practiced yoga before, they are joining those classes in community centres which consist of students with mixed-levels! People like me (no previous yoga experience) may find it (those classes) hard to follow… Those private yoga centres do offer classes with different levels, for beginner, intermediate, and advance, but those (yoga centres) require people to pay for one-year membership fee…um…I'm not sure if I'm capable to practice yoga or interested in yoga…"

[Female, 56 years old, no yoga experience]

Table 52

Participants' responses in Perceived Barriers of Yoga Practice (N = 86)

Responses	EXP (n = 42) No. of responses	EXP (n = 42) No. of respondents	NIL (n = 44) No. of responses	NIL (n = 44) No. of respondents
Perceived barriers of practising yoga	124		138	
Time constraints	**19**		**13**	
Busy for work/study	16 (84.2%)	8	8 (61.5%)	8
Child care demand	3 (15.8%)	3	5 (38.5%)	3
Adverse effects	**9**		**14**	
Injuries arose from practicing yoga reported by the media or friends	3 (33.3%)	3	8 (57.1%)	7
Being injured during practice	6 66.7%)	4	0 (0.0%)	0
Belief that it will worsen joint problems	0 (0.0%)	0	6 (42.9%)	6
Cost	**0**		**8**	
Classes at yoga centres or fitness centers	0	0	8 (100%)	8
Negative preconceptions	**96**		**103**	
1. Negative impression of yoga	*13*		*33*	
Female dominated	9 (69.2%)	4	0 (0.0%)	0
Belief that it is difficult to practice yoga	2 (15.4%)	2	17 (51.5%)	11
Belief that it is too religious	2 (15.4%)	1	2 (6.1%)	2
Challenge for individuals who are not flexible	0 (0.0%)	0	9 (27.3%)	5
Boring activity	0 (0.0%)	0	4 (12.1%)	2
Insufficient intensive in term of physical activity	0 (0.0%)	0	1 (3.0%)	1
2. Obstacles in yoga practice	*58*		*28*	
Lack of personal space for self-practice at home	14 (24.1%)	8	0 (0.0%)	0
High reliance on yoga teachers' guidance	13 (22.4%)	7	6 (21.4%)	4
Lack of self-motivation to practice yoga at home	9 (15.5%)	7	2 (7.1%)	2
Poor environment of practice venue (e.g. dirty, noisy, crowd)	12 (20.7%)	7	2 (7.1%)	2
Difficulty for finding someone to accompany	4 (6.9%)	3	8 (28.6%)	6
Difficulty for practicing in mixed level yoga classes	6 (10.3%)	4	10 (35.7%)	4
3. Other negative preconceptions [a]	*25*		*42*	
Negative impression to yoga centres (e.g. sudden closures, payment options of membership fee)	6 (24.0%)	4	18 (42.9%)	11
Insufficient knowledge about yoga (e.g. style of yoga and qualifications framework of yoga teacher)	5 (20.0%)	4	12 (28.6%)	9
Negative impression to yoga teacher	3 (12.0%)	3	6 (14.3%)	4
Belief that it is difficult to find a "good" yoga teacher	5 (20.0%)	4	3 (7.1%)	2
Failure in enrolling yoga classes provided by LCSD	6 (24.0%)	3	3 (7.1%)	3

[a] The total percentage does not sum to exactly 100% due to round-off error.
EXP individuals who had practice yoga for at least three months
Nil individuals who had never practiced yoga

6.4 Summary

Study Two aims to explore the motivations, perceived benefits and barriers of yoga practice of individuals with and without yoga experience. There were 86 participants in this study, of which 42 had participated in yoga for at least three months (the EXP participants) and 44 had no yoga experience in practising yoga (the NIL participants). The participants of the study took part in one of the 14 focus group sessions to discuss their motivation, perceived benefits and barriers of yoga practice. Participants' responses in the subject matters were coded and analyzed as meaningful units and categorized into themes and sub-themes. Major findings of Study Two were highlighted in Figure 6.

Findings of the study indicated that motivations for initiating yoga practice included participants' concerns on physical health and emotions, yoga information from mass media, and yoga practice experiences shared from relatives, friends, and health professionals. Perceived health benefit was the major reason for EXP participants to continue their yoga practice.

Regardless of the yoga experiences, both EXP participants and NIL participants addressed a wide range of perceived health benefits. The health benefits were classified into physical health benefits and mental health benefits. Participants believed that yoga practice could improve their physical health by having beneficial effects on different body systems, promoting physically active lifestyle, preventing diseases, and enhancing some physical fitness components. Participants also found yoga practice beneficial to various aspect of mental health. The most recognised benefits included stress reduction and senses of relaxation, calmness, and vitality.

Differences in perceived barriers of yoga practice between participants with different yoga experiences were noted, with the NIL participants perceiving more barriers than the EXP participants. The NIL participants had a number of negative impressions to yoga and the operation of yoga centre. They believed that yoga was a challenging activity, and the adverse effects of yoga scared off them from initiating yoga practice. The EXP participants encountered many obstacles in continuing their yoga practices, especially they had difficulties in self-practice and were highly relied on yoga teachers' guidance.

Though growing evidence suggested that yoga was beneficial to various aspects of physical health and mental health, qualitative evidence in researching the motivation, perceived benefits and barrier of yoga practice was limited. The findings of the current study addressed the important role of qualitative studies in researching the effects of yoga, and the findings are discussed in more detail in Chapter 7.

<u>Motivations of initiating and continuing yoga practice</u>

- Physical health concerns
- Word of mouth
- Mass media
- Emotional concerns

<u>Perceived benefits of yoga practice</u>

Physical health benefits:

- Health promotion
    - Improve various body systems
        - Musculoskeletal system
        - Cardiorespiratory system
        - Digestive system
        - Renal function
    - Promoting physically active lifestyle
        - Fewer perceived barriers
        - Less physically challenge for sedentary individuals
    - Other benefits
        - Enhancing sleep quality
        - Better body shape
        - Better posture
- Disease prevention
    - Improved immune response
    - Prevention of back pain
    - Prevention of heart diseases
- Enhancement of physical fitness components
    - Health-related
        - Flexibility
        - Muscle strength and endurance
        - Body composition
    - Skill-related
        - Balance
        - agility

Mental health benefits:

- Relaxation
- Calmness
- Stress reduction
- Increased vitality
- Improved concentration
- Spiritual growth
- Improved mood
- Balance mind and body

<u>Perceived barriers of yoga practice</u>

- Time constraints
    - Busy for work/study
- Adverse effects
    - Injuries arose from yoga practice
- Cost
    - Expensive classes at yoga centres or fitness centers
- Negative preconceptions
    - Difficult to practice
    - Lack of personal space for self-practice
    - Lack of motivation to practice yoga at home
    - Poor environment of practice venue
    - Negative impression to the operation of yoga centres
    - Insufficient knowledge about yoga

Figure 6. Major findings of Study Two

CHAPTER 7 DISCUSSION OF STUDY TWO

Study Two, a qualitative study, was conducted to explore the motivations, perceived benefits and barriers of yoga practice of individuals with and without yoga experiences. This chapter discusses the findings of Study Two and consists of six sections. The first section discusses the participant recruitment and the participants' characteristics of the study. The second section consists of three subsections, which discuss the motivation, perceived benefits and barriers of yoga practice, respectively. The third section discusses the limitations of this study, particularly focuses on the methodological problems. The fourth and fifth sections discuss the implications of Study Two findings and the recommendations for future research. Finally, the last section is a summary the discussion of Study Two.

7.1 Study Two Participants' Recruitment and Characteristics

Participants of Study Two were purposively selected based on the criteria that were described in Section 3.4.3. Purposive sampling was used in Study Two because it was difficult to randomly recruit participants to join a 1-hour discussion on a topic that they might not be interested in. The researcher has attempted to recruit the participants from all walks of life by mass-mailing (as described in Section 3.4.5), but it was likely to have individuals who were health-conscious and interested in yoga to join Study Two.

According to the results presented in previous chapter (Section 6.2), the EXP and the NIL groups had significant differences in the three demographic characteristics, which included age, education level and occupation. Though demographic differences existed, the two groups shared similar views on motivations of yoga practice. The EXP participants had more perceived benefits as compared to the NIL participants. This might be due to their difference in yoga experiences. Since the EXP participants had actual yoga experiences, they had deeper understanding toward yoga and were able to prevent more in-depth information during the discussions. On the contrary, the NIL participants, without firsthand yoga experience, perceived yoga practice beneficial was based on the information received from mass media, health professionals, and relatives and friends who practiced yoga before. Thus, information provided by the NIL participants was comparatively superficial. Results of Study Two found that the NIL participants perceived more barriers than the EXP participants. This may arise from the three demographic differences or other personal characteristics that have not been compared across participants, or both.

7.2 Findings of the Central Questions of Study Two

The findings responding the three central questions of Study Two (described in Section 1.4) were presented in Section 6.3, and are discussed in the following three subsections: 7.2.1 Motivations of Yoga Practice, 7.2.2 Perceived Benefits of Yoga Practice, 7.2.3 Perceived Barriers of Yoga Practice. Findings of Study Two and previous evidence will be compared in each subsection.

7.2.1 Motivations of Yoga Practice

Central Question 1
What are the motivations for yoga practice? Do individuals with and without yoga experience have different reasons for initiating yoga practice?

The Study has revealed that the reasons for initiating yoga practice of individuals with and without yoga experiences included physical health concerns, word of mouth, mass media, and emotional concerns. Positive yoga experiences of the NIL participants' relatives, friends, and health professionals helped motivate the NIL participants to initiate yoga practice. On the other hand, the EXP participants usually initiated and continued their yoga practice as they considered yoga as a rehabilitation of musculoskeletal injuries or as a complementary and alternative therapy for treating their chronic health problems, which they found traditional therapies were not effective. Similar findings were found in existing literature (Atkinson & Permuth-Levine, 2009; Danhauer et al., 2008). Regardless of yoga experience, participants believed that yoga was a physical exercise and regular yoga practice would enhance their physical health and that was in line with a local survey (LCSD, 2012). The results of the local survey indicated that majority of Hong Kong adult samples took part in sporting activities for health promotion or disease prevention or cure (LCSD, 2012). Though growing literature suggested various beneficial effects of yoga practice, more solid research based evidence are needed for promoting yoga practice at local community level.

7.2.2 Perceived Benefits of Yoga Practice

> ***Central Question 2***
> *How do individuals with and without yoga experience perceive the benefits of regular yoga practice? Do they perceive differently?*

As mentioned in Section 7.1, the EXP participants presented more information and further detail about perceived benefits as compared to the NIL participants. Both findings from a previous qualitative study (Atkinson & Permuth-Levin, 2009) and the present study indicated that yoga was generally considered as a physical exercise. The present study identified larger number of perceived health benefits than that of Atkinson and Permuth-Levin (2009), this might be due to the larger sample size of the current study.

This qualitative study classified the identified yoga benefits into physical health-related and mental health-related benefits. For physical health-related benefits, Study Two identified three major functions of yoga, which included health promotion, disease prevention, and enhancement of physical fitness components. The participants generally believed regular yoga practice like other forms of exercises could improve one's health status and physical fitness, and help prevent diseases. Most identified physical health benefits of yoga practice in this study were also benefits of other exercises, but some benefits were worth discussing. Within health promotion context, musculoskeletal system related benefits were most noticeable. Both EXP participants and NIL participants generally considered yoga as an effective way to improve the musculoskeletal functioning; some regarded yoga as a treatment, even though they did not use the terms of "therapy" or "treatment" to describe their application of yoga during the focus group discussions. These qualitative findings were consistent with the findings of other quantitative studies, which suggested that yoga relieved the distress and perceived pain for individuals with different musculoskeletal problems (Bosch et al., 2009; Groessl et al, 2008; Hartfiel et al., 2012; Sherman et al, 2005; Tekur et al, 2008). The US survey also reported the high prevalence of yoga use for improving health conditions, particularly treating neck or back pain (Saper, Eisenberg, Davis, Culpepper, & Phillips, 2004). More and stronger evidence is needed in order to support the application of yoga in dealing with different musculoskeletal problems.

Though previous evidence suggested that yoga represented low levels of physical activity and did not meet recommendations for levels of physical activity for improving or maintaining health or cardiovascular fitness (Hagins, Moore, & Rundle, 2007), EXP participants experienced cardiorespiratory related improvement through regular yoga practice. They believed that yoga practice could help improve their blood circulation, because they did not feel tired easily when performing daily activities and were able to sustain in exercise for longer duration. Also, they believed that the breathing techniques learnt from yoga class, together with improved posture through yoga practice, helped them to breathe deeper than before. Further investigation of the effect of yoga on cardiorespiratory system is needed to enhance the understanding of this subject area.

Health promotion benefits were not limited to improvement in various conditions and functioning of different parts of the body, yoga practice was found to promote physically active lifestyle. The participants also perceived that there were fewer environmental barriers in yoga practice as compared to other sporting activities. Those participants, who were sedentary or middle-aged, or both, preferred low-to-moderate activities such as yoga to vigorous sporting activities such as running and ball games. The findings were in line with those found in the local survey (LCSD, 2012). It was found that young adults frequently participated in ball games and running or jogging, whereas the elderly preferred less physical demanding activities such as walking. Change of health status was the main concern or barrier in physical activity participation for older people (Government of Western Australia, 2013). It is notable that appropriate sporting opportunities which meet the individuals' concerns are the key of success in promoting physical active lifestyle.

For mental health-related benefits, both EXP and NIL participants generally perceived that yoga helped improve their psychological well-being, particularly they might feel more relax and calm, and reduce stress. Although a few participants described yoga as "mind-body-spirit activity" or "mind-body exercise", EXP participants presented some psychophysiological changes during practicing yoga. For instance, they adopted yoga breathing technique to help relax their mind, and performed yoga poses to reduce stress-induced muscle tightness. The psychophysiological changes that experienced by the participants might imply that the participants perceived the linkage between mind, body, and even spirit.

The quantitative findings of Study One were not consistent with the qualitative findings of Study Two. For example, there were no significant differences in the changes of perceived stress and vitality domain of HRQoL between the yoga and the control groups in Study One, whereas Study Two participants suggested that yoga can help reduce their stress and increase their vitality; there was a significant improvement in social functioning domain of HRQoL in Study One, yet only a few response of Study Two suggesting yoga practice provide an opportunity to socialize. The Further studies are needed to have more understanding of the discrepancies in the results found between Study One and Study Two. Also, Study Two participants addressed many mental health benefits of yoga practice, and some psychological variables such as calmness, mood state and concentration were not assessed in Study

One. Future research may adopt psychological instruments to assess other psychological variables quantitatively in order to confirm the qualitative findings and increase the confidence of the use of the current qualitative evidence.

7.2.3 Perceived Barriers of Yoga Practice

Central Question 3 *How do individuals with and without yoga experience perceive the barriers of regular yoga practice? Do they perceive differently?*

This qualitative study suggested that the participants encountered four major barriers of yoga practice, including time constraints, adverse effects, cost, and negative preconceptions. The barriers identified in the present study were slightly different from those found in other studies on yoga (Atkinson & Permuth-Levine, 2009) and physical activity (Daskapan, Tuzun, & Eker, 2006; Government of Western Australia, 2013).

Though lack of time was the most frequently reported barriers of physical activity participation in existing literatures (Daskapan, Tuzun, & Eker, 2006; Government of Western Australia, 2013), the negative preconceptions were the most frequently reported barriers in the present study. The participants were health-conscious and were willing to spend time on participating in activities that could enhance their health status. Reports from news and experiences of relatives and friends about the adverse effects of yoga practice raised participants' concern of the safety issue of yoga practice.

The EXP participants had fewer participation barriers than the NIL participants, and majority of the barriers were the obstacles that affect their continuation of yoga practice. EXP participants found difficulty in practicing at home. Those with fewer yoga experiences relied heavily on teachers' guidance. Therefore, participants generally practiced in yoga classes offered by LCSD, community centers, and yoga centres. But practicing at the above places was not a good option. The participants criticized the quality of the yoga classes, particularly in insufficient guidance from teacher, and the noisy and crowd environment due to large class size. Though yoga practice required small space (size of a yoga mat, about 180cm X 60cm), spacious and quiet environment could enhance the effects of yoga practice and the yoga participants were able to focus on their mind and stay away from distraction during practice. Hong Kong was one of the world's densest cities with a fast pace of life (Information Services Department, Hong Kong Special Administrative Region Government, 2013; Taylor, Inclan-Valadez, Yip, Chak, & Leung, 2011), it was difficult for people to escape from the crowd and noisy environment to achieve "peace of mind" in daily life.

NIL Participants addressed wide range of negative preconceptions of yoga practice. Belief that practicing yoga is difficult, negative impression to yoga centres, and insufficient knowledge about yoga were the three most frequently addressed barriers among NIL participants. Demonstrations of yoga in mass media were one of the major sources of information about yoga that NIL participants received. Demonstrators showed their high flexibilities when executing yoga poses. The participants might perceive that yoga was intended for those who were already with high body flexibility, and hesitate to initiate yoga practice due to this preconception. High flexibility is not the prerequisite of practicing yoga, on the contrary, improved flexibility is the notable benefit of regular yoga practice (Chen et al., 2008; Cowen & Adams, 2005; Gothe & McAuley, 2012; Lau et al., 2012). Further information of yoga, particularly on the principles of yoga, should be complemented with yoga demonstrations in order to reduce the public's misconceptions.

NIL participants had very negative impression toward yoga centres that greatly reduced their confidence of enrolling yoga classes in yoga centres. Their negative impression was understandable because the successive closure of yoga centres and the undesirable sales practices of yoga centres and fitness centres were frequently reported in the recent years (Consumer Council, 2008, 2010, 2011a, 2011b). It is suggested that reinforcement of government's supervision of the business operation of private service providers is needed to protect the participants from financial loss, and related stakeholders should make effort to establish good corporate images in order to rebuild the community's confidence.

Yoga has gained increasing popularity in Hong Kong, but it was not well understood by majority of the community. Many NIL participants did not initiate their yoga practice as they did not have sufficient knowledge of yoga. Though abundant information about yoga could be found on the internet, it would be difficult for those without basic knowledge of yoga to judge if the information was from quality and reliable resources. Moreover, there was neither an accreditation system nor authorized body monitoring yoga teacher qualifications in Hong Kong (Consumer Council, 2006). To date, there was no authorized body to govern the development of yoga in Hong Kong, convey reliable and comprehensive information of yoga to the community, and oversee the quality of yoga teachers. Experienced yoga practitioners should work closely to form a local authorized body, which makes effort to sustain and support the field of yoga.

7.3 Limitations of Study Two

Four potential methodological limitations of the study were addressed:

1. Participants' characteristics:

As discussed in Section 7.1, even though participants were recruited from the local community, individuals who enrolled this study might be health-conscious and have a preexisting interest in yoga. These characteristics might affect their responses towards matters discussed during the focus group discussions.

2. Unequal gender distribution of the sample:

Despite open participant recruitment, the number of female applicants was far more than the number of male applicants in both Study One and Study Two. Less than 25% of EXP participants (n = 10) and less than 10% of NIL participants (n = 4) were males in Study Two (see Section 6.2). With such a small number of male participants, the researcher failed to conduct a number of separate discussion groups for males and females that would be sufficient for reaching saturation of each theme. Therefore, the researcher failed to explore if there were any preexisting gender differences on the subject matters. With the difference in responding the recruitment of the study between males and females, the researcher believed that gender differences would exist in the subject matters, particularly in perceived barriers of yoga practice. However, a lack of male participants in Study Two hindered the exploration of their barriers of yoga practice.

3. Generalizability:

As the difficulty of employing random sampling was addressed in Section 7.1, purposive sampling was used in this study. Compared to other nonprobability sampling procedures, purposive sampling has less selection bias, better internal validity via homogeneous sampling, and the findings are more generalizable (Daniel, 2012; Morgan, 1997). But caution should be taken when interpreting the current findings because Study Two participants were largely females, therefore, the result of the study cannot be generalized to males.

4. Quality of the study

The researcher previously described the procedures for assuring the quality of Study Two (see Section 3.4.9) and pilot study for assuring feasibility of the study (see Section 3.4.10). Due to limited resources, both data collection and analysis were conducted by the researcher. Though existing literature has suggested that it would be beneficial for the transcripts to be coded by more than one person to avoid bias and subjectivity in analysis (Kvale, 1996; Reid, Burr, Williams, & Hammersley, 2008), facilitating the focus group discussions by a single researcher could help ensure consistency across the discussions and enable the researcher to develop an overall understanding of the data set (Malpass, Andrews, & Turner, 2009). These are the mechanisms adopted to assure the quality of this research.

7.4 Implications of the Findings of Study Two

Since the researcher adopted the concurrent triangulation strategy to address the research questions of the whole study, a quantitative method and a qualitative method were employed in Study One and Study Two, respectively. The qualitative method used in Study Two was able to offset some of the limitations of the quantitative method used in Study One. For example, the focus group discussion of Study Two allowed the participants to share their information in an open-ended format and the researcher was able to gain a deeper understanding of the participants' experiences and perceptions. Furthermore, the qualitative method was able to capture personal experiences and feelings, which could not be measured by the quantitative instruments used in Study One. Due to limited resources, it was not feasible to conduct an intervention study with longer duration (e.g. over one year) and to measure the effects of yoga longitudinally on many different aspects at a time. The focus group discussion offered a platform for participants who have practiced yoga for longer time to share their direct experiences. The positive qualitative feedback may enhance our understanding of the long-term effects of yoga practice and provide a stronger indicator of potential clinical significances of a yoga intervention for different populations with various health statuses.

Although anecdotal reports from the media are available, to our knowledge, Study Two is the first qualitative study that adopted focus group approach to explore the motivation, perceived benefits and barriers of yoga practice among Hong Kong adults with and without yoga experiences. The researcher conducted sufficient number of discussion groups for achieving saturation in each theme and the data were collected from a larger sample as compared to the existing literature (Atkinson & Permuth-Levine, 2009). Thus, Study Two findings were relatively more representative which could enhance the understanding of yoga practice in local community, and could be transferred to the communities that have similar prevalence and pattern of yoga use as Hong Kong. The results of this study provided detail information of the motivation, perceived benefits and barriers of yoga practice, all this information would enhance the policy makers' understanding of yoga practice, and be helpful for identifying the barriers of participation and developing strategic plan of promoting physical active lifestyle through yoga practice. To sum up, Study Two may serve as an important step for development and administration of long-term intervention studies and lifestyle modification in the future.

7.5 Recommendations for the Future Research

Though the current study recruited sufficiently large sample for reaching saturation of each theme, the gender distribution of sample was unequal. It is suggested that future research could recruit more male participants or solely male participants in order to explore any gender differences of the subject matters.

The present study recruited individuals with and without yoga experiences and merely compared the subject matters between these two groups. Future studies can explore if differences exist among individuals with different yoga experiences. For instance, novice, intermediate participants, and advanced participants (or yoga teachers) may have different reasons for them to continue their yoga practice, and face different difficulties in continuing their practice. With different mastery levels of yoga, they may have different perceived benefits that brought from regular yoga practice.

7.6 Summary

This chapter discussed the findings of Study Two that identified the motivation, perceived benefits and barriers of yoga practice of individuals with and without yoga experiences through focus group discussions. With limited previous qualitative evidence, the present findings add to growing literature on the benefits of yoga practice. The qualitative feedback may be helpful for policy makers in identifying the motivations and barriers of yoga practice and developing a strategic plan that may help promote physical active lifestyle through yoga practice. Notwithstanding the methodological limitations in the study, the large sample and sufficient number of discussion groups of the study made the present findings being representative and transferable to the similar social contexts. Differences in the motivation, perceived benefits and barriers of yoga practice between genders and across yoga experiences would be worth pursuing in further research. Study Two is not only a standalone qualitative study with its own clinical and practical significances, but also a component of the whole study, which adopted mixed method approach. The results of Study One and Study Two will be integrated and the implications of the whole study will be presented in the next chapter.

CHAPTER 8 CONCLUSION

This is the conclusion chapter of the whole study. The first section is an overview of the whole study. The second section discusses the implications of the whole study, which based on incorporating the findings of Study One and Study Two, and then makes related recommendations. The final section summarizes the implications of the study findings and suggests orientations for future research.

8.1 Overview of the Study

Physical inactivity is one of the main causes of major noncommunicable diseases and contributes substantially to the global burden of disease, death and disability. To reverse the trend towards inactivity, it is important to promote physical activities with low participation barrier and numerous benefits to encourage sedentary individuals to become physically active. Yoga has been increasingly popular and practiced as a low-to-moderate intensity physical activity in recent years. Yoga originated in India and its principle is to achieve the integration of body, mind, and spirit. Though increasing evidence suggests the beneficial effects of Hatha yoga on various health conditions, potential long-term effects of yoga on health are under-researched. Comparisons across many existing studies are limited by methodological problems. This study, which aimed to investigate the effects of yoga on physical and mental health quantitatively and qualitatively with the mixed methods approach, was conducted during 2010-2012. The study was composed of quantitative (Study One) and qualitative (Study Two) components, in order to address the research issue comprehensively and to generate a more thorough picture of the research topic.

Study One was conducted to investigate the physiological and psychological effects of a 12-week Hatha yoga program. The study recruited 173 Hong Kong Chinese (aged 34-71) to participated this study and assigned the participants to either the yoga group (n = 87) or the control group (n = 86). The yoga group participated in the 12-week Hatha yoga program (1-hour session/week), whereas the control group maintained their lifestyle as usual. Outcome variables of the study included metabolic risk factors, physical activity level, health-related physical fitness, cortisol level, psychological variables, and health-related quality of life. The primary analysis compared the changes of the outcome variables from baseline to post-intervention between the yoga and control groups of the whole study sample. The two subgroup analyses focused on samples with and without metabolic syndrome (MetS), respectively.

Findings of Study One revealed that the yoga intervention program has produced significantly beneficial effects on some metabolic risk factors including waist circumference, fasting blood glucose, triglyceride and MetS z score, health-related physical fitness, general health perceptions domain and social functioning domain of health-related quality of life ($p < 0.05$). However, results of Study One did not reveal any significant effects of the Hatha yoga program on physical activity level, cortisol level, and any of the psychological variables. Furthermore, results of the two subgroup analyses revealed that the yoga participants with MetS experienced more improvement in terms of the number of outcome variables than the yoga participants without MetS. The MetS yoga participants also experienced stronger beneficial effects than the non-MetS yoga participants when same outcome variables were compared.

Study Two was conducted to explore the perceived benefits and barriers of regular yoga practice and participation pattern of Hong Kong Chinese adults. Eighty-six participants, consisted of individuals who have practiced yoga for at least three months (EXP, *n* = 42) and individuals who had never practiced yoga (NIL, *n* = 44), were recruited for 14 focus groups discussions. Findings of Study Two indicated that motivations for initiating yoga practice included: participants' concerns on physical health and emotions, yoga information from mass media, relatives, friends, and health professionals. Perceived health benefit was the major reason for the EXP participants to continue their yoga practice. Regardless of the yoga experiences, Study Two participants addressed a wide range of perceived health benefits. They believed that yoga practice could enhance their physical health by having beneficial effects on different body systems, promoting physically active lifestyle, preventing diseases, and improving some physical fitness components. Participants also found yoga practice beneficial to different aspect of mental health, particularly stress reduction and promoting the senses of relaxation, calmness, and vitality. Differences in perceived barriers of yoga practice between participants with different yoga experiences were noted, with the NIL participants perceiving more barriers than the EXP participants. The NIL participants had more negative impressions of yoga than the EXP participants. The EXP participants, on the other hand, encountered some obstacles in continuing their yoga practices.

The current study adopted the mixed methods approach in attempting to integrate the quantitative and qualitative findings collected from Study One and Study Two for answering the research questions. Though Study One and Study Two had their own practical and clinical significances, further implications of the whole study could be addressed by incorporating the findings of Study One and Study Two together. These implications will be presented in the next section.

8.2 Implications of the Study and Recommendations

By integrating the findings of Study One and Study Two, the findings of the whole study could be addressed in a more comprehensive way and the implications of the whole study could be further expanded. The implications of the whole study and related recommendations were discussed as follows:

8.2.1 Disease Prevention and Potential Therapeutic Functions

The qualitative findings suggested a wide range of perceived health benefits of yoga practice. The participants believed that practising yoga regularly can strengthen the body and hence prevent diseases. Yoga practice was frequently noted for its therapeutic functions in treating different musculoskeletal problems. Practicing yoga on a regular basis might strengthen the musculoskeletal system, and thus reduce the risk of musculoskeletal injuries. The above findings were in line with the quantitative findings in existing literature.

Despite growing evidence showing the beneficial effects of yoga on various metabolic risk factors as discussed in Chapter 2 (Literature Review), the reliability of the evidence was limited by methodological problems. In our qualitative study, there were only a few participants perceiving yoga as a preventive measure for heart disease, hypertension and hyperglycaemia. Our quantitative study provided more solid and representative evidence about the effects of the yoga intervention on different metabolic risk factors. Significant reduction in waist circumference, systolic blood pressure, fasting blood glucose, triglyceride, and MetS z score were noted in the yoga group of Study One. We may conclude that yoga practice was an effective way in reducing waist circumference, systolic blood pressure, fasting blood glucose, triglyceride, and MetS z score. Consequently, yoga practice may be effective in reducing the severity of MetS. It is noteworthy for further investigation on the effects of yoga on the metabolic risk factors and the mechanisms underlying these effects.

8.2.2 Enhancement of Physical Fitness Components and Physical Functioning

The significant enhancing effects of the yoga intervention on the four health-related physical fitness components (body composition, cardiovascular endurance, muscular strength and endurance, and flexibility) revealed in our quantitative findings were supported with our qualitative findings. The improvement in muscular strength and endurance and flexibility were most noticeable. Study One findings indicated that the yoga intervention exhibited large-to-very large effects on these two components. The improvement of these two components were very obvious among participants in our qualitative study, and other extended benefits were also addressed, e.g. reduced muscle tightness, resolved musculoskeletal pain, enhanced sports performance, and better posture. The qualitative findings not only confirmed the quantitative findings, but also indicated that yoga practice may have further practical significance for individuals' health. The qualitative findings also added insight in the yoga effects on other physical functions such as agility, balance, and fall prevention. Future research is needed for determining the effects of yoga practice on other physical functions and the related effect sizes.

8.2.3 Improvement of Health-Related Quality of Life

The quantitative findings of Study One revealed that yoga intervention program could significantly improve some dimensions of HRQoL, including general health perception, bodily pain, and social functioning. Except social functioning, these findings were coincided with the qualitative findings of Study Two, which suggested that practicing yoga regularly could improve health status and reduce musculoskeletal pain. Increased confidence of findings of the whole study was resulted as the quantitative and qualitative findings of Study One and Study Two were mutually coincided. The whole study found that yoga might improve some dimensions of HRQoL of both individuals with and without MetS, whether yoga exhibited similar favorable effects on HRQoL to individuals with other ailments is warranted for future research.

8.2.4 Further Research for Psychological Effects of Yoga Practice

As discussed in Chapter 5, the quantitative findings revealed that the yoga effects on all psychological outcome measures (perceived stress, depression, state-trait anxiety, and global self-esteem) were non-significant, and one possible reason for this result was the short duration of the intervention. On the contrary, participants of the qualitative study addressed a diverse range of mental health benefits gained from yoga practice, particularly on stress reduction and relaxation. Together with the evidence from previous literature, future studies with longer duration of intervention period are needed for determining the effects of the yoga intervention on those psychological outcome measures. Moreover, it might not be feasible to evaluate many outcome measures quantitatively at a time, therefore, the qualitative study helped explore the possible effects of yoga on mental health. Further research could evaluate the effects of yoga practice on those psychological variables that were noted in the qualitative study, such as calmness and tranquillity, for advancing our understanding of the effects of yoga on mental health.

8.2.5 Gender Differences in Yoga Practice

In both Study One and Study Two, the number of female applicants was far more than the number of male applicants. It may be suggested that males may not be interested in yoga practice based on this observation. Potential gender differences in yoga practice may exist, such as perceived barriers of yoga practice identified in our qualitative study (e.g. "yoga is a female dominated activity"). Our study recruited a small number of male participants and those male participants might have pre-existing interest in yoga, thus our study failed to explore the reasons why males were not interested in yoga practice. Future qualitative research may recruit male participants to discuss their perception of yoga practice.

8.2.6 Feasibility and Sustainability of Yoga Practice

The high adherence and absence of adverse effects found in the present yoga intervention program suggested that it would be feasible to conduct a short-term yoga intervention program in the community, especially for sedentary and middle aged females.

From financial perspective, cost is one of the determinants of the feasibility and sustainability of a physical activity. High cost is a common perceived barrier of physical activity participation. For those who are novice to yoga practice, they may learn yoga in attending yoga classes, the tuition fee of a yoga program is certainly a financial concern. Also, self-practice at home may also incur expense on equipments for yoga practice. The qualitative findings of Study Two indicated that participants generally perceived the expenditure on yoga practice was affordable. The expense on tuition fees of yoga classes depended on the service providers. Our participants commented that the tuition fees of yoga programs offered by LCSD and the community centres were affordable. They also pointed out that self-practice at home did not require a lot of equipment, a yoga mat was the basic equipment for yoga practice and it was affordable. The qualitative finding of the present study may suggest that yoga is an affordable physical activity, its feasibility and sustainability are warranted.

From the public health perspective, it is more important to sustain exercise regularly to promote people's physical activity level and achieve active lifestyle in the long run. The qualitative findings of this study identified that yoga was considered as a low-to-moderate activity that older or sedentary individuals were able to sustain throughout the practice. This was also supported by high adherence of the quantitative study, of which the sample was largely middle-aged individuals. However, a number of environmental factors making yoga practice less sustainable were also identified in the present study, such as the noisy and crowd environment of yoga class due to large class size and lack of quiet and spacious environment at home for self-practice.

The present study added evidence of the feasibility and health benefits of a yoga intervention program. The related stakeholders should make effort to improve the sustainability of yoga practice in the community by overcoming the perceived barriers of yoga practice identified in the present study. Discussion among the related stakeholders and experienced yoga practitioners was needed in order to formulate a strategic plan to help reduce the participation barriers of yoga practice and increase the sustainability of yoga practice in the community.

8.2.7 Promotion of Yoga Practice in the Community

To promote yoga practice effectively, it is important to know the factors that motivated and hindered individuals to practice yoga. The present qualitative findings revealed that perceived health benefits of yoga practice and word of mouth were strong motivators of yoga practice, whereas a diverse range of negative preconceptions was the major factor discouraging people from initiating and continuing yoga practice. It is suggested that more information about yoga practice and its health benefits should be provided to the community so as to clarify any misconceptions about yoga practice in order to and motivate more people to practice yoga. The present study provided local evidence of health benefits of yoga practice that might increase the community's confidence of yoga use.

Though mass media can convey information to a large audience at a time, it might not be as persuasive as words of mouth. Our qualitative findings indicated that participants were motivated by words of mouth of family, friends and healthcare professionals. Healthcare professionals play a unique role of health promotion. People commonly trust professionals' advices, particularly to those directly influencing their health status. A local survey (Xue, Zhang, Holroyd, & Suen, 2008) indicated that healthcare professionals, such as nurses, had extensive interaction and communication with patients. These professionals' beliefs and personal experience with CAM appear to have a significant influence on their patients' uptake of different kinds of CAM for individual health needs, particularly in respect of disabling chronic diseases. Thus, healthcare professionals' recommendations of yoga use could be a powerful measure in promoting yoga practice in the community. More research evidence and actual yoga experiences should be provided to healthcare professionals in order to enlighten their understanding of yoga practice and raise their confidence in encouraging others to practice yoga for health promotion.

8.3 Conclusion

Physical inactivity is a global public health problem with enormous social cost. Growing evidences revealed the high prevalence of physical inactivity was found in both developed and developing countries. Strategic intervention including choosing appropriate activities is required to promote active lifestyle to the sedentary population in the community. Yoga has been well known as a CAM in India and western countries. Hatha yoga, the physical aspect of this ancient Indian philosophy, has now been widely practised as a low-to-moderate intensity exercise in many countries.

The present study determined the effects of Hatha yoga intervention on physical and mental health, and explored the motivation, perceived benefits and barriers of yoga practice. The beneficial effects of yoga on physical health have been solidly supported by both quantitative and qualitative data of the present study. Findings of the present study were also in line with existing evidence. The therapeutic potentials of yoga were reported in the present study, the clinical importance of yoga practice and the effects of yoga on different ailments are worth further researching. The quantitative and qualitative findings about the effects of yoga on mental health were not coincided. No beneficial effects of yoga on most psychological variables were found in our quantitative study, while our qualitative findings addressed that yoga might improve one's mental health, particularly help reduce stress and stay relax and calm. Since the positive psychological effects of yoga interventions have been widely suggested in previous literature, future research with longer intervention period is warranted for attempting to explain the inconsistent findings of the present study and determining the long-term psychological effects of yoga. Comparing the effects of yoga practice across the yoga styles is also suggested for obtaining a more comprehensive picture of the health benefits of yoga practice.

The present study added knowledge to the effects of yoga on physical and mental health of Hong Kong Chinese adults; it also deepened the understanding of participation pattern of yoga practice in Hong Kong. Findings of this study suggested that the beneficial effects of yoga practice and word of mouth were strong motivators for starting and continuing yoga practice. Individuals without yoga experience were discouraged from trying yoga practice as they perceived many negative preconceptions of yoga, whereas individuals with yoga experience perceived many obstacles when continuing their yoga practice.

High adherence of the present study might demonstrate the feasibility of conducting a yoga intervention for health promotion in the community, particularly desirable for sedentary or middle aged females. The favourable yoga effects found in the present study supported the use of yoga for health promotion and motivating active lifestyle through yoga practice. Experience in conducting a yoga intervention and better understanding of participation pattern of yoga practice gained from the present study may provide useful insight and guidance to related stakeholders when planning and organizing yoga programs and other physical activities that aim to enhance health and well-being in the community.

Reference

Allen, F. (1998). *Health Psychology: Theory and Practice*. St. Leonards: Allen & Unwin.

American College of Sports Medicine [ACSM]. (2010a). *ACSM's resource manual for guidelines for exercise testing and prescription* (6th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

American College of Sports Medicine [ACSM]. (2010b). *ACSM's guidelines for exercise testing and prescription* (8th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Atkinson, N. L., & Permuth-Levine, R. (2009). Benefits, barriers, and cues to action of yoga practice: A focus group approach. *American Journal of Health Behavior*, *33* (1), 3-14.

Barnes, P. M., Bloom, B., & Nahin, R. L. (2008). Complementary and alternative medicine use among adults and children: United States, 2007. *National Health Statistics Reports*, *December* (12), 1-23.

Berg, B. L., & Lune, H. (2012). *Qualitative research methods for the social sciences* (8th ed.). Boston: Pearson.

Bertisch, S. M., Wee, C. C., & McCarthy, E. P. (2008). Use of complementary and alternative therapies by overweight and obese adults. *Obesity*, *16* (7), 1610-1615. doi:10.1038/oby.2008.239

Bijlani, R., Vempati, R., Yadav, R., Ray, R., Gupta, V., Sharma, R., & ... Mahapatra, S. (2005). A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. *Journal of Alternative and Complementary Medicine*, *11* (2), 267-274.

Björntorp, P., & Rosmond, R. (2000). Neuoendocrine abnormalities in visceral obesity. *International Journal of Obesity*, *24* (Supp 2), 80-85.

Booth-LaForce, C., Thurston, R. C., & Taylor, M. R. (2007). A pilot study of a hatha yoga treatment for menopausal symptoms. *Maturitas*, *57*, 286-295.

Bosch, P. R., Traustadottir, T., Howard, P., & Matt, K. S. (2009). Functional and physiological effects of yoga in women with rheumatoid arthritis: A pilot study. *Alternative Therapies in Health and Medicine*, *15* (4), 24-31.

Bower, J. E., Garet, D., Sternlieb, B., Ganz, P. A., Irwin, M. R., Olmstead, R., & Greendale, G. (2012). Yoga for persistent fatigue in breast cancer survivors: A randomized controlled trial. *Cancer*, *118* (15), 3766-3775. doi:10.1002/cncr.26702

Bukowski, E. L., Conway, A., Glentz, L. A., Kurland, K., & Galantino, M. L. (2007). The effect of Iyengar yoga and strengthening exercises for people living with osteoarthritis of the knee: A case series. *International Quarterly of Community Health Education*, *26* (3), 287-305.

Cade, W. T., Reeds, D. N., Mondy, K. E., Overton, E. T., Grassino J, Tucker, S., … Yarasheski, K. E. (2010). Yoga lifestyle intervention reduces blood pressure in HIV-inflected adults with cardiovascular disease risk factors. *HIV Medicine*, *11* (6), 379-388. doi:10.1111/j.1468-1293.2009.00801.x

Carrico, M. (2005). *Fitness yoga*. US: American Council on Exercise.

Carter, B. Methodological issues and complementary therapies: researching intangible? (2003). *Complementary Therapies in Nursing and Midwifery*, *9* (3), 133-139. doi:10.1016/S1353-6177(03)00042-8

Canadian Society for Exercise Physiology [CSEP]. (2002). *Physical Activity Readiness Questionnaire (PAR-Q & YOU)*. Retrieved from http://www.csep.ca/forms

Centers for Disease Control and Prevention [CDC]. (2012). *Health-Related Quality of Life (HRQOL)*. Retrieved from http://www.cdc.gov/hrqol/concept.htm

Centre for Health Protection [CHP]. (2012). Sitting less for better health and longer life. *Non-Communicable Diseases Watch*, *5* (1), 1-11. Retrieved from http://www.chp.gov.hk/files/pdf/ncd_watch_jan2012.pdf

Centre for Health Protection [CHP]. (2013a). Obesity. Retrieved from http://www.chp.gov.hk/en/content/9/25/8802.html

Centre for Health Protection [CHP]. (2013b). Hypertension - the Preventable and Treatable Silent Killer. Retrieved from http://www.chp.gov.hk/en/view_content/28272.html

Chan, R. M. (2010). Traditional Chinese medicine: Acupuncture, herbalism and massage. In R. Adams (Eds.), *Foundations of Complementary Therapies and Alternative Medicine* (pp.243-258). Basingstoke: Palgrave Macmillan.

Chang, A. M. (1999). *Psychosocial nursing intervention to promote self-esteem and functional independence following stroke*. Retrieved from ProQuest Digital Dissertations. (9945667).

Chattha, R., Raghuram, N., Venkatram, P., & Hongasandra, N. R. (2008). Treating the climacteric symptoms in Indian women with an integrated approach to yoga therapy: a randomized control study. *The Journal of The North American Menopause Society*, *15* (5), 862-870. doi:10.1097/gme.0b013e318167b902

Chen, K. M., Chen, M. H., Hong, S. H., Chao, H. C., Lin, H. S., & Li, C. H. (2008). Physical fitness of older adults in senior activity centres after 24-week silver yoga exercises. *Journal of Clinical Nursing*, *17*, 2634-2646.

Chen, K. M., Chen, M. H., Lin, M. H., Fan, J. T., Lin, H. S., & Li, C. H. (2010). Effects of yoga on sleep quality and depression in elders in assisted living facilities. *Journal of Nursing Research*, *18* (1), 53-61.

Chen, K. M., Tseng, W. S., Ting, L. F., & Huang, G. F. (2007). Development and evaluation of a yoga exercise programme for older adults. *Journal of Advanced Nursing*, *57* (4), 432-441. doi:10.1111/j.1365-2648.2006.04115.x

Chi, I. (1995). Mental health of the old-old in Hong Kong. *Clinical Gerontologist*, *15*, 31-44.

Chi, I., & Boey, K. W. (1992). *Validation of measuring instruments of mental health status of the elderly in Hong Kong*. Hong Kong: Department of Social Work & Social Administration, University of Hong Kong.

Chi, I., & Chou, K. L. (2001). Social support and depression among elderly Chinese people in Hong Kong. *International Journal of Aging and Human Development*, *52* (3), 231-252.

Chinapaw, M. J. M., Proper, K. I., Brug, J., van Mechelen, W., & Singh, A. S. (2011). Relationship between young peoples' sedentary behaviour and biomedical health indicators: A systematic review of prospective studies. *Obesity Reviews*, *12*, e621-e632. doi:10.1111/j.1467-789X.2011.00865.x

Chou, K. L., & Chi, I. (2000). Financial strain and depressive symptoms in Hong Kong elderly Chinese: The moderating or mediating effect of sense of control. *Aging & Mental Health*, *5* (1), 23-30.

Chrousos, G. P. (2000). The role of stress and the hypothalamic-pituitary-adrenal axis in the pathogenesis of the metabolic syndrome: Neuro-endocrine and target tissue-related causes. *International Journal of Obesity*, *24* (Supp 2), 50-55.

Cohen, D. L., Bloedon, L. T., Rothman, R. L., Farrar, J. T., Galantino, M. L., Volger, S., … Townsend, R. R. (2011). Iyengar yoga versus enhanced usual care on blood pressure in patients with prehypertension to stage I hypertension: A randomized controlled trial. *Evidence-Based Complementary and Alternative Medicine*, *546428*, doi:10.1093/ecam/nep130

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behaviour*, *24*, 385-396.

Cohen, S., & Williamson, G: (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Ed.), *The social psychology of health* (pp. 31-68). Newbury Park, CA: Sage.

Consumer Council (2006). Listen to the experts: Is yoga for you, too – CHOICE # 351. Retrieved from: www.consumer.org.hk/website/ws_en/news/press_releases/p35102.html

Consumer Council (2008). New trade practices statute proposed as consumer complaints surge to record high. Retrieved from: http://www.consumer.org.hk/website/ws_en/news/press_releases/2008012101.html

Consumer Council (2010). Complaints against yoga centre closure. Retrieved from: www.consumer.org.hk/website/ws_en/news/press_releases/2010052001.html

Consumer Council (2011a). Public education proved to be effective: consumer complaints alleviated in 2010. Retrieved from: www.consumer.org.hk/website/ws_en/news/press_releases/2010052001.html

Consumer Council (2011b). Consumer Council: Half Yearly Review. Retrieved from: www.consumer.org.hk/website/ws_en/news/press_releases/2011071201.html

Cowen, V. S., & Adams, T. B. (2005). Physical and perceptual benefits of yoga asana practice: Results of a pilot study. *Journal of Bodywork and Movement Therapies*, *9* (3), 211-219.

Cox, R. (2007). *Sport Psychology: Concepts and Applications* (6th ed.). New York, NY: McGraw-Hill.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E. , Booth, M. L. , Ainsworth, B. E., … Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*, *35* (8), 1381-1395.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Culos-Reed, S. N., Carlson, L. E., Daroux, L. M., & Hately-Aldous, S. (2006). A pilot study of yoga for breast cancer survivors: Physical and psychological benefits. *Psycho-Oncology*, *15*, 891-897.

da Silva, T. L., Ravindran, L. N., & Ravindran, A. (2009). Yoga in the treatment of mood and anxiety disorders: A review. *Asian Journal of Psychiatry*, *2* (1), 6-16. doi:10.1016/j.ajp.2008.12.002

Danhauer, S. C., Tooze, J. A., Farmer, D. F., Campbell, C. R., McQuellon, R. P., Barrrett, R., & Miller, B. E. (2008). Restorative yoga for women with ovarian or breast cancer: findings from a pilot study. *Journal of the Society for Integrative Oncology*, *6* (2), 47-58.

Daniel, J. (2012). *Sampling essentials: Practical guidelines for making sampling choices*. Thousand Oaks, CA: Sage Publications.

Daskapan, A., Tuzun, E. H., & Eker, L. (2006). Perceived barriers to physical activity in university students. *Journal of Sports Science and Medicine*, *5*, 615-620.

Deshpande, S., Nagendra, H. R., & Nagarathna, R. (2009). A randomized control trial of the effect of yoga on Gunas (personality) and self esteem in normal health volunteers. *International Journal of Yoga*, *2* (1), 13-21. doi:10.4103/0973-6131.43287

Donesky-Curenco, D., Nguyen, H. Q., Paul, S., & Carrier-Kohlman, V. (2009). Yoga therapy decreases dyspnea-related distress and improves functional performance in people with chronic obstructive pulmonary disease: A pilot study. *The Journal of Alternative and Complementary Medicine*, *15* (3), *225-234*.

Dunstan, D. W., Barr, E. L. M., Healy, G. N., Salmon, J., Shaw, J. E., Balkau, B., … Owen, N. (2010). Television viewing time and mortality. The Australian diabetes, obesity and lifestyle study (AusDiab). *Circulation*, *121* (3), 384-391.

Ebnezar, J., Nagarathna, R., Bali, Y., & Nagendra, H. R. (2011). Effect of an integrated approach of yoga therapy on quality of life in osteoarthritis of the knee joint: A randomized control study. *International Journal of Yoga*, *4* (2), 55-63. doi:10.4103/0973-6131.85486

Elavsky, S., & McAuley, E. (2007). Exercise and self-esteem in menopausal women: a randomized controlled trial involving walking and yoga. *American Journal of Health Promotion*, *22* (2), 83-92.

Fern, E. F. (2001). *Advanced focus group research*. Thousand Oaks, Calif.: Sage Publications

Fowler, S. B., Moussouttas, M., & Mancini, B. (2005). Metabolic syndrome: Contributing factors and treatment strategies. *Journal of Neuroscience Nursing*, *37* (4), 220-223.

Galantino, M. L., Bzdewka, T. M., Eissler-Russo, J. L., Holbrook, M. L., Mogek, E. P., & Farrar, J. T. (2004). The impact of modified hatha yoga on chronic low back pain: A pilot study. *Alternative Therapies in Health and Medicine*, *10* (2), 56-59.

Galantino, M. L., Desai, K., Greene, L., Demichele, A., Stricker, C. T., & Mao, J. J. (2012). Impact of yoga on functional outcomes in breast cancer survivors with aromatase inhibitor-associated arthralgias. *Integrative Cancer Therapies*, *11* (4), 313-320. doi:10.1177/1534735411413270

Ganpat , T. S., & Nagendra, H. R. (2011). Integrated yoga therapy for improving mental health in managers. *Industrial Psychiatry Journal*, *20* (1), 45-48.

Gaurav, V. (2011). Effects of Hatha yoga training on the health-related physical fitness. *International Journal of Sports Science and Engineering*, *5* (3), 169-173.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago: Aldine Pub. Co.

Gordon, L., Morrison, E., McGrowder, D., Young, R., Fraser, Y., Zamora, E., ... Irving, R. (2008). Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes. *BMC Complementary and Alternative Medicine*, *8*: 21. doi:1472-6882/8/21

Gothe, N. & McAuley, E. (2012). Yoga Offers Similar Functional Benefits As Stretching-Strengthening Exercises: A Pilot RCT. Poster to be presented at The Gerontological Society of America's 65th Annual Scientific Meeting, San Diego, CA, November 2012.

Government of Western Australia (2013). Motivators and barriers in physical activity. Retrieved from: http://www.dsr.wa.gov.au/454

Grafton, J., Lillis, A. M., & Mahama, H. (2011). Mixed methods research in accounting. *Qualitative Research in Accounting & Management*, *8* (1), 5-21. doi:10.1108/11766091111124676

Granath, J., Ingvarsson, S., von Thiele, U., & Lundberg, U. (2006). Stress management: A randomized study of cognitive behavioural therapy and yoga. *Cognitive Behaviour Therapy*, *35* (1), 3-10.

Green, J. (2007). The use of focus groups in research into health. In M. Sak, & J. Allsop, *Researching health: Qualitative, quantitative and mixed methods* (pp. 112-132). Los Angeles: Sage Publications.

Groessl, E. J., Weingart, K. R., Aschbacher, K., Pada, L., & Naxi, S. (2008). Yoga for veterans with chronic low-back pain. *The Journal of Alternative and Complementary Medicine*, *14* (9), 1123-1129.

Grundy, S. M., Cleeman, J. I., Daniels, S. R., Donato, K. A., Eckel, R. H., Franklin, B. A., … Costa, F. (2005). Diagnosis and management of the metabolic syndrome. An American Heart Association/National Heart, Lung, and Blood Institute scientific statement. *Circulation*, *112*, 2735-2752.

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Thousand Oaks, CA: Sage Publications.

Gururaja, D., Harano, K., Toyotake, I., & Kobayashi, H. (2011). Effect of yoga on mental health: Comparative study between young and senior subjects in Japan. *International Journal of Yoga*, *4* (1), 7-12. doi:10.4103/0973-6131.78173

Hagins, M., Moore, W., & Rundle, A. (2007). Does practicing Hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness? *BMC Complementary and Alternative Medicine*, *7* (40). doi:10.1186/1472-6882-7-40

Harinath, K., Malhotra, A. S., Pal, K., Prasad, R., Kumar, R., Kain, T. C., … Sawhney, R. C. (2004). Effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. *The Journal of Alternative and Complementary Medicine*, *10* (2), 261-268.

Hartfiel, N., Burton, C., Rycroft-Malone, J., Clarke, G., Havenhand, J., Khalsa, S. B., & Edwards, R. (2012). Yoga for reducing perceived stress and back pain at work. *Occupational Medicine (Oxford, England)*, *62* (8), 606-612. doi:10.1093/occmed/kqs168

Hays, D. G., & Singh, A. A. (2012). *Qualitative inquiry in clinical and educational settings*. New York, NY: The Guilford Press.

Hegde, S. V., Adhikari, P., Kotian, S., Pinto, V. J., D'Souza, S., & D'Souza, V. (2011). Effect of 3-month yoga on oxidative stress in type 2 diabetes with or without complications. *Diabetes Cares*, *34* (10), 2208-2010. doi:10.2337/dc10-2430

Hennink, M. M. (2007). *International focus group research: A handbook for the health and social sciences*. Cambridge: Cambridge University Press.

Hewitt, J. (2001). *The complete yoga book*. New York: Schocken Books Inc.

Hill, J., & Timmis, A. (2002). ABC of clinical electrocardiography: Exercise tolerance testing. *British Medical Journal*, *324*, 1084-1087.

Hirschl, M. C. (2010). *Vital yoga: A sourcebook for students and teachers*. Albuquerque, NM: Prajna Pub. Co.

Hui, S. C., Lau, W. C., Yuen, P. Y., Wong, W. K., & Lam, W. K. (2008). Effects of a school-based intervention program for obese Chinese children: The Fun-and-Fit project. *The ICHPER˙SD Journal of Research*, *3* (1), 6-11.

Hui, S. C., & Yuen, P. Y. (2000). Validity of the modified back saver sit-and-reach test: A comparison with other protocols. *Medicine and Science in Sports and Exercise*, *32* (9), 1655-1659.

Information Services Department, Hong Kong Special Administrative Region Government. (2013). *Hong Kong: The Facts – Population*. Retrieved from: http://www.gov.hk/en/about/abouthk/factsheets/docs/population.pdf

Innes, K. E., & Selfe, T. K. (2012). The effects of a gentle yoga program on sleep, mood, and blood pressure in older women with restless legs syndrome (RLS): A preliminary randomized controlled trial. *Evidence-Based Complementary and Alternative Medicine*, *294058*. doi:10.1155/2012/294058.

Innes, K. E., Vincent, H. K., & Taylor, A. G. (2007). Chronic stress and insulin resistance-related indices of cardiovascular disease risk, part 2: A potential role for mind-body therapies. *Alternative Therapies*, *13* (5), 44-51.

Jack, D. E., Sowash, J., Anning, J., McGloughlin, T., & Andres, F. (2002). Effect of exercise at three exercise intensities on salivary cortisol. *Journal of Strength and Conditioning Research*, *16* (2), 286-289.

James, W. P., Chunming, C., & Inoue, S. (2002). Appropriate Asian body mass indices? *Obesity Reviews*, *3* (3), 139.

Jayasinghe, S. R. (2004). Yoga in cardiac health (a review). *The European Society of Cardiology*, *11* (5), 369-375.

John, P. J., Sharma, N., Sharma, C. M., & Kankane, A. (2007). Effectiveness of yoga therapy in the treatment of migraine without aura: A randomized controlled trial. *Headache*, *47* (5), 654-661. doi:10.1111/j.1526-4610.2007.00789.x

Johnson, J. L., Slentz, C. A., Houmard, J. A., Samsa, G. P., Duscha, B. D., Aiken, L. B., ... Kraus, W. E. (2007). Exercise training amount and intensity effects on metabolic syndrome (from studies of a targeted risk reduction intervention through defined exercise). *The American Journal of Cardiology*, *100*, 1759-1766.

Kaminoff, L. (2007). *Yoga anatomy*. US: Human Kinetics.

Kappmeier, K. L., & Ambrosini, D. M. (2006). *Instructing Hatha yoga*. Champaign, IL: Human Kinetics.

Khalsa, S. B. S. (2004). Treatment of chronic insomnia with yoga: a preliminary study with sleep-wake diaries. *Applied Psychophysiology and Biofeedback*, *29* (4), 269-278.

Kirschbaum, C., & Hellhammer, D.H. (1989). Salivary cortisol in psychobiological research: An overview. *Neuropsychobiological*, *22*, 150-169.

Knodel, J. (1993). The design and analysis of focus group studies: A practical approach. In D. L. Morgan, *Successful focus groups: Advancing state of the art* (pp.35-50). Thousand Oaks, CA: Sage Publications.

Krucoff, C., Carson, K, Peterson, M., Shipp, K., & Krucoff, M. (2010). Teaching yoga to seniors: Essential considerations to enhance safety and reduce risk in a uniquely vulnerable age group. *The Journal of Alternative and Complementary Medicine*, *16* (8), 899-905. doi:10.1089/acm.2009.0501

Krueger, R. A., & Casey, M. A. (2000). *Focus group: A practical guide for applied research* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Kvale, S. (1996). *Interviews: an introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage Publications.

Kyrou, I., Chrousos, G. P., & Tsigos, C. (2006). Stress, visceral obesity, and metabolic complications. *Annals New York Academy of Sciences*, *1083*, 77-110.

Lam, C. L. K. (2003). Reliability and construct validity of the Chinese (Hong Kong) SF-36 for patients in primary care. *Hong Kong Practitioner*, *25* (10), 468-475.

Lam, C. L. K., Fong, D. Y. T., Lauder I. J., & Lam, T. P. (2002). The effect of health related quality of life (HRQOL) on health service utilization of a Chinese population. *Social Science & Medicine*, *55*, 1635-1646.

Lam, C. L. K., Gandek, B., Ren, X. S., & Chan, M. S. (1998). Tests of scaling assumptions and construct validity of the Chinese (HK) version of the SF-36 Health Survey. *Journal of Clinical Epidemiology*, *51* (11), 1139-1147.

Lam, C. L. K., Lauder, I. J., Lam, T. P., & Gandek, B. (1999). Population based norming of the Chinese (HK) version of the SF-36 health survey. *Hong Kong Practitioner*, *21* (10), 460-470.

Lau, H. L. C., Kwong, J. S. W., Yeung, F., Chau, P. H., & Woo, J. (2012). Yoga for secondary prevention of coronary heart disease: Cochrane systematic review. *Cochrane Database of Systematic Reviews 2012*, *12*. Art. No.: CD009506. doi:10.1002/14651858.CD009506.pub2.

Lavey, R., Sherman, T., Mueser, K. T., Osborne, D. D., Currier, M., & Wolfe, R. (2005). The effects of yoga on mood in psychiatric inpatients. *Psychiatric Rehabilitation Journal*, *28* (4), 399-402.

Lazarus, R. S. (1999). *Stress and emotion: A new synthesis.* New York: Springer.

Lee, J. A., Kim, J. W., & Kim, D. Y. (2012). Effects of yoga exercise on serum adiponectin and metabolic syndrome factors in obese postmenopausal women. *The Journal of The North American Menopause Society*, *19* (3), 296-301. doi:10.1097/gme.0b013e31822d59a2

Leisure and Cultural Services Department [LCSD]. (2010). The Chinese version of Physical Activity Readiness Questionnaire (PAR-Q & YOU). Retrieved from http://www.lcsd.gov.hk/b5/forms_parq.php

Leisure and Cultural Services Department [LCSD]. (2012). Health Exercise for All Campaign – Physical fitness test for the community: Final summary report. Retrieved from http://www.lcsd.gov.hk/healthy/physical_fitness/en/findings.php

Levine, M. (2000). *The positive psychology of Buddhism and yoga: Path to a mature happiness with a special application to handle anger*. Mahwah, N.J.: Lawrence Erlbaum Publishers.

Li, A. W., & Goldsmith C. A. (2012). The effects of yoga on anxiety and stress. *Alternative Medicine Review*, *17* (1), 21-35.

Liamputtong, P. (2011). *Focus group methodology: Principles and practices*. Los Angeles: Sage Publications.

Lim, M. K., Sadarangani, P., Chan, H. L., & Heng J. Y. (2005). Complementary and alternative medicine use in multiracial Singapore. *Complementary Therapies in Medicine*, *13*, 16-24. doi:10.1016/j.ctim.2004.11.002

Lima, M. G., Barros, M. B., César, C. L., Goldbaum, M., Carandina, L., & Ciconelli, R. M. (2009). Impact of chronic disease on quality of life among the elderly in the state of São Paulo, Brazil: a population-based study. *Pan American Journal of Public Health*, *25* (4), 314-321.

Littman, A., Bertram, L., Ceballos, R., Ulrich, C., Ramaprasad, J., McGregor, B., & McTiernan, A. (2012). Randomized controlled pilot trial of yoga in overweight and obese breast cancer survivors: Effects on quality of life and anthropometric measures. *Supportive Care in Cancer*, *20* (2), 267-277.

Lovallo, W. R. (2005). *Stress and health: Biological and Psychological Interactions* (2nd ed.). Thousand Oaks, CA: Sage.

Macfarlane, D. J., Lee, C. C. Y., Ho, E. Y. K., Chan, K. L., & Chan, D. T. S. (2007). Reliability and validity of the Chinese version of IPAQ (short, last 7 days). *Journal of Science and Medicine in Sport*, *10*, 45–51.

MacHale, S. (2002) Managing depression in physical illness. *Advances in Psychiatric Treatment*, *8*, 297-305.

Mack, N., Woodsong, C. MacQueen, K. M., Guest, G., & Namey, E. (2005). *Qualitative research methods: A data collector's field guide*. Research Triangle Park, NC: Family Health International.

Madanmohan, Bhavanani, A., Dayanidy, G., Sanjay, Z., & Basavaraddi, I. (2012). Effect of yoga therapy on reaction time, biochemical parameters and wellness score of peri and post-menopausal diabetic patients. *International Journal of Yoga*, *5* (1), 10-15.

Mahapure, H., Shete, S., & Bera, T. (2008). Effect of yogic exercise on super oxide dismutase levels in diabetics. *International Journal of Yoga*, *1* (1), 21-26.

Malpass, A., Andrews, R., & Turner, K. M. (2009). Patients with Type 2 Diabetes experiences of making multiple lifestyle changes: A qualitative study. *Patient Education and Counselling*, *74*, 258-263. doi: 10.1016/j.pec.2008.08.018

Manchanda, S. C., Narang, R., Reddy, K. S., Sachdeva, U., Prabhakaran, D., Dharmanand, S., … Bijlani, R. (2000). Retardation of coronary atherosclerosis with yoga lifestyle intervention. *JAPI*, *48* (7), 687-694.

Manson, Su., Tovey P., & Long, A. F. (2002). Evaluating complementary medicine: methodological challenges of randomised controlled trials. *BMJ*, *325*, 832-834.

Mclver, S., O'Halloran, P., & McGartland, M. (2009). Yoga as a treatment for binge eating disorder: A preliminary study. *Complementary Therapies in Medicine*, *17*, 196-202.

Michalsen, A., Grossman, P., Acil, A., Langhorst, J., Lüdtke, R., Esch, T., … Dobos, G. J. (2005). Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program. *Medical Science Monitor*, *11* (12), 555-561.

Miller, M. D., & Reynolds, C. F. (2003). *Living Longer Depression Free: A Family Guide to Recognizing, Treating, and Preventing Depression in Later Life (*Large print ed.). Baltimore, MD: J. Hopkins University Press.

Mitchell, K. S., Mazzeo, S. E., Rausch, S. M., & Cooke, K. L. (2007). Innovative interventions for disordered eating: Evaluating dissonance-based and yoga intervention. *International Journal of Eating Disorders*, *40* (2), 120-128.

Mittal, S. (2008). *The Metabolic Syndrome in Clinical Practice*. London: Springer.

Moadel, A. B., Shah, C., Wylie-Rosett, J., Harris, M. S., Patel, S. R., Hall, C.B., & Sparano, J. A. (2007). Randomized controlled trial of yoga among a multiethnic sample of breast cancer patients: Effects on quality of life. *Journal of Clinical Oncology*, *25* (28), 4387-4395.

Morgan, D. L. (1997). *Focus groups as qualitative research* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Morgan, D. L. & Krueger, R. A. (1993). When to use focus group and why. In D. L. Morgan, *Successful focus groups: Advancing state of the art* (pp.3-19). Thousand Oaks, CA: Sage Publications.

Morley, J. E., & Sinclair, A. (2009). The metabolic syndrome in older persons: A loosely defined constellation of symptoms or a distinct entity? *Age and Ageing*, *38*, 494-497.

Morrow, J. R. Jr., Jackson, A. W., Disch, J. G., & Mood, D. P. (2005). *Measurement and Evaluation in Human Performance* (3rd ed.). US: Human Kinetics.

Mourya, M., Mahajan, A. S., Singh, N. P., & Jain, A. K. (2009). Effect of slow- and fast-breathing exercises on autonomic functions in patients with essential hypertenstion. *The Journal of Alternative and Complementary Medicine*, *15* (7), 711-717.

Nieman, D. C., Austin, M. D., Benezra, L., Pearce, S., McInnis, T., Unick, J., & Gross, S. J. (2006). Validation of Cosmed's Fitmate^{TM} in measuring oxygen consumption and estimating resting metabolic rate. *Research in Sports Medicine*, *14*, 89-96. doi:10.1080/15438620600651512

Nieman, D. C., LaSasso, H., Austin, M. D., Pearce, S., McInnis, T., & Unick, J. (2007). Validation of Cosmed's Fitmate^{TM} in measuring exercise metabolism. *Research in Sports Medicine*, *15*, 67-75. doi:10.1080/154386201184380

O'Cathain, A. (2010). Mixed methods involving qualitative research. In I. Bourgeault, R. Dingwall, & R. DeVries, *The SAGE handbook of qualitative methods in health research* (pp. 575-588). Los Angeles: Sage Publications.

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report*, *12* (2), 281-316.

Oken, B. S., Zajdel, D., Kishiyama, S., Flegal, K., Dehen, C., Haas, M., ... Leyva, J. (2006). Randomized, controlled, six-month trial of yoga in healthy seniors: effects on cognition and quality of life. *Alternative Therapies in Health and Medicine*, *12* (1), 40-47.

Pal, A., Srivastava, N., Tiwari, S., Verma, N. S., Narain VS, Agrawal, G. G., …Kumar, K. (2011). Effect of yogic practices on lipid profile and body fat composition in patients of coronary artery disease. *Complementary Therapies in Medicine*, *19* (3), 122-127. doi:10.1016/j.ctim.2011.05.001

Pickering, T. G., Hall, J. E., Appel, L. J., Falkner, B. E., Graves, J., Hill, M. N., ... Roccella, E. J. (2005). AHA scientific statement: Recommendations for blood pressure measurement in humans and experimental animals. *Hypertension*, *45*, 142-161.

Pilkington, K., Kirkwood, G., Rampes, H., & Richardson, J. (2005). Yoga for depression: the research evidence. *Journal of Affective Disorder*, *25* (89), 13-24.

Powers, S. K., & Howley, E. T. (2012). *Exercise Physiology: Theory and Application to Fitness and Performance* (8th ed.). Boston: McGraw-Hill Higher Education.

Pullen, P. R., Nagamia, S. H., Mehta, P. K., Thompson, W. R., Benardot, D., Hammoud, R., … Khan, B. V. (2008). Effects of yoga on inflammation and exercise capacity in patients with chronic heart failure. *Journal of Cardiac Failure*, *14* (5), 407-413. doi:10.1016/j.cardfail.2007.12.007

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385-401.

Rakhshani, A., Maharana, S., Raghuram, N., Nagendra, H. R., & Venkatram, P. (2010). Effects of integrated yoga on quality of life and interpersonal relationship of pregnant women. *Quality of Life Research*, *19* (10), 1447-1455. doi:10.1007/s11136-010-9709-2

Raub, J. A. (2002). Psychophysiological effects of Hatha yoga on musculoskeletal and cardiopulmonary function: A literature review. *The Journal of Alternative and Complementary Medicine*, *8* (6), 797-812.

Reaven, G. M. (1988) Banting lecture 1988: role of insulin resistance in human disease. *Diabetes*, *37*, 1595-1607.

Reid, M., Burr, J., Williams, S., & Hammersley, R. (2008). Eating disorders patients' views on their disorders and on an outpatient service: A qualitative study. Journal of Health Psychology, 13 (7), 956-960. doi:10.1177/1359105308095070

Riley, D. (2004). Hatha yoga and the treatment of illness. *Alternative Therapies in Heath and Medicine*, *10* (2), 20-21.

Ripoll, E., & Mahowald, D. (2002). Hatha yoga therapy management of urologic disorders. *World Journal of Urology*, *20*, 306-309.

Ritenbaugh, C., Verhoef, M., Fleishman, S., & Boon, H. (2003). Whole systems research: a discipline for studying complementary and alternative medicine. *Alternative Therapies in Health and Medicine*, *9* (4), 32-36.

Ritter, L. A., & Lampkin, S. M. (2012). *Community Mental Health*. Sudbury, MA: Jones & Bartlett Learning.

Rocha, K. K. F., Ribeiro, A. M., Rocha, K. C. F., Sousa, M. B. C., Albuquerque, F. S., Ribeiro, S., & Silva, R. (2012). Improvement in physiological and psychological parameters after 6 months of yoga practice. *Consciousness and Cognition*, *21* (2), 843-850. doi:10.1016/j.concog2012.01.014

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, N.J.: Princeton University Press.

Rosmond, R. (2005). Role of stress in the pathogenesis of the metabolic syndrome. *Psychoneuroendocrinology*, *30*, 1-10.

Ross, A., & Thomas, S. (2010). The health benefits of yoga and exercise: a review of comparison studies. *Journal of Alternative and Complementary Medicine*, *16* (1), 3-12. doi:10.1089=acm.2009.0044

Sabina, A. B., Williams, A. L., Wall, H. K., Bansal, S., Chupp, G., Katz, D. L. (2005). Yoga intervention for adults with mild-to-moderate asthma: a pilot study. *Annals of Allergy, Asthma & Immunology*, *94*, 543-548.

Saper, R. B., Eisenberg, D. M., Davis, R. B., Culpepper, L., & Phillips, R. S. (2004). Prevalence and patterns of adult yoga use in the United States: Results of a national survey. *Alternative Therapies in Health and Medicine*, *10* (2), 44-49.

Saptharishi, L., Soudarssanane, M., Thiruselvakumar, D., Navasakthi, D., Mathanraj, S., Karthigeyan, M., & Sahai, A. (2009). Community-based randomized controlled trial of non-pharmacological interventions in prevention and control of hypertension among young adults. *The Indian Journal of Community Medicine*, *34* (4), 329-334. doi:10.4103/0970-0218.58393

Sarafino, E. P., & Smith, T. W. (2011). *Health psychology: Biopsychosocial interactions* (7th ed.). Hoboken, NJ: Wiley.

Satyapriya, M., Nagendra, H. R., Nagarathna, R., & Padmalatha, V. (2009). Effect of integrated yoga on stress and heart rate variability in pregnant women. *International Journal of Gynecology and Obstetrics*, *104*, 218-222.

Selye, H. (1950). The physiology and pathology of exposure to stress: A treatise based on the concepts of the general adaptation syndrome and the diseases of adaptation (1st ed.). Montreal, Canada: Acta, Inc.

Sharpe, P. A., Blanck, H. M., Williams, J. E., Ainsworth, B. E., & Conway, J. M. (2007). Use of complementary and alternative medicine for weight control in the United States. *The Journal of Alternative and Complementary Medicine*, *13* (2), 217-222. doi:10.1089/acm.2006.6129

Sheasby, J. E., Barlow, J. H., Cullen, L. A., & Wright, C. C. (2000). Pyschometric properties of the Rosenberg Self-Esteem Scale among people with arthritis. *Psychological Reports*, *86*, 1139-1146.

Shek, D. T. L: (1988). Reliability and factor structure of the Chinese Version of the State-Trait Anxiety Inventory. *Journal of Psychopathology and Behavioral Assessment*, *10* (4), 303-317.

Sherman, K. J., Cherkin, D. C., Erro, J., Miglioretti, D. L., & Deyo, R. A. (2005). Comparing yoga, exercise, and a self-care book for chronic low back pain: A randomized, controlled trial. *Annals of Internal Medicine*, *143* (12), 849-856.

Simões, G. (2012). Mobile Metronome (Version 1.2.4.F) [Mobile application software]. Retrieved from https://play.google.com/store/apps/details?id=gabriel.metronome

Singh, S., Malhotra, V., Singh, K., Sharma, S., Madhu, S., & Tandon, O. (2001). A preliminary report on the role of yoga asanas on oxidative stress in non-insulin dependent diabetes mellitus. *Indian Journal Of Clinical Biochemistry: IJCB*, *16* (2), 216-220. doi:10.1007/BF02864866

Sivasankaran, S., Pollard-Quintner, S., Sachdeva, R., Pugeda, J., Hoq, S. M., & Zarich, S. W. (2006). The effect of a six-week program of yoga and meditation on brachial artery reactivity: Do psycholosocial interventions affect vascular tone? *Clinical Cardiology*, *29* (9), 393-398

Skoro-Kondza, L., Tai, S. S., Gadelrab, R., Drincevic, D., & Greenhalgh, T. (2009). Community based yoga classes for type 2 diabetes: An exploratory randomised controlled trial. *BMC Health Services Research*, *9*, 33. doi:10.1186/1472-6963-9-33

Smith, B. W., Shelley, B. M., Dalen., J., Wiggins, K., Tooley E., & Bernard, J. (2008). A pilot study comparing the effects of mindfulness-based and cognitive-behavioral stress reduction. *The Journal of Alternative and Complementary Medicine*, *14* (3), 251-258.

Smith, C., Hancock, H., Blake-Mortimer, J., & Eckert, K. (2007). A randomised comparative trial of yoga and relaxation to reduce stress and anxiety. *Complementary Therapies in Medicine*, *15*, 77-83.

Smith, E. E., Nolen-Hoeksema, S., Fredrickson, B., & Loftus, G. R. (2003). *Atkinson and Hilgard's Introduction to Psychology* (14th ed.). US: Thomson: Wadsworth.

Spielberger, C. D. (1971). Trait-state anxiety and motor behaviour. *Journal of Motor Behavior*, *3*, 265-279.

Spielberger, C. D. (1983). *Manual for the Stait-Trait Anxiety Inventory (form Y)*. Palo Alto: Consulting Psychologists Press.

Stamatakis, E., Hamer, M, & Dunstan, D. W. (2011). Screen-based entertainment time, all-cause mortality, and cardiovascular events: Population-based study with ongoing mortality and hospital events follow-up. *Journal of the American College of Cardiology*, *57* (3), 292-299. doi:10.1016/j.jacc.2010.05.065

Streeter, C. C., Whitfield, T. H., Owen, L., Rein, T., Karri, S. K., Yakhkind, A., … Jensen, J. E. (2010). Effects of yoga versus walking on mood, anxiety, and brain GABA levels: a randomized controlled MRS study. *The Journal of Alternative and Complementary Medicine*, *16* (11), 1145-1152. doi:10.1089/acm2010.0007

Sullivan, V. K. (2006). Prevention and treatment of the metabolic syndrome with lifestyle intervention: Where do we start? *Journal of the American Dietetic Association*, *106* (5), 668-671.

Tan, C. E., Chew, S. K., Ma, S., Tai, E. S., & Wai, D. (2004). Can we apply the National Cholesterol Education Program Adult Treatment Panel definition of the metabolic syndrome to Asians? *Diabetes Care*, *27* (5), 1182-1186.

Taylor, M., Inclan-Valadez, C., Yip, P. S. F., Chak, S. G., & Leung, P. (2011). Living at density: voices of Hong Kong residents. *Cities, Health and Well-being*. Retrieve from http://lsecities.net/media/objects/articles/living-at-density

Taylor, S. E. (2006). *Health psychology*. Boston: McGraw-Hill Higher Education.

Telles, S., Naveen, V., Balkrishna, A., & Kumar, S. (2010). Short term health impact of a yoga and diet change program on obesity. *Medical Science Monitor: International Medical Journal Of Experimental And Clinical Research*, *16* (1), CR35-CR40.

Tekur, P., Nagarathna, R., Chametcha, S., Hankey, A., & Nagendra, H. (2012). A comprehensive yoga programs improves pain, anxiety and depression in chronic low back pain patients more than exercise: An RCT. *Complementary Therapies In Medicine*, *20* (3), 107-118. doi:10.1016/j.ctim.2011.12.009

Tekur, P., Singhow, C., Nagendra, H. R., & Raghuram, N. (2008). Effect of short-term intensive yoga program on pain, functional disability, and spinal flexibility in chronic low back pain: A randomized control study. *The Journal of Alternative and Complementary Medicine*, *14* (6), 637-644.

Tekur, P., Singphow, C., Nagendra, H. R., & Raghuram, N. (2010). Effect of yoga on quality of life of CLBP: A randomized control study. *International Journal of Yoga*, *3* (1), 10-17. doi:10.4103/0973-6131.66773

Tong, P. C., Kong, A. P., So, W. Y., Yang, X., Ho, C. S., Ma, R. C., … Cockram, C. S. (2007). The usefulness of the International Diabetes Federation and the National Cholesterol Education Program's Adult Treatment Panel III definitions of the metabolic syndrome in predicting coronary heart disease in subjects with type 2 diabetes. *Diabetes Care*, *30* (5), 1206-1211.

Tran, M. D., Holly, R. G., Lashbrook, J., & Amsterdam, E. A. (2001). Effects of Hatha yoga practice on the health-related aspects of physical fitness. *Preventive Cardiology*, *4* (4), 165-170.

Tsigos, C., & Chrousos, G. P. (2002). Hypothalamic-pituitary-adrenal axis, neuroendocrine factors and stress. *Journal of Psychosomatic Research*, *53*, 865-871.

Tsigos, C., & Chrousos, G. P. (2006). Stress, obesity, and metabolic syndrome, *Annals New York Academy of Sciences,1083*, xi-xiii. *doi:10.1196/annals.1367.025*

Tsoi, M. M., Ho, E., & Mak, K. C. (1986). Becoming pregnant again after stillbirth or the birth of a handicapped child. In L. Dennerstein & L. Fraser (Eds.), *Hormone and behavior* (pp. 310-316). Holland: Elservier Science.

Uebelacker, L. A., Tremont, G., Epstein-Lubow, G., Gaudiano, B. A., Gillette, T., Kalibatseva, Z., & Miller, I. (2010). Open trial of Vinyasa yoga for persistently depressed individuals: evidence of feasibility and acceptability. *Behavior Modification*, *34* (3), 247-264. doi:10.1177/0145445510368845

U.S. Department of Health and Human Services [USHHS]. (1996). *Physical activity and health: A report of the surgeon general*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

U.S. Department of Health and Human Services [USHHS]. (1999). *Mental Health: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health.

U.S. Department of Health and Human Services [USHHS]. (2008). *Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee Report, 2008*. Washington, DC: U.S. Department of Health and Human Services.

Vadiraja, H. S., Raghavendra, R. M., Nagarathna, R., Nagendra, H. R., Rehka, M., Vanitha, N., ... Kumar, V. (2009). Effects of a yoga program on cortisol rhythm and mood states in early breast cancer patients undergoing adjuvant radiotherapy: A randomized controlled trial. *Integrative Cancer Therapies*, *8* (1), 37-46.

van Uffelen, J. G. Z., Wong, J., Chau J. Y., van der Ploeg, H. P., Riphagen, I., Gilson, N. D., … Brown, W. J. (2010). Occupational sitting and health risks: A systematic review. *American Journal of Preventive Medicine*, *36* (4), 379-388.

Visceglia, E., & Lewis, S. (2011). Yoga therapy as an adjunctive treatment for schizophrenia: A randomized, controlled pilot study. *The Journal of Alternative and Complementary Medicine*, *17* (7), 601-607. doi:10.1089/acm.2010.0075

Visweswaraiah, N. K., & Telles, S. (2004). Randomized trial of yoga as a complementary therapy for pulmonary tuberculosis. *Respirology*, *9*, 96-101.

Walsh, L. (2009). *Depression care across the lifespan*. Chichester, U.K.: Wiley-Blackwell.

Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). *SF-36 health survey manual & interpretation guide*. Boston, Mass.: Health Institute, New England Medical Center.

West, J., Otte, C., Geher, K., Johnson, J., & Mohr, D. C. (2004). Effects of hatha yoga and African dance on perceived stress, affect, and salivary cortisol. *Annals of behavioral medicine*, *28* (2), 114-118.

Wijndaele, K. Duvigneaud, N., Matton, L., Duquet, W., Delcluse, C., Thomis, M., ... Philippaerts, R. M. (2009). Sedentary behaviour, physical activity and a continuous metabolic syndrome risk score in adults. *European Journal of Clinical Nutrition*, *63*, 421-429.

Wilson, P. W. F., D'Agostino, R. B., Parise, H., Sullivan, L., & Meigs, J. B. (2005). Metabolic syndrome as a precursor of cardiovascular disease and type 2 diabetes mellitus. *Circulation*, *112*, 3066-3072. doi: 10.1161/CIRCULATIONAHA.105.539528

Woolery, A., Myers, H., Sternlieb, B., & Zeltzer, L. (2004). A yoga intervention for young adults with elevated symptoms of depression. *Alternative Therapies in Health and Medicine*, *10* (2), 60-63.

World Health Organization [WHO]. (1997). *Programme on Mental Health:WHOQOL Measuring Quality of Life.* Retrieved from http://www.who.int/mental_health/media/68.pdf

World Health Organization [WHO]. (2002). World Health Report 2002: Reducing risks, promoting healthy life. Retrieved from http://www.who.int/whr/2002/en/whr02_en.pdf

World Health Organization [WHO]. (2004). Global strategy on diet, physical activity and health. Retrieved from http://www.who.int/dietphysicalactivity/strategy/eb11344/en/index.html

World Health Organization [WHO]. (2006). Constitution of the World Health Organization. Retrieved from www.who.int/governance/eb/who_constitution_en.pdf

World Health Organization [WHO]. (2011). Noncommunicable diseases country profiles 2011. Retrieved from http://www.who.int/nmh/publications/ncd_profiles2011/en/index.html

World Health Organization [WHO]. (2012a). Global strategy on diet, physical activity and health: Physical inactivity: A global public health problem. Retrieved from http://www.who.int/dietphysicalactivity/factsheet_inactivity/en/

World Health Organization [WHO]. (2012b). Mental health: Depression. Retrieved from http://www.who.int/mental_health/management/depression/en/index.html

World Health Organization Regional Office for Europe [WHO/Europe]. (2012). Facts and figures: Physical activity to stay healthy. Retrieved from http://www.euro.who.int/en/what-we-do/health-topics/disease-prevention/physical-activity/facts-and-figures/physical-activity-to-stay-healthy

Wright, C. C., & Sim, J. (2003). Intention-to-treat approach to data from randomized controlled trials: A sensitivity analysis. *Journal of Clinical Epidemiology*, *56*, 833-842. doi:10.1016/S0895-4356(03)00155-0

Xue, C. C. L., Zhang, A. L., Holroyd, E., & Suen, L. K. P. (2008). Personal use and professional recommendations of complementary and alternative medicine by Hong Kong registered nurses. *Hong Kong Medical Journal*, *14*, 110-115.

Xue, C. C. L., Zhang, A. L., Lin, V., Da Costa, C., & Story, D. F. (2007). Complementary and alternative medicine use in Australia: A national population-based survey. *The Journal of Alternative and Complementary Medicine*, *13* (6), 643-650. doi:10.1089/acm.2006.6355

Yang, K. (2007). A review of Yoga program for four leading risk factors of chronic diseases. *Evidence-Based Complementary and Alternative Medicine*, *4* (4), 487-491. doi:10.1093/ecam/nem154

Yang, K., Bernardo, L., Sereika, S., Conroy, M., Balk, J., & Burke, L. (2011). Utilization of 3-month yoga program for adults at high risk for type 2 diabetes: a pilot study. *Evidence-Based Complementary And Alternative Medicine: Ecam*. Art. No.: 2011257891.

Yang, X., Telama, R., Hirvensalo, M., Mattsson, N., Viikari, J. S., & Raitakari, O. T. (2008). The longitudinal effects of physical activity history on metabolic syndrome. *Medicine & Science in Sports & Exercise*, *40* (8), 1424-1431. doi:10.1249/MSS.0b013e318172ced4

Yoga Alliance [YA]. (2012). Styles of Yoga. Retrieved from http://yogaalliance.org/content/understanding-different-styles-yoga

Yogendra, J., Yogendra, H. J., Ambardekar, S., Lele, R. D., Shetty, S., Dave, M., & Husein, N. (2004). Beneficial effects of yoga lifestyle on reversibility of ischaemic heart disease: Caring heart project of International Board of Yoga. *The Journal of Association of Physicians of India*, *52*, 283-289.

Yu, R., & Ho, S. C. (2010). Psychometric evaluation of the Perceived Stress Scale in early postmenopausal Chinese women. *Psychology*, *1*, 1-8.

Yu, R. H. Y., Ho, S. C., Lamb, C. W. K., Woo, J. L. F., & Ho, S. S.Y. (2010). Psychological factors and subclinical atherosclerosis in postmenopausal Chinese women in Hong Kong. *Maturitas*, *67*, 186-191.

Appendix A Information Sheet for Study One (English and Chinese Versions)

Department of Medicine and Therapeutics
Faculty of Medicine
The Chinese University of Hong Kong

Effects of Regular Yoga Practice

Background and Purpose of the study

Yoga originated in Indian more than 5000 years ago, its principle is to achieve the integration of body, mind, and spirit. It consists of poses, breathing exercises and meditation. Nowadays yoga is a kind of popular recreation activity and low intensity physical activity. Regular practicing yoga can help improve flexibility, muscular endurance and balance, and reduce stress. Recently there are many publications about the health benefits of yoga, yet the influence of yoga on physical and mental health has not been fully examined and local evidence is lacking. Therefore the results of this study would help understand the influence of yoga on physical and mental health.

We are sincerely inviting you to participate in the study

Individuals who meet the following requirement are eligible to participate in the study:

1. Aged 18 or above
2. Chinese and able to communicate in Cantonese
3. No regular participation of (> 1/week) yoga for last 3 months or concurrent use of yoga, Qigong or meditation
4. Without pregnancy or breast feeding
5. Without undergoing any other concurrent nonpharmacological treatment of Metabolic Syndrome
6. Without suffering chronic illnesses such as cancer, kidney disease, cirrhosis, rheumatologic diseases, or chronic inflections
7. Without suffering major psychiatric illnesses
8. Not concurrently participation in any other studies, experimental therapies, or blinded treatments

Participants are required to complete

1. Two blood tests (Triglycerides、Cholesterol and fasting plasma glucose)
2. Two measurements of blood pressure
3. Two physical fitness tests (Body height, weight, waist circumference, muscle strength and endurance, cardiorespiratory function)
4. Two Yoga and Health Questionnaires
5. Four salivary cortisol tests

Venue：Prince of Wales Hospital, Shatin

Date/Time：within office hours, Monday-Friday

The researcher will contact participants for the arrangement 2 weeks prior the test

Participants are required to complete the 12-week yoga course

Teacher：Ms Lau Hoi Lam（Registered group fitness instructor and yoga teacher）

Venue：Prince of Wales Hospital, Shatin

Date：Saturday or Sunday（depends on group assignment）

Mode：1 hour/week, 12 consecutive weeks

Time：Researcher

Time of Lesson 1 and 12 of all the groups will be 6:00-7:30pm, and the time of Lesson 2-11 will be

Group A：SAT 2:00-3:00pm	Group B：SAT 3:15-4:15pm	Group C：SAT 4:30-5:30pm
Group D：SUN 2:00-3:00pm	Group E：SUN 3:15-4:15pm	Group F：SUN 4:30-5:30pm

Benefits upon completion of the study

1. Health benefits of regular yoga practice which include increasing flexibility and muscle endurance, improving balance, and releasing stress and improving mood state.
2. Blood test report
3. Physical fitness test report

Enrollment methods

Submit the completed enrollment form by the following methods：

Mailing address：Room 124021, 10/F, Clinical Sciences Building, Prince of Wales Hospital, Shatin

Email：carenlau@cuhk.edu.hk

Fax: 26379215

香港中文大學醫學院內科及藥物治療學系
瑜伽與身心健康研究項目

研究目的與背景

瑜伽是一種源於印度的古文化，是一系列的修身養心方法，包括調身的姿勢、調息的呼吸法、調心的冥想法等，以達至身心的合一。瑜伽也是近年受大眾歡迎的消閒活動，亦是一種低強度的運動，能鍛練柔軟度、肌肉耐力和平衡力及舒緩情緒壓力。過往已有許多研究報告指出運動對身心的益處，但對現存有關瑜伽的對身心健康之研究證據仍未完善，而本地亦缺乏嚴謹的控制實驗來驗證瑜伽對身心健康的影響，所以本研究之結果將有助更全面的了解瑜伽對身心健康的影響。

我們誠意邀請你的參與

現在本研究，正招募符合以下條件的朋友參與:

1. 18歲或以上
2. 中國籍並能以廣東話溝通
3. 沒有學習過或已停止練習瑜伽、氣功或冥想超過３個月.
4. 現在沒有懷孕、準備懷孕或進行母乳餵食
5. 現在沒有為新陳代謝綜合症接受非藥物性治療
6. 沒有患上慢性疾病（如癌病、腎病、肝硬化、風濕疾病）或受慢性病毒感染
7. 沒有患上情緒病或精神病
8. 現在沒有參與其他研究項目

參加者須進行以下測試

1. 兩次抽血 (血脂、膽固醇和血糖測試)
2. 兩次量血壓
3. 兩次體適能測試 (量度身高、體重、腰圍、肌肉力量及心肺耐力)
4. 兩次身心健康問卷調查
5. 四次口水皮質醇測試

地點：沙田威爾斯醫院
日期/時間：星期一至五辦公時段內進行
研究人員會於最少兩星期前聯絡測試者安排測試事宜

參加者須參與12星期瑜伽課程

導師：劉凱琳小姐（合格團體運動及瑜伽導師）
地點：沙田威爾斯醫院
日期：星期六或星期日（視乎組別）
模式：每星期一堂每堂一小時連續12星期
時間：研究人員會根據參加者的資料安排組別
所有組別的第1堂及第12堂上課時間：6:00-7:30pm，第2至11堂上課時間

A組：星期六 2:00-3:00pm	B組：星期六 3:15-4:15pm	C組：星期六 4:30-5:30pm
D組：星期日 2:00-3:00pm	E組：星期日 3:15-4:15pm	F組：星期日 4:30-5:30pm

完成是次研究活動的參與者可獲得

1. 恆常練習瑜珈的益處：增加柔軟度、肌肉耐力和平衡力及舒緩情緒壓力、改善心情
2. 驗血報告
3. 血壓報告
4. 體適能報告

參加方法

填妥後可以利用以下方法遞交報名表格：
郵寄地址：沙田威爾斯醫院臨床醫學大樓10樓124021室
電郵：carenlau@cuhk.edu.hk
傳真(Fax): 26379215

Appendix B Enrolment form for Study One (English and Chinese Versions)

Department of Medicine and Therapeutics
Faculty of Medicine
The Chinese University of Hong Kong

Effects of Regular Yoga Practice

Enrollment form

Submit the completed enrollment form by the following methods:

1. Email: carenlau@cuhk.edu.hk
2. Fax: 26379215
3. Mailing: Room 124021, 10/F, Clinical Sciences Building, Prince of Wales Hospital, Shatin, Hong Kong (ATTN：Ms LAU Hoi Lam)

Name: (Chi)__________________ (English)______________________________

Tel: (Mobile)______________ (Home) _____________Email:_________________________

Sex: Male / Female Age:______ Date of birth:_____________(dd/mm/yy)

Height______cm Weight: ____lbs or____kg Waist circumference: _____inches or _____cm

Answer the following questions and delete as appropriate:
Qualification: No education / Primary / Secondary / Tertiary

Occupation: Full Time / Part Time / Unemployed / Housewife / Retired / Student

Martial status: Single / Married / Widowed

Illnesses and symptoms
Have you experienced the following situations in the last 5 years (delete as appropriate)

Heart problems	Yes / No	Kidney disease	Yes / No	Coughing with blood	Yes / No
Cardiovascular disease	Yes / No	Hepatitis	Yes / No	Headache	Yes / No
Palpitations	Yes / No	Heart murmur	Yes / No	Back pain	Yes / No
Varicose veins	Yes / No	Rheumatoid	Yes / No	Joint problems	Yes / No
Pulmonary disease	Yes / No	Chest pain/discomfort	Yes / No	Diabetes	Yes / No
Asthma	Yes / No	Difficulty in breathing	Yes / No	Epilepsy	Yes / No

Other illnesses and symptoms:

____

Hospitalization record: Please list the hospitalization record in the last 5 years (if any)

____

Do you need to take medication(s) for long term prescribed by doctor(s)?
No / Yes (Please list the illness(es) and related medications):

____

Other lifestyle habits

Do you smoke?	**No / Yes**
Do you drink alcohols?	**No / Yes**

Is your work / daily activities involved manual labor? **Yes / No**

Do you usually have vigorous physical activities in the past month? **No / Yes,** __________per week

Are you undergoing weight management plan? **No / Yes, diet/exercise/medication/other:**________

Availability (Delete as appropriate)

SAT 10:30am-12:00nn	Yes / No	SUN 10:30am-12:00nn	Yes / No
SAT 2pm-3:30pm	Yes / No	SUN 2pm-3:30pm	Yes / No
SAT 3:45pm-5:15pm	Yes / No	SUN 3:45pm-5:15pm	Yes / No

The information provided will be research purpose only and kept strictly confidential, submission of the form will indicate that you have read and understand the recruitment information.

This is the end of the enrollment form, thank you for your participation !

香港中文大學醫學院內科及藥物治療學系
瑜伽與身心健康研究項目

報名表格

填妥後可以利用以下方法遞交報名表格：

1. 電郵: carenlau@cuhk.edu.hk
2. 傳真: 26379215
3. 郵寄: Room 124021, 10/F, Clinical Sciences Building, Prince of Wales Hospital, Shatin, Hong Kong. (ATTN：Ms LAU Hoi Lam)

姓名: (中文)____________________ (英文全名)________________________________

電話: (手提)_______________ (住宅) ______________電郵地址:_______________________________

性別: 男 / 女 年齡:______ 出生日期:____________ (日日/月月/年年)

*必須*提供以下資料:
現時身高：______厘米 現時體重：____磅或____公斤 現時腰圍：_____寸或_____厘米

以下問題請***刪除不適用***的答案
最高學歷: 沒有接受正規教育 / 小學 / 中學 / 大專或以上

職業: 全職 / 兼職 / 待業 / 家庭主婦 / 退休人士 / 學生

婚姻狀況: 單身 / 已婚 / 寡婦或鰥夫

其他健康狀況

最近5年內曾試過以下情況嗎?(請***刪除不適用***的答案)

心臟問題	有 / 無	腎病	有 / 無	咳嗽帶血	有 / 無
心血管病	有 / 無	肝炎	有 / 無	經常頭痛	有 / 無
心悸	有 / 無	心漏症	有 / 無	背痛	有 / 無
靜脈曲張	有 / 無	風濕	有 / 無	關節問題	有 / 無
肺病	有 / 無	胸口痛/不適	有 / 無	糖尿病	有 / 無
哮喘	有 / 無	呼吸困難	有 / 無	癲癇症	有 / 無

其他健康問題：

____

住院紀錄：請列出最近五年的住院紀錄 (如有)

____

需要長期服用由醫生處方的藥物？ 無 / 有 (請例出病因及藥物名稱):

____

<u>其他生活健康習慣</u>

1. 你有無吸煙的習慣？ **無 / 有**
2. 你有無飲酒的習慣？ **無 / 有**
3. 你的工作需要體力勞動嗎？**需要 / 不需要**
4. 最近一個月內有無經常進行劇烈的體力活動？ **無/有**，平均每星期___天
5. 現在有無進行減體重計劃？ **無 / 有，透過節食 / 運動 / 藥物 / 其他:** ___________

<u>可以上課的時間</u> (*刪除不適用*的答案)

星期六**10:30am-12:00nn**	可以 / 不可以	星期日**10:30am-12:00nn**	可以 / 不可以
星期六**2pm-3:30pm**	可以 / 不可以	星期日**2pm-3:30pm**	可以 / 不可以
星期六**3:45pm-5:15pm**	可以 / 不可以	星期日**3:45pm-5:15pm**	可以 / 不可以

＃閣下所填寫之資料<u>只供本研究使用</u>，資料會以保密處理，而閣下遞交表格即代表閣下已細閱及明瞭本研究的招募資料。

全卷完，謝謝參與！

Appendix C Consent Form for Study One (English and Chinese Versions)

<u>Written Consent</u>

Title of study

Effects of Regular Yoga Practice

Chief investigator

Ms. LAU, H. L. PhD Student, the Chinese University of Hong Kong (CUHK)

Background and Purpose of the study

Background:

Yoga originated in Indian more than 5000 years ago, its principle is to achieve the integration of body, mind, and spirit. It consists of poses, breathing exercises and meditation. Nowadays yoga is a kind of popular recreation activity and low intensity physical activity. Regular practicing yoga can help improve flexibility, muscular endurance and balance, and reduce stress. Recently there are many publications about the health benefits of yoga, yet the influence of yoga on physical and mental health has not been fully examined and local evidence of randomized control trial is lacking. Therefore the results of this study would help understand the influence of yoga on physical and mental health.

Purposes:

1. To examine the beneficial effects of yoga practice on physical and mental health
2. To examine the effectiveness of regular yoga practice on improvement of Metabolic Syndrome and elucidate the possible underlying mechanisms of yoga practice by which improve Metabolic Syndrome

If I agree to participate, the following things will happen:

1. In the study, I will be assigned to either yoga group or waitlist control group. For yoga group, participants will attend a 12-week hatha yoga programme, with a frequency of once per week and one hour per session. For waitlist control group, participants will be asked to maintain the daily activities.
2. During the study, I will participate in two assessment sessions scheduled before the start and after the end of the yoga program. During each assessment session, I will be interviewed to complete questionnaire, undergo physical fitness assessment (push-up, sit-up and treadmill), measure body height, body weight, waist circumference, heart rate and blood pressure. A blood sample (6ml) will be taken to measure the levels of triglyceride, high density cholesterol and fasting glucose in each session. Two samples will be taken in the study.
3. If I will be assigned to yoga group, I will be asked to provide saliva samples before the start and after the end of Lesson 1 and 12, totally four samples will be provided and volume of each sample will be 50μl. If I will be assigned to waitlist control group, I will be arranged to my saliva sample at the same time as those yoga counterparts.
4. If I will be assigned to yoga group, I will be asked to keep yoga self practice weekly records for 12 weeks, and submit the weekly records to the research assistant the records for Week 1 to 11 in lesson 2 to 12, and the record for Week 12 in the 2nd assessment session.
5. I will be asked to inform the research assistant and withdrawn from the study if there would be change of my health status such as major psychiatric illnesses, chronic illnesses (e.g. cancer, kidney disease, cirrhosis, rheumatologic diseases), chronic inflections, cognitive impairment, substance abuse or pregnancy would be found during the participation of the study.

Risk

1. The process of blood sample taking would cause tiny wound and pain.
2. Yoga practice involves some poses which would challenge individual's flexibility and balance, injury would cause with inappropriate practice. The yoga program will be instructed by certified yoga instructor and proper training will be provided to ensure participants' safety.

Benefit

1. There may be no direct financial benefit to me from participating in the study.
2. Yoga practice can increase the physical activity level and muscular endurance, improve balance and flexibility, and reduce stress.

Confidentiality

All my personal data will be used for research purpose only, and is subjected to strict confidentiality and anonymity. My name or other identifying information will not be stated in any of the writing that is associated with this study.

Questions

The research assistant has discussed with me and offered to answer my questions. If I have further questions, I can contact her or Miss Lau can be researched through telephone at 2632 2190 or 2252 8786 during office hour.

Right to refuse or withdraw

I understand that to participate or not in the study is voluntary, and I have the right to withdraw from the study anytime, if I wish to. Participation or withdrawal of the study will not affect the treatment I will receive.

Consent

I agree to participate in this study. I have been given a copy of this form and had a chance to read it.

Participant's Signature:_________________ **Investigator's Signature:**_________________

Participant's Name: ____________________ **Investigator's Name:** ____________________

Date:_________________________________

利益

1. 本人知悉本人不會因參與這研究而取得任何金錢上的利益。
2. 本人知悉參與練習瑜伽能有助增加體力活動量和肌肉耐力，改善平衡力和柔軟度及紓緩壓力。

機密處理

本人的個人資料只用作研究用途，並將會作絕對保密和匿名的處理。本人的名字和一些能夠確認個人身分的資料將不會在任何與這份研究有關的報告內提及。

問題查詢

研究人員已和本人解釋研究內容及解答所有疑問。如本人還有問題查詢，可於辦公時間內聯絡劉小姐（2632 2190或2252 8786）。

婉拒或退出研究的權

本人明白參加這項研究屬自願性質，知道本人可以在這項研究進行的任何階段退出，而參加與否絕對不會影響本人在醫院的治療。

同意書

本人同意和自願參加此項研究。本人已有同意書的副本及閱讀和被告知有關的內容。

參與者簽名:________________________ 研究員簽名:________________________

參與者姓名:________________________ 研究員姓名:________________________

日期:______________________________

Appendix D PAR-Q & YOU (English and Chinese Versions)

Physical Activity Readiness Questionnaire - PAR-Q (revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
☐	☐	**1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?**
☐	☐	**2. Do you feel pain in your chest when you do physical activity?**
☐	☐	**3. In the past month, have you had chest pain when you were not doing physical activity?**
☐	☐	**4. Do you lose your balance because of dizziness or do you ever lose consciousness?**
☐	☐	**5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?**
☐	☐	**6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?**
☐	☐	**7. Do you know of any other reason why you should not do physical activity?**

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME ________________________________

SIGNATURE ________________________________ DATE ________________________

SIGNATURE OF PARENT ________________________ WITNESS ________________________
or GUARDIAN (for participants under the age of majority)

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

CSEP | SCPE © Canadian Society for Exercise Physiology www.csep.ca/forms

體能活動適應
能力問卷 —PAR-Q
(修訂版—2007 年 7 月)

體能活動適應能力問卷與你

(一份適用於 15 至 69 歲人士的問卷)

經常進行體能活動不但有益身心，而且樂趣無窮，因此，愈來愈多人開始每天多做運動。對大部分人來說，多做運動是很安全的。不過，有些人則應在增加運動量前，先行徵詢醫生的意見。

如果你計劃增加運動量，請先回答下列 7 條問題。如果你介乎 15 至 69 歲之間，這份體能活動適應能力問卷會告訴你應否在開始前諮詢醫生。如果你超過 69 歲及沒有經常運動，請徵詢醫生的意見。

普通常識是回答這些問題的最佳指引。請仔細閱讀下列問題，然後誠實回答：

請答「是」或「否」

是	否	
☐	☐	1. 醫生曾否說過你的心臟有問題，以及只可進行醫生建議的體能活動？
☐	☐	2. 你進行體能活動時會否感到胸口痛？
☐	☐	3. 過去一個月內，你曾否在沒有進行體能活動時也感到胸口痛？
☐	☐	4. 你曾否因感到暈眩而失去平衡，或曾否失去知覺？
☐	☐	5. 你的骨骼或關節(例如脊骨、膝蓋或髖關節)是否有毛病，且會因改變體能活動而惡化？
☐	☐	6. 醫生現時是否有開血壓或心臟藥物（例如 water pills）給你服用？
☐	☐	7. 是否有其他理由令你不應進行體能活動？

如果你的答案是：

一條或以上答「是」

在開始增加運動量或進行體能評估前，請先致電或親身與醫生商談，告知醫生這份問卷，以及你回答「是」的問題。

- 你可以進行任何活動，但須在開始時慢慢進行，然後逐漸增加活動量；又或你只可進行一些安全的活動。告訴醫生你希望參加的活動及聽從他的意見。
- 找出一些安全及有益健康的社區活動。

全部答「否」

如果你對這份問卷的全部問題誠實地答「否」，你有理由確信你可以：

- 開始增加運動量——開始時慢慢進行，然後逐漸增加，這是最安全和最容易的方法。
- 參加體能評估——這是一種確定你基本體能的好方法，以便你擬定最佳的運動計劃。此外，亦主張你量度血壓；如果讀數超過 144/94，請先徵詢醫生的意見，然後才逐漸增加運動量。

→

延遲增加運動量：

- 如果你因傷風或發燒等暫時性疾病而感到不適——請在康復後才增加運動量；或
- 如果你懷孕或可能懷孕——請先徵詢醫生的意見，然後才決定是否增加運動量。

請注意：如因健康狀況轉變，致使你隨後須回答「是」的話，便應告知醫生或健身教練，看看應否更改你的體能活動計劃。

適當使用體能活動適應能力問卷：
The Canadian Society for Exercise Physiology、Health Canada 及其代理人毋須爲進行體能活動的人承擔責任。如填妥問卷後有疑問，請先徵詢醫生的意見，然後才進行體能活動。

不得更改問卷內容。歡迎複印整份問卷(必須整份填寫)

註： 如一名人士在參加體能活動或進行體能評估前已獲得這份問卷，本部分可作法律或行政用途。

本人已閱悉、明白並填妥本問卷。本人的問題亦已得到圓滿解答。

姓名:________________　　身份證明文件號碼:________________
簽署:________________　　日期:________________
家長或監護人簽署:________________　　見證人:________________
（適用於 18 歲以下的參加者）

備註：

如果在上述問卷中有一個或以上「是」的答案，即表示你的身體狀況可能不適合參與有關活動。故爲安全起見，請你先行諮詢醫生的意見；並須在報名或租訂健身室設施時出示醫生紙，證明你的身體狀況適宜參與有關活動。如未能出示醫生紙，則須填妥「申請人聲明」，並於報名或租訂健身室設施時連同報名表一併遞交。

©Canadian Society for Exercise Physiology　　Supported by: Health Canada

此問卷由填寫當天起計 12 個月內有效。如因健康狀況轉變，致使你隨後對上述的任何問題答「是」的話，則本問卷即告無效。

Appendix E Demographic Data Sheet for Study One (English and Chinese Versions)

Demographic Data Sheet

Name: _________________ Subject Code:________ Date of interview:______________

Date of birth: ____________ Gender: Male / Female
(dd/mm/yy)

Marital status: Single/Married/Widowed

Highest education attained: No formal education / Primary School / Secondary School / Tertiary or above
Employment: Full time / Part time / Unemployed / Housewife / Retired / Student
Is your work / daily activities involved manual labor? Yes / No
Smoking: Yes / Quit / Never
If yes: have been smoking for _______ year(s) and take _______bag(s) of cigarette/week
If quitted: have quitted for _________(years/months), smoked for _______ year(s) and took _______bag(s) of cigarette/week
Amount of alcohol: Quit / Never / Occasional / Regular

個人資料

姓名: _________________ 研究編號:________ 訪受日期:______________

出生日期: ____________ 性別:男 / 女 婚姻狀況: 單身 / 已婚 / 寡婦或鰥夫
日日/月月/年年
最高學歷: 沒有接受正規教育 / 小學 / 中學 / 大專或以上
職業: 全職 / 兼職 / 待業 / 家庭主婦 / 退休人士 / 學生
你的日常工作或活動是否體力勞動? 是 / 否
吸煙習慣: 有 / 已戒 / 從不
如有吸煙習慣: 已吸煙_______年, 平衡每星期吸_______包煙
如已戒煙: 已戒煙_______年/月,已吸煙_______年, 以前平衡每星期吸_______包煙
飲酒的習慣: 已戒/ 從不 / 間中 / 經常

Appendix F Physical Fitness Assessment Record Sheet for Study One
(English and Chinese Versions)

Physical Fitness Assessment Record Sheet

Name: ________________ Subject code: _______ Sex: Male / Female

Assessment	Baseline	Post-intervention
Date (dd/mm/yy)		
Height (correct to 0.5 cm)	cm	cm
Weight (correct to 0.5 kg)	kg	kg
Waist circumference (correct to 0.5 cm)	cm	cm
Resting heart rate	bpm	bpm
Systolic Blood Pressure	mmHg	mmHg
Diastolic Blood Pressure	mmHg	mmHg
Push-Up	times	times
Sit-Up	times	times
VO_{2max} (Maximum oxygen uptake)	ml/kg/min	ml/kg/min

Flexibility	Baseline				Post-intervention			
Trial	1	2	3	Result	1	2	3	Result
Left leg								
Right leg								

體適能測試紀錄表

姓名:________________ 研究編號: __________ 性別: 男 / 女

體適能測試項目	前測	後測
日期 (dd/mm/yy)		
身高 (準確至 0.5 厘米)	厘米	厘米
體重 (準確至 0.5 公斤)	公斤	公斤
腰圍 (準確至 0.5 厘米)	厘米	厘米
靜態心跳率	每分鐘 次	每分鐘 次
血壓 - 上壓	mmHg	mmHg
血壓 - 下壓	mmHg	mmHg
掌上壓	次	次
仰臥起坐	次	次
最大攝氧量	ml/kg/min	ml/kg/min

柔軟度	前測 (準確至 0.5 厘米)				後測 (準確至 0.5 厘米)			
測試	1	2	3	成績	1	2	3	成績
左腳								
右腳								

Appendix G Yoga and Health Questionnaire for Study One
(English and Chinese Versions)

Yoga and Health Questionnaire

The purpose of this study is to examine the beneficial effects of yoga practice on physical and mental health of individuals. The questionnaire comprises 6 parts. Your answers to the items in the questionnaire are anonymous and confidential. All information provided will be used for the research purpose only. Thank you for your time in filling out this questionnaire.

Subject Code:__________ Date:____________

Part 1: IPAQ

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

    _____ **days per week**

    ☐ No vigorous physical activities ➜ ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

    _____ **hours per day**

    _____ **minutes per day**

    ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

    _____ **days per week**

    ☐ No moderate physical activities ➜ ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → *Skip to question 7*

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Parts 2-6 contain a series of statements about how people might think, feel, or behave. You are asked to indicate the extent to which each statement pertains to you personally. There are no right or wrong answers. Just answer as accurately as possible. Remember, your responses are confidential, so please be completely honest and answer all items.

Part 2: PSS

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate. For each question choose from the following alternatives:

		Never	Almost never	Sometimes	Fairly often	Very often
1.	How often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2.	How often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3.	How often have you felt nervous or "stressed"?	0	1	2	3	4
4.	How often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5.	How often have you felt that things were going your way?	0	1	2	3	4
6.	How often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7.	How often have you been able to control irritations in your life?	0	1	2	3	4
8.	How often have you felt that you were on top of things?	0	1	2	3	4
9.	How often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
10.	How often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Part 3: CESD

Below is a list of some of the ways you may have felt or behaved. Using a scale like the one below, indicate how often you have felt this way during the past week by entering it to the left of the number of the statement.

		Rarely or none of the time	Some of a little of the time	Occasionally or a moderate amount of the time	Most or all of the time
1.	I was bothered by things that usually don't bother me.	0	1	2	3
2.	I did not feel like eating; my appetite was poor.	0	1	2	3
3.	I felt that I could not shake off the blues even with help from my family or friends.	0	1	2	3
4.	I felt that I was just as good as other people.	0	1	2	3
5.	I had trouble keeping my mind on what I was doing.	0	1	2	3
6.	I felt depressed.	0	1	2	3
7.	I felt that everything I did was an effort.	0	1	2	3
8.	I felt hopeful about the future.	0	1	2	3
9.	I thought my life had been a failure.	0	1	2	3
10.	I felt fearful.	0	1	2	3
11.	My sleep was restless.	0	1	2	3
12.	I was happy.	0	1	2	3
13.	I talked less than usual.	0	1	2	3
14.	I felt lonely.	0	1	2	3
15.	People were unfriendly.	0	1	2	3
16.	I enjoyed life.	0	1	2	3
17.	I had crying spells.	0	1	2	3
18.	I felt sad.	0	1	2	3
19.	I felt that people disliked me.	0	1	2	3
20.	I could not get "going".	0	1	2	3

(0 = Less than 1 day, 1 = Some of a little of the time, 2 = Occasionally or a moderate amount of the time, 3 = Most or all of the time)

Part 4: RSE

Using a scale like the one below, indicate your answer by entering it to the left of the number of the statement.

		Always disagree	Mostly disagree	Mostly agree	Always agree
1.	I feel that I'm a person of worth at least on an equal plane with others.	1	2	3	4
2.	I feel that I have a number of good qualities.	1	2	3	4
3.	All in all, I am inclined to feel that I am a failure.	1	2	3	4
4.	I am able to do things as well as other people.	1	2	3	4
5.	I feel I do not have much to be proud of.	1	2	3	4
6.	I take a positive attitude toward myself.	1	2	3	4
7.	On the whole, I am satisfied with myself.	1	2	3	4
8.	I wish I could have more respect for myself.	1	2	3	4
9.	I certainly feel useless at times.	1	2	3	4
10.	At times I think I am no good at all.	1	2	3	4

Part 5: SF-36

Instruction: This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

1. In general, would you say your health is:

	(Circle one)
Excellent	1
Very Good	2
Good	3
Fair	4
Poor	5

2. Compared to one year ago, how would you rate your health in general now?

	(Circle one)
Much better now than one year ago	1
Somewhat better now than one year ago	2
About the same as one year ago	3
Somewhat worse now than one year ago	4
Much worse now than one year ago	5

3. The following items are about activities you might do during a typical day. Does **your health now limit** you in these activities? If so, how much?

(Circle one number on each line)

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing several flights of stairs	1	2	3
e. Climbing one flight of stairs	1	2	3
f. Bending, kneeling, or stooping	1	2	3
g. Walking more than a mile	1	2	3
h. Walking several blocks	1	2	3
i. Walking one block	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

(Circle one number on each line)

		Yes	No
a	Cut down the amount of time you spent on work or other activities	1	2
b	Accomplished less than you would like	1	2
c	Were limited in the kind of work or other activities	1	2
d	Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

(Circle one number on each line)

		Yes	No
a	Cut down the amount of time you spent on work or other activities	1	2
b	Accomplished less than you would like	1	2
c	Didn't do work or other activities as carefully as usual	1	2

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle one)

Not at all 1
Slightly 2
Moderately.. 3
Quiet a bit 4
Extremely 5

7. How much bodily pain have you had during the past 4 weeks?

	(Circle one)
None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Very Severe	6

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

	(Circle one)
Not at all	1
Slightly	2
Moderately	3
Quiet a bit	4
Extremely	5

9. These questions are about how you feel and how things have been with you during the **past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks**…

(Circle one number on each line)

		All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
a.	Did you feel full of pep?	1	2	3	4	5	6
b.	Have you been a very nervous person?	1	2	3	4	5	6
c.	Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
d.	Have you felt calm and peaceful?	1	2	3	4	5	6
e.	Did you have a lot or energy?	1	2	3	4	5	6
f.	Have you felt downhearted and blue?	1	2	3	4	5	6
g.	Did you feel worn out?	1	2	3	4	5	6
h.	Have you been a happy person?	1	2	3	4	5	6
i.	Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

	(Circle one)
All of the time	1
Most of the time	2
Some of the time	3
A little of the time	4
None of the time	5

11. How TRUE or FALSE is each of the following statements for you?

(Circle one number on each line)

		Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a.	I seem to get sick a little easier than other people	1	2	3	4	5
b.	I am as healthy as anybody I know	1	2	3	4	5
c.	I expect my health to get worse	1	2	3	4	5
d.	My health is excellent	1	2	3	4	5

Part 6: STAI

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the response option to the right to indicate <u>how you feel right now</u>, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement, but give the answer which seems to describe your present feelings best.

		Not At All	Somewhat	Moderate So	Very Much so
1.	I feel calm*	1	2	3	4
2.	I feel secure*	1	2	3	4
3.	I am tense	1	2	3	4
4.	I feel regretful	1	2	3	4
5.	I feel at ease*	1	2	3	4
6.	I feel upset	1	2	3	4
7.	I am presently worrying over possible misfortunes	1	2	3	4
8.	I feel rested*	1	2	3	4
9.	I feel anxious	1	2	3	4
10.	I feel comfortable*	1	2	3	4
11.	I feel self-confident*	1	2	3	4
12.	I feel nervous	1	2	3	4
13.	I am jittery	1	2	3	4
14.	I feel "high strung"	1	2	3	4
15.	I am relaxed*	1	2	3	4
16.	I am contented*	1	2	3	4
17.	I am worried	1	2	3	4
18.	I feel over-excited and "rattled"	1	2	3	4
19.	I feel joyful*	1	2	3	4
20.	I feel pleasant*	1	2	3	4

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the response option to the right to indicate how you feel most of the time. There are no right or wrong answers. Do not spend too much time on any one statement, but give the answer which seems to describe your feelings best.

		Almost Never	Sometimes	Often	Almost Always
21.	I feel pleasant*	1	2	3	4
22.	I tire quickly	1	2	3	4
23.	I feel like crying*	1	2	3	4
24.	I wish I could be as happy as others seem to be*	1	2	3	4
25.	I am losing out on things because I can't make up my mind soon enough	1	2	3	4
26.	I feel rested*	1	2	3	4
27.	I am "calm, cool and collected"*	1	2	3	4
28.	I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29.	I worry too much over something that really doesn't matter	1	2	3	4
30.	I am happy*	1	2	3	4
31.	I am inclined to take things hard	1	2	3	4
32.	I lack self-confidence	1	2	3	4
33.	I feel secure*	1	2	3	4
34.	I try to avoid facing a crisis or difficulty*	1	2	3	4
35.	I feel blue	1	2	3	4
36.	I am content*	1	2	3	4
37.	Some unimportant thought runs through my mind and bothers me	1	2	3	4
38.	I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39.	I am a steady person*	1	2	3	4
40.	I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

This is the end of the questionnaire, thank you!

瑜伽練習與身心健康研究問卷

這個研究的目的是探討瑜伽練習對身心健康之影響。此問卷共有六個部分， 你的答案是不記名和保密，而所提供的資料只供研究之用。謝謝閣下撥冗填妥本問卷。

研究編號: ____________ **受訪日期:** ____________________

第一部分:IPAQ

此問卷是探討人們日常參與體育活動的情形，問卷內容是有關你在過去七天內所用於參與體育活動的時間。即使你不是一個活躍的人，請你回答每條問題。請細想有關你日常活動包括工作、家務、園藝、各地方的往返、以及閒暇時所參與的康樂、體育活動或運動。

試想想你在過去七天內曾進行過的**劇烈**體育活動，**劇烈**體育活動是指該活動需要消耗大量體能及使你的呼吸比平常更為辛苦。試只想那些你每次進行**最少十分鐘**的體育活動。

1. 在過去七天內，你有多少天是進行**劇烈**體育活動，例如提重物、掘地、跳健康舞或快速踏單車？

   每星期_________天

2. 在以上其中一天，你通常用多少時間進行**劇烈**體育活動？

   每日_________小時_________分鐘

   ☐ 不知道/不太清楚

試想想你在過去七天內曾進行過的中度體育活動，中度體育活動是指該活動需要消耗中度體能及使你的呼吸比平常較為辛苦。試只想那些你每次進行最少十分鐘的體育活動。

3. 在過去七天內，你有多少天是進行中度體育活動，例如提輕便物件、均速踏單車或網球雙打？但不包括步行。

   每星期_________天

   ☐ 沒有中度體育活動，請跳至第五題

4. 在以上其中一天，你通常用多少時間進行中度體育活動？

   每日_________小時_________分鐘

   ☐ 不知道/不太清楚

試想想你在過去七天內曾用於步行的時間，這包括在工作或在家、步行前往乘搭交通工具，及步行前往參與康樂活動、運動或閒暇活動等。

5. 在過去七天內，你有多少天是進行步行而每次不少於十分鐘？

   每星期_________天

   ☐ 沒有步行，請跳至第七題

6. 在以上其中一天，你通常用多少時間步行？

   每日_________小時_________分鐘

   ☐ 不知道/不太清楚

最後一條問題是有關你在<u>過去七天內</u>(不包括星期六、日)曾用於<u>坐著</u>的時間，這包括在工作、在家裡、進修和閒暇的時間，這可以包括在書桌前看書、探訪朋友、閱讀、或坐著或躺臥看電視。

7. 在<u>過去七天內</u>，你平日用多少時間<u>坐著</u>(不包括星期六、日)？

每日________小時________分鐘

☐ 不知道/不太清楚

第二、第三和第四部分是有關個人的想法、 感覺或行爲的句子。請你指出每句句子對你的同意程度。這些沒有對或錯的答案，請儘量精確地回答。記住你的答案是保密的，所以請如實作答所有問題。

第二部分:PSS

我們想知道你<u>***過去一個月***</u>的感覺和想法，聽完每條問題後，請你講出最接近你過去一個月的感覺和想法的答案。

	於過去一個月裏面…	完全沒有	差不多沒有	間中	經常	差不多每天都是
1.	你有幾多時間曾經因爲一些預料不到的事而感到不開心?	0	1	2	3	4
2.	你有幾多時間感覺到自己沒有能力控制自己生命中重要的事?	0	1	2	3	4
3.	你有幾多時間感覺到壓力及精神緊張的?	0	1	2	3	4
4.	你有幾多時間覺得有信心和能力去處理自己的個人問題?	0	1	2	3	4
5.	你有幾多時間感到事情係隨心所欲?	0	1	2	3	4
6.	你有幾多時間感到自己應付不到所有要面對的事情?	0	1	2	3	4
7.	你有幾多時間感到自己有能力去控制生命中的煩擾?	0	1	2	3	4
8.	你有幾多時間感到一切事情都在掌握之中?	0	1	2	3	4
9.	你有幾多時間爲一些不能控制的事而感到忿怒?	0	1	2	3	4
10.	你有幾多時間感到難以克服越積越多的困難?	0	1	2	3	4

第三部分: CESD

我們想知道***這一星期以來***你的感覺和想法，請你聽完每條問題後，講出你覺得最能表達自己感覺的答案。

		完全不是	間中	經常	差不多每天都是
1.	我被一些平時不會困擾我的事情困擾。	0	1	2	3
2.	我不想吃東西, 我的胃口很差。	0	1	2	3
3.	即使有家人和朋友的幫忙, 我仍然覺得憂鬱。	0	1	2	3
4.	我覺得我不比其他人差。	0	1	2	3
5.	我很難集中精神工作。	0	1	2	3
6.	我覺得情緒低落。	0	1	2	3
7.	我覺得我做每件事情都很吃力。	0	1	2	3
8.	我對將來抱有希望。	0	1	2	3
9.	我覺得自己一生很失敗。	0	1	2	3
10.	我覺得恐懼。	0	1	2	3
11.	我睡眠不安寧。	0	1	2	3
12.	我很開心。	0	1	2	3
13.	我比平時少說話。	0	1	2	3
14.	我覺得孤獨。	0	1	2	3
15.	我覺得其他人不友善。	0	1	2	3
16.	我很享受生活。	0	1	2	3
17.	我會經常無故哭泣。	0	1	2	3
18.	我覺得不開心。	0	1	2	3
19.	我覺得其他人不喜歡我。	0	1	2	3
20.	我提不起勁。	0	1	2	3

(完全不是 = 一天都不會，間中 = 一至兩天，經常 = 三至四天，差不多每天都是 = 五至七天)

第四部分: **RSESC**

我們想知道你*過去一個月*的感覺和想法，聽完每條問題後，請你講出最接近你過去一個月的感覺和想法的答案。

		十分不同意	很不同意	很同意	十分同意
1.	我認爲自己是個有價値的人，最低限度和其他人一樣。	1	2	3	4
2.	我認爲自己擁有一些個人的優點。	1	2	3	4
3.	從各方面考慮，我傾向認爲自己是個失敗者。	1	2	3	4
4.	我能和其他人一樣把事情做好。	1	2	3	4
5.	我覺得自己沒有什麼事能引以爲傲。	1	2	3	4
6.	我對自己抱有正面的態度。	1	2	3	4
7.	總括而言，我對自己滿意。	1	2	3	4
8.	我希望我能對自己有多些尊重。	1	2	3	4
9.	我有時覺得自己沒用。	1	2	3	4
10.	我有時覺得自己一無是處。	1	2	3	4

第五部分:MOS SF-36

填寫說明

這項調查是詢問你對自己健康狀況的了解。此項資料記錄你的自我感覺和日常生活的情況。

請你按照說明回答下列問題。如果你對某一個問題不能做出肯定的回答，請按照你的理解選擇最合適的答案。

1. 總括來說，你認爲你的健康狀況是：

	(只圈出一個答案)
極好	1
很好	2
好	3
一般	4
差	5

2. *和一年前相比較*，你認爲你*目前*全面的健康狀況如何？

	(只圈出一個答案)
比一年前好多了	1
比一年前好一些	2
比一年前差不多	3
比一年前差一些	4
比一年前差多了	5

3. 下列各項是你日常生活中可能進行的活動。以你目前的健康狀況，你在進行這些活動時，有沒有受到限制？如果有的話，程度如何？

(每項只圈出一個答案)

活動	有很大限制	有一點限制	沒有任何限制
a. 劇烈活動，比如跑步、搬重物，或參加劇烈的體育活動	1	2	3
b. 中等強度的活動，比如搬桌子、使用吸塵器清潔地面、玩保齡球或打太極拳	1	2	3
c. 提起或攜帶蔬菜、食品或雜貨	1	2	3
d. 上幾層樓梯	1	2	3
e. 上一層樓梯	1	2	3
f. 彎腰、跪下、或俯身	1	2	3
g. 步行十條街以上 (一公里)	1	2	3
h. 步行幾條街 (幾百米)	1	2	3
i. 步行一條街 (幾十米)	1	2	3
j. 自己洗澡或穿衣服	1	2	3

4. *在過去四星期裏*，你在工作或其他日常活動中，有沒有因爲身體健康的原因而遇到下列的問題？

(每項只圈出一個答案)

	有	沒有
a. 減少工作或其他活動的時間	1	2
b. 實際做的比想做的要少	1	2
c. 工作或其他活動種類受到限制	1	2
d. 完成工作或其他活動時有困難 (比如覺得更爲吃力)	1	2

5. *在過去四星期裏*，你在工作或其他日常活動中，有沒有由於情緒方面的原因 (比如感到沮喪或焦慮) 而遇到下列的問題？

(每項只圈出一個答案)

	有	沒有
a. 減少工作或其他日常活動的時間	1	2
b. 實際做完的比想做的要少	1	2
c. 工作或其他活動時不如往常細心了	1	2

6. *在過去四星期裏*，你的身體健康或情緒問題在多大程度上妨礙了你與人、朋友、鄰居或社團的日常社交活動？

(只圈出一個答案)

毫無影響.. 1
有很少影響.. 2
有一些影響.. 3
有較大影響.. 4
有極大影響.. 5

7. *在過去四星期裏*，你的身體有沒有疼痛？如果有的話，疼痛到什麼程度？

(只圈出一個答案)

完全沒有............ 1
很輕微............ 2
輕微............ 3
有一些............ 4
劇烈............ 5
非常劇烈............ 6

8. *在過去四星期裏*，你身體上的*疼痛*對你的日常工作 (包括上班和家務) 有多大影響？

(只圈出一個答案)

毫無影響............ 1
有很少影響............ 2
有一些影響............ 3
有較大影響............ 4
有極大影響............ 5

9. 下列問題有關你在*過去四星期裏*的自我感覺和其他情況。請針對每一問題，選擇一個最接近你的感覺的答案。

在*過去四星期裏*有多少時間：............(每項只圈出一個答案)

		常常如此	大部份時間	相當多時間	有時	偶爾	從來沒有
a.	你覺得充滿活力？	1	2	3	4	5	6
b.	你覺得精神非常緊張？	1	2	3	4	5	6
c.	你覺得情緒低落，以致沒有任何事能使你高興起來？	1	2	3	4	5	6
d.	你感到心平氣和？	1	2	3	4	5	6
e.	你感到精力充足？	1	2	3	4	5	6
f.	你覺得心情不好，悶悶不樂？	1	2	3	4	5	6
g.	你感到筋疲力盡？	1	2	3	4	5	6
h.	你是個快樂的人？	1	2	3	4	5	6
i.	你覺得疲倦？	1	2	3	4	5	6

10. *在過去四星期裏*，有多少時間由於你的*身體健康或情緒問題*妨礙了你的社交活動 (比如探親，訪友等)？

(只圈出一個答案)

常常有影響............ 1
大部份時間有影響............ 2
有時有影響............ 3
偶爾有影響............ 4
完全沒有影響............ 5

11. 如果用下列句子來形容你，你認爲有多正確？

(每項只圈出一個答案)

		肯定對	大致對	不知道	大致不對	肯定不對
a.	你好像比別人更容易生病	1	2	3	4	5
b.	你和所有認識的人一樣健康	1	2	3	4	5
c.	你覺得自己的身體狀況會變壞	1	2	3	4	5
d.	你的健康極好	1	2	3	4	5

第六部分:STAI

我們想知道你*現在*的感覺，請你聽完每一個陳述後，講出你覺得最能表達你而家感覺的答案。

不要對任何一個陳述花太多時間去考慮，亦沒有對或錯的答案。

		完全沒有	有些	中等程度	非常明顯
1.	我感到心情平靜*	1	2	3	4
2.	我感到安全*	1	2	3	4
3.	我是緊張的	1	2	3	4
4.	我感到緊張束縛	1	2	3	4
5.	我感到安逸*	1	2	3	4
6.	我感到煩亂	1	2	3	4
7.	我現在正煩惱, 感到這種煩惱超過了可能的不幸	1	2	3	4
8.	我感到滿意*	1	2	3	4
9.	我感到害怕	1	2	3	4
10.	我感到舒適*	1	2	3	4
11.	我有自信心*	1	2	3	4
12.	我覺得神經過敏	1	2	3	4
13.	我極度緊張不安	1	2	3	4
14.	我優柔寡斷	1	2	3	4
15.	我是輕鬆的*	1	2	3	4
16.	我感到心滿意足*	1	2	3	4
17.	我是煩惱的	1	2	3	4
18.	我感到慌亂	1	2	3	4
19.	我感到鎮定*	1	2	3	4
20.	我感到愉快*	1	2	3	4

現在我們想知道你*平時 / 經常*的感覺，請你聽完每一個陳述後，講出你覺得最能表達你平時/ 經常感覺的答案。不要對任何一個陳述花太多時間去考慮，亦沒有對或錯的答案。

		幾乎沒有	有些	經常	幾乎總是如此
21.	我感到愉快*	1	2	3	4
22.	我感到神經過敏和不安	1	2	3	4
23.	我感到自我滿足*	1	2	3	4
24.	我希望能像別人那樣地高興*	1	2	3	4
25.	我感到我像衰竭一樣	1	2	3	4
26.	我感到很寧靜*	1	2	3	4
27.	我是平靜的，冷靜的和泰然自若的*	1	2	3	4
28.	我感到困難一一堆集起來，因此無法克服	1	2	3	4
29.	我過份優慮一些事，實際這些事無關緊要	1	2	3	4
30.	我是高興的*	1	2	3	4
31.	我的思想處於混亂狀態	1	2	3	4
32.	我缺乏自信心	1	2	3	4
33.	我感到安全*	1	2	3	4
34.	我容易做出決斷*	1	2	3	4
35.	我感到不合適	1	2	3	4
36.	我是滿足的*	1	2	3	4
37.	一些不重要的思想總纏繞著我，并打擾我	1	2	3	4
38.	我產生的沮喪是如此強烈，以致我不能從思想中排除它們	1	2	3	4
39.	我是一個鎮定的人*	1	2	3	4
40.	當我考慮我目前的事情和利益時，我就陷入緊張狀態	1	2	3	4

訪問完畢，多謝參與本研究！

Appendix H Description of 57 Yogic Postures for Study One

The poses were divided into the following six categories, namely, Standing Poses, Sitting Poses, Kneeling Poses, Supine Poses, Prone Poses, and Arm Support Poses. The poses were described in alphabetical order in each category.

Standing Poses

Chair Pose (Utkatasana)

Starting from Mountain Pose, the arms were raised up perpendicular to the floor with an inhalation. Bending the knees with an exhalation and trying to take the thighs as nearly parallel to the floor as possible. The knees were projected out over the feet, and the torso was leaned slightly forward over the thighs until the front torso formed approximately a right angle with the tops of the thighs. The shoulder blades were firmed against the back. The tailbone was taken down toward the floor and in toward the pubis to keep the lower back long. Breathing was done for five times. The knees were straightened with an inhalation, lifting strongly through the arms. Exhaling, release the arms to the sides into Mountain Pose.

Variation: Chair with Torso Twist

Performing Chair Pose, palms were pressed together in front of the chest with an inhalation. Exhaling, twisting the upper torso to the right side. Breathing was done for five times. Inhaling, twisting the upper torso back to the centre. Exhaling, twisting the upper torso to the left side. Breathing was done for five times. Inhaling, twisting the upper torso back to the centre. The knees were straightened with an inhalation, lifting strongly through the arms. Exhaling, release the arms to the sides into Mountain Pose.

Extended Hand-Toe Pose (Utthita Hasta Padangusthasana)

Starting from Mountain Pose, the left knee was brought toward the belly. Reaching the left arm inside the thigh, cross it over the front ankle, and holding the outside of the left foot. Inhale and extend the left leg forward and the knee was straightened. Then swinging the leg out to the side. Breathing was done for six times. Swinging the leg back to center with an inhalation, and the foot was lowered to the floor with an exhalation. Repeat on the other side.

Extended Side Angle Pose (Utthita Parsvakonasana)

Starting from Mountain Pose, exhaling, and stepping or lightly jumping 3.5 to 4 feet apart. Raising the arms parallel to the floor and reaching out to the sides with palms down. The left foot was turned in slightly to the right and the right foot was turned out to the right 90 degrees. The right heel was aligned with the left heel. The left hip was rolled slightly forward, toward the right, but the torso was rotated back to the left. The left heel was anchored to the floor by lifting the inner left groin deep into the pelvis. Exhaling, the right knee was bent over the right ankle, so that the shin was perpendicular to the floor. The left arm was extended straight up toward the sky, then the left palm was turned to face toward the head and reaching the arm over the back of the left ear with an inhalation, palm facing the floor. Stretching from the left heel through the left fingertips, the entire left side of the body was lengthened. Turning the head to look at the left arm. The right shoulder was released away from the ear. Exhaling and lay the right side of the torso down onto the top of the right thigh. Press the right fingertips or palm on the floor just outside of the right foot. Breathing was done for five times. Inhaling, pushing both heels strongly into the floor and reaching the left arm forcefully toward the ceiling to lighten the upward movement. Reverse the feet and repeat the pose. Then come up and return to Mountain Pose.

Half Moon (Ardha Chandrasana)

Performing Extended Side Angle Pose (right), and the left hand was rested on the left hip. Inhaling, reaching the right hand forward, beyond the Baby toe side of the right foot, at least 12 inches. Exhaling, the right hand and right heel were pressed firmly into the floor, and the right leg was straightened, simultaneously the left leg was lifted parallel (or a little above parallel) to the floor. Then rotating the upper torso to the left. The lower hand was pressed lightly to the floor, using it to regulate the balance. The inner ankle of the standing foot was lifted strongly upward, as if drawing energy from the floor into the standing groin. The sacrum and scapulas were pressed firmly against the back torso, and the coccyx was lengthened toward the raised heel. The left hand was extended out with fingers pointing to the sky. Breathing was done for five times. Then the raised leg was lowered to the floor with an exhalation, and return to Triangle Pose or Extended Side Angle Pose. Repeat the pose on the other side.

Supplementary Exercise: Modified Half Moon

This is not a traditional yoga pose. But it is an exercise for improving the balance and muscular strength for performing Half Moon, especially for the beginners with poor core muscle and balance and have difficulty to perform Half Moon.

Starting with akneeling position, the right hand was extended out to the shoulder height with palm facing down, and the leg hand was rested on the left hip. Then the left leg was straightened with the left feet pressing on the floor. Inhaling, the right palm was placing on the floor with finger pointing to the right side and the left leg was lifted up parallel to the floor.

Intense Side Stretch (Parsvottanasana)

Stepping the legs three to four feet (about one meter) apart from a Mountain Pose. Turning to the right so that the right leg was forward and the left leg was back. The hips were squared to the front. The palms were pressed together behind the back with the fingertips pointed up. The shoulders were kept open. Breath was kept natural. The tailbone was extended down, back was arched and the chest was lifted. With the exhalation, the right hip was pulled back, the length of the spine was maintained and folded forward until spine was parallel with the floor. The hips were kept squared and the ribs were kept parallel to the ground. With the next exhalation, the torso was released down over the right leg without rounding the back. The neck was kept relax and the abdomen was softened. Breathing was done for five times. Pressing down firmly through both feet and extending up through the crown of the head in order to come out of the position. The ribcage and chest were pressed forward and the body was lifted upright with inhalation. Repeat this pose with the left side.

King of the Dancers Pose (Natarajasana)

Starting from Mountain Pose, inhaling, the weight was shifted onto the right foot, and the left heel was lifted toward the left buttock as bending the knee. Pressing the head of the right thigh bone back, deep into the hip joint, and pulling the knee cap up to keep the standing leg straight and strong. Then reaching back with the left hand and grasping the outside of the left foot or ankle. The pubis was lifted toward the navel, and the tailbone was pressed toward the floor. The left foot was lifted up, away from the floor, and back, away from the torso. The left thigh was extended behind and parallel to the floor. Stretching the right arm forward, in front of the torso, and parallel to the floor. Breathing was done for six times. Then the grasp on the foot was released, the left foot was placed back onto the floor, and repeat the pose on the other side.

Lunge

Starting from Downward-Facing Dog. With an exhalation, the right foot was stepped forward between the hands, the knee was aligned over the heel. Inhale and Raise the torso to upright with an inhalation. At the same time, sweeping the arms wide to the sides and raising them overhead, palms facing. Lengthening the tailbone toward the floor and reaching back through the left heel. Looking up toward the thumbs. The ribs were drawn down and into the torso. The arms were lifted from the lower back ribs, reaching through the little fingers. Breathing was done for five times. Then exhale, release the torso to the right thigh, the hands were swept back onto the floor, and, with another exhalation, the right foot was stepped back and return to Downward Facing. Breathing was done for five times and repeating the pose with the left foot forward.

Mountain Pose (Tadasana)

Mountain Pose is the starting position for most of the standing poses. Standing with the bases of the big toes touching, heels slightly apart. The toes were lifted and spread and the balls of the feet, then lay on the floor. The weight of the body should be evenly distributed on the foot. Firming the thigh muscle and the knee caps was lifted. The inner ankles were lifted to strengthen the inner arches, and the upper thighs were turned slightly inward. The tailbone was lengthened toward the floor and the pubis was lifted toward the navel. The shoulder blades were pressed into the back, then widened across and released down the back. Lifting the top of the sternum straight toward the ceiling without pushing the lower front ribs forward. The arms were hung beside the torso. Balance the crown of the head directly over the center of the pelvis, with the underside of the chin parallel to the floor, throat soft, and the tongue wide and flat on the floor of the mouth. Soften the eyes.

Revolved Side Angle Pose (Parivrtta Parshvakonasana)

Starting from Extended Side Angle Pose with the right leg forward and the right hand to the outside of the right foot. The torso was brought upright and palms were pressed together in front of the chest. Rotating the chest toward the right knee and bringing the left elbow over the right knees as exhalation. The spine was lengthened and the chest was open on each inhalation. Twisting slightly more to the right on each exhalation. Breathing was done for five times. Exhaling and twisting the torso back to the centre. Release the palms and come to Mountain Pose. Repeat the post on the left side.

Revolved Lunge

Performing Lunge (right) and then the palm were pressed together in front of the chest with the fingertips pointed up. Twisting the torso to the right and leaning forward with the left elbow over the knee. Breathing was done for five times. Turning the torso back to the centre and lifting upright. Placing the hands on the floor and then stepping foot back one by one to become Plank Pose. Performing Downward Facing Dog and breathing was done for five times. Performing Revolved Lunge on the left side.

Revolved Triangle Pose (Parivrtta Trikonasana)

Moving from Mountain Pose, stepping the left leg back far enough for balance, but the left foot was firmly kept on the floor. Facing the right foot forward, and turning out the left foot approximately 10 to 15 degree. The hips were kept squared. Inhaling, the low spine was lengthened and the left arm was extended forward with the right arm back. The left hand was placed as far down the outside of the right legs as possible. By extending the torso away from the hips, reopen the space between the hips and ribs. Exhaling, turning the head to look at the right hand which extended pointing toward the sky, and the left hand extending down toward the ground. The shoulders were rolled open with both palms facing forward. Exhaling, drawing the shoulders away from the ears. The chin was aligned with the right shoulder. Breathing was done for five times. Both hands were brought to either side of the front foot, then the hands were brought to the hips with inhalation. Raise the torso upright and return to Mountain Pose. Repeat on the other side.

Squat-Sitting-Down Pose (Malasana)

Squat with the feet as close together as possible. Separate the thighs slightly wider than the torso. With an exhalation, the torso was leaned forward and fitted snugly between the thighs. The elbows were pressed against the inner knees, the palms were brought to together, and resisted the knees into the elbows in order to length the front torso. Breathing was done for ten times. Inhaling, the knees were straightened and returned to Mountain Pose.

Standing Forward Bend (Uttanasana)

Starting from Mountain Pose with the feet a comfortable yet challenging distance apart. The front thigh muscle was kept firmed, exhale and the torso was folded forward at the hip joint. The length of the spine was kept intact. The arms were fold in front of the chest. Reach out of the low back to keep length in the entire spine. Relax and sink the spine forward. Keep breathing naturally. The neck was kept relax to make the crown of the head sinks toward the floor. Tailbone and sit bones were reaching up the sky and the crown of the head was reaching toward the floor. The heels were pressed through as inhaling, allowing the spine to relax even deeper, suspending the upper body forward. The belly was softened to release the abdomen release back toward the front of the spine. Breathing into the low back, and allowing the ribs to expand out to the sides, creating more space for the breath. The shoulders were pulled away from the ears. Breathing was done for five times. Placing both hands on the hips and rolled the shoulders open by squeezing the shoulder blades and elbows together behind. The front of the ribcage was elevated, lifting the torso through the crown of the head as inhaling. Return to Mountain Pose.

Tree Pose (Vrkshasana)

Starting from Mountain Pose, shifting the weight onto the left foot, keeping the inner foot firm to the floor, and bending the right knee. The right foot was drawn up and the sole was placed against the inner left thigh, the right heel was pressed into the inner left groin if possible, toes pointing toward the floor. The center of the pelvis should be directly over the left foot. Rest the hands on the top rim of the pelvis. The pelvis was kept in a neutral position with the top rim parallel to the floor. The tailbone was lengthened toward the floor. Firmly pressing the right foot sole against the inner thigh and resisting with the outer left leg. Stay for 30 seconds to one minute. Step back to Mountain Pose with an exhalation and repeat with the legs reversed.

Triangle Pose (Trikonasana)

Starting from Mountain Pose, stepping or jumping the feet 3.5 to 4 feet apart with an exhalation. The arms were raised parallel to the floor and reached actively out to the sides with shoulder blades wide and palms down. Turning the left foot in to the right and the right foot out to the right 90 degrees. The right heel was aligned with the left heel. Firming the thighs and turning the right thigh outward. Exhaling, extending the torso to the right directly over the plane of the right leg, bending from the hip joint, not the waist. The torso was rotated to the left, keeping the two sides equally long. The left hip was come slightly forward and the tailbone was lengthened toward the back heel. The right hand was placed on the shin, ankle, or the floor outside the right foot, without distorting the sides of the torso. The left arm was stretched toward the ceiling, in line with the tops of the shoulders. Turning the head to the left and gazing at the left thumb. Breathing was done for five times. Inhaling and lifting up the torso. Repeat the pose on the other side.

Warrior I (Virabhadrasana I)

Standing from Downward Facing Dog, inhaling and stepping the right foot between both hands. Rotating the left foot out approximately 45 degrees and firming it on the floor. The left heel was then aligned with the right heel. The torso was lifted up so it was perpendicular to the floor. The hips were kept level with the front knee. Keeping the right knee bent at 90 degrees to make the right knee be parallel to the floor. The arms were raised overhead in shoulder-width apart. The hips were kept squared with the right knee opening toward the right Baby toe. Breathing was done for five times. Placing both hands on the floor, stepping the right foot back and perform Plank Pose. Transit to Downward Facing Dog and repeat the pose on the other side.

Warrior II (Virabhadrasana II)

Starting from Plank Pose, stepping the right foot and placing it between both hands. Raising the arms parallel to the floor and reaching them actively out to the sides with shoulder blades wide and palms down. The left foot was turned out to the left 90 degrees. The left heel was aligned with the right heel. Exhaling, bending the left knee over the left ankle, so that the shin was perpendicular to the floor. The left thigh was brought parallel to the floor. Press the tailbone slightly toward the pubis. Turn the head to the left and gaze over the fingers. Breathing was done for five times. Come up with an inhalation. Reverse the feet and repeat the pose on the other side.

Warrior III (Virabhadrasana III)

Starting from Warrior I with the right foot forward, the hips were square, pulling back through the crease in the hip of the bent leg. The arms remain overhead. Inhaling, the body weight was shifted onto the front leg. Folding forward at the hips and straightening the right leg as the left leg was begin to lift up until the torso and the left leg were parallel to the floor. Gazing straight ahead and the shoulder were pulled away from the ear. Breathing was done for five times. Inhaling, the left leg was lowered down to the floor and the torso was then lifted upright and perpendicular with the floor. Repeat the pose on the other side.

Wide-Stance Forward Bend (Prasarita Padottansana)

Starting from Mountain Pose, the legs were spread out as wide as feeling comfortable. The knees, feet, hips, and chest were pointed forward. The arm was extended and then the shoulders were rolled back and down to the hips. The feet were firmly pressed against the ground, and the spine was lengthened. Inhaling and then arching the back, lifting the chest and pressing the pelvis forward. The hands were reached to the floor and placed them shoulder-width apart between the feet. Inhaling, the arms were straightened and looking in the direction of the toes and arching the back slightly. Exhaling and bending

the elbows when lowering the crown of the head toward the floor. The elbows were pulled in toward each other and the shoulders were rolled away from the ears. The body weight was adjusted so that the hip joints were placed directly over the ankles and rolled more toward the toes. If the participant's head can touch the floor, putting much weight on the crown of the head as feeling comfortable to the participant. Exhaling, pressing the legs and folding forward from the hips. The length of the upper back was maintained. Breathing was done for five times. The hands were placed on the hips and the feet were pressed firmly. The elbow were kept pointing away behind the back. Lifting the torso upright with an inhalation. Stepping or jumping the feet together and return to Mountain Pose.

Variation: Wide-Stance Forward Bend with Torso Twist

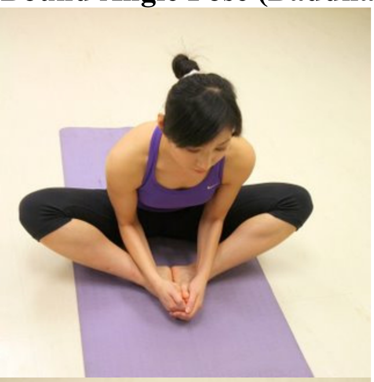
Similar to Wide-Stance Forward Bend, when both hands were placed on the floor, moving the right hand to the centre and the left hand was off the floor. The torso was then turned to the left and stretching the left arm out and the left hand pointing to the sky. So the left arm and right arm were aligned as a straight line from the ground to the sky. Staying in this position and breathing was done for five times. Then placing the left hand on the floor and turning the torso back to the centre. Moving the left hand to the centre and repeat the twist. After that placing both hands on the floor and return to Mountain Pose by lifting up the torso as if performing Wide-Stance Forward Bend.

Sitting Poses

Boat Pose (Navasana)

Starting with a seated position with the legs straight. The hands were placed on the floor a little behind the hips, fingers pointing toward the feet, and strengthen the arms. Lift through the top of the sternum and lean back slightly. Exhaling and bending the knees, then the feet were lifted off the floor, so that the thighs were angled about 45-50 degrees relative to the floor. The tailbone was lengthened into the floor and the pubis was lifted toward the navel. If possible, slowly straightening the knees, raising the tips of the toes slightly above the level of the eyes. If this is impossible to remain with the bent knees, perhaps lifting the shins parallel to the floor. The arms were stretched alongside the legs, parallel to each other and the floor. The shoulder blades were spread across the back and reaching strongly out through the fingers. If impossible, the hands were kept on the floor beside the hips or hold on to the backs of the thighs. The heads of the thigh bones were pressed toward the floor to help anchor the pose and the top sternum was lifted. Breathe easily. At first stay in the pose for 10-20 seconds. Gradually increase the time of the stay to one minute. Release the legs with an exhalation and sit upright on an inhalation.

Bound Angle Pose (Baddha Konasana)



Starting with a seated position, the heels were pulled toward the pelvis, then the knees were dropped out to the sides and the soles of the feet were pressed together. The big toe of each foot was grasped with the first and second finger and thumb. Sit so that the pubis in front and the tailbone in back were equidistant from the floor. The perineum then was approximately parallel to the floor and the pelvis in a neutral position. The sacrum and shoulder blades were firmed against the back and the front torso was lengthened through the top of the sternum. Staying in this pose from 1-5 minutes, inhaling, the knees were lifted away from the floor and extended back to their original position.

Cow-Face Pose (Gomukhasana)

Starting with a seated position, exhaling and bending the right knee toward the chest. The right leg was cross over the left leg and the right foot was placed on the ground outside the left thigh. Then separate the feet and come back to sit between the feet. The left arm was brought up towards the sky with a bent left elbow and the left hand was brought down the center of the back. The right arm was brought to the right side with a bent elbow and the right was armed up the center of the back. The hands were held behind the back. The elbows were kept toward the center. Stay in this pose for 30 seconds to one minute. Exhaling, releasing the hands and the legs. Repeat the pose on the other side.

Half Lord of the Fishes Pose (Ardha Matsyendrasana)

Starting with a seated position, keeping the knees bent and putting the feet on the floor, then sliding the left foot under the right leg to the outside of the right hip. The outside of the left leg was laid on the floor. Step the right foot was stepped over the left leg and stand it on the floor outside the left hip. The right knee point directly up to the sky. Exhaling, twist toward the inside of the right thigh. Press the right hand against the floor just behind the right buttock, and set the left upper arm on the outside of the right thigh near the knee. The front torso and inner right thigh were pulled snugly together. Press the inner right foot very actively into the floor, release the right groin, and lengthen the front torso. Lean the torso back slightly and continue to lengthen the tailbone into the floor. Counter the twist of the torso by turning the head left and looking over the left shoulder at the right foot. With every inhalation, lifting a little more through the sternum, pushing the fingers against the floor to help. Twist a little more with every exhalation. Stay for 30 seconds to one minute, then release with an exhalation, return to the starting position, and repeat the pose on the left side.

Head-to-Knee Pose (Janu Shirshasana)

Starting with a seated position, bending the left knee and bringing the sole of the left foot to the inner-right thigh. Square the torso over the extended right leg, and begin to forward bend over that leg. The right foot was kept flexed while pressing the back of the right thigh down toward the floor. Then the chest was kept lifted up. When the limit was reached, the chest and head were brought down toward the extended leg. Extending the spine long with each inhalation, and deepening the forward bend with each exhalation. The pose was held for 30 seconds to one minute. The torso was lifted upright with an exhalation. Repeat the pose on the other side.

Marichi I (Marichyasana I)

Starting with a seated position with the knees bent, the left foot was placed on the floor with the heel as close to the left sitting bone as possible. The right leg was kept strong and rotated slightly inward, grounding the head of the thighbone into the floor. Press the back of the right heel and the base of the big toe away from the pelvis. Twisting the torso to the right and pressing the back of the left shoulder against the inside of the left knee. Reaching the left arm forward and rotating it inwardly, so the thumb was pointing to the floor with palm facing out to the left. Reaching the left arm forward, the torso was lengthend forward and the left shin was snuggled into the armpit. With an exhalation, sweeping the forearm around the outside of the leg. Then pressing the left hand against the outside of the left thigh or buttock. With another exhalation, sweeping the right arm around behind the back. Clasping the right wrist in the left hand. Exhaling, the torso was extended forward from the groins, keeping the lower belly long. Staying in position for 30 seconds to a minute, then coming up with an inhalation. Repeat the pose on the other side.

Pigeon Pose (Raja Kapotasana)

Starting with a seated position, the right shin was brought more parallel with the front of the mat. When the left knee was bent, the left foot was drawn into the crook of the left elbow. The right arm was reached up and the hands were clasped behind the head. Breathing was done for five times. Exhaling, releasing the hand. Reverse the legs and repeat the pose on the other side.

Revolved Head-to-Knee Pose(Parivrtta Janu Shirshanasana)

Starting with a seated position, bending the left knee and bringing the sole of the left foot to the inner-right thigh. Twisting the torso to the left in order to face to the left side. The right foot was kept flexed while pressing the back of the right thigh down toward the floor. Extending the left arm overhead and the right arm in front of the extended leg while leaning the torso toward the extended leg. Then the chest was kept lifted up. Using both hands to grasp the right foot if possible. Extending the spine long with each inhalation, and deepening the forward bend with each exhalation. The pose was held for 30 seconds to one minute. The torso was lifted upright with an exhalation. Repeat the pose on the other side.

Seated Forward Bend (Paschimottanasana)

Starting with a seated position with the straight legs, the legs were brought together and the straight arms were brought to the sides and up over the head. Inhaling, drawing the spine up long. Exhaling, begin to come forward and hinging at the hips., Extend the spine with each inhalation, and come a bit farther into the forward bend with each exhalation. Keep the neck at the natural extension of the spine. Take hold of the ankles or shins. The pose was held for 30 seconds to one minute. Exhaling and lifting the torso upright.

Seated Wide-Angle Pose (Upavistha Konasana)

Starting with a seated position, the legs were open out as wide as comfortable. The thigh muscles were kept engaged and feet were flexed with toes pointing straight up to the sky. The legs were pressed down into the floor. Exhaling, folding the torso toward the floor and maintaining the length of the spine. Stay in the position for 30 seconds to one minute. Inhaling, the torso was lifted upright with the support of the hand. Exhaling, release the legs.

Kneeling Poses

Camel Pose (Ushtrasana)

Starting with a kneeling position with the knee hip-width apart, the toes were curled and so the heels were lifted. Both hands were placed on the hips and the elbows and shoulder blades were squeezed together. Pressing both hands against the top of the pelvis and pushing the hips slightly forward. Keeping the thigh to be perpendicular to the floor, inhaling and lifting the ribs and chest up. Reaching the right hand behind toward the right heel and the thumbs should point away from the body. Doing the same on the left side and continue to focus on breathing. With the next inhalation, relaxing the neck and allowing the head to drop back. Breathing was done for five times. Inhaling and moving slowly to bring the torso upright and hips to the heels.

Child's Pose (Balasana)

Starting with a kneeling position, hips were sunk down on to the heels. Exhaling and folding forward from the hips. The tailbone was lengthened away from the back of the pelvis while the base of the skull was lifted away from the back of the neck. The hands with the palms up were placed on the floor alongside the torso, and the fronts of the shoulders were release toward the floor. To come up, first lengthen the front torso, and then with an inhalation lift from the tailbone as it presses down and into the pelvis.

Gate Pose (Parighasana)

Starting with a kneeling position, knees were place hip-width apart with thighs perpendicular to the floor. The right leg straight was rolled out to the right side with leg in line with the torso. The top of the right thigh was rolled out so the knee points up. The arms were extended to the sides with palm facing the floor. Inhaling and the spine was lengthened, reaching the crown of the head up and the tailbone toward the floor. Exhaling and reaching the right arm out over the right leg, maintaining length in the low back. With the left arm over the head and palm facing the floor, turning the head and looking up toward the left arm. Breathing was done for five times. Inhaling and the torso was lifted up. Exhaling and the arm were placed aside. The right knee was brought back under the body and the pose repeated on the left side.

Modified Half Moon

The description was mentioned in Half Moon Pose.

One-Legged Royal Pigeon and Folded Forward (Raja Kapotasana)

These two asanas are usually performed at the same time and they are variations of Pigeon Pose. From Downward Facing Dog, the right leg was brought up to the front between the hands with a bent right knee, the right knee was then brought to outside the right hand and releasing the top of the left leg to the floor. Square the hips towards the floor. Take padding under the right side of the butt as necessary to bring the hips square. To perform the Folded Forward version, the torso was brought down into a forward bend over the right leg. The weight of the body was rested on the right leg while the left leg was pressed down to the mat. Keep the natural breathing and stay in this position for 30 seconds to one minute. Bringing the hands in line with the hips in order to come back up. Bending the left knee and reaching back for the left foot with the left hand. The foot was drawn towards the butt, stretching the left thigh. Square the shoulders to the front of the room. Release the left foot, curl the left toes under and step back to Downward Facing Dog. Repeat pose on the other side.

Supine

Apana Pose (Apanasana)

Starting with a supine position, the knees were brought to the chest and clasped them with the hands. Breathing was done for five times. Return to the starting position by releasing both hands and lowering the legs softly and slowly.

Belly Twist (Jathara Partivartanasana)

Starting from a supine position, bending the knees and bringing the heels close to the hips. Exhaling, crossing the right left over the left above the knee. The arms were reached out to the sides at shoulder height. Turning and gazing the right hand on the floor. Inhaling and lengthening the spine against the floor. The shoulder blades were pressed against on the mat. Exhaling, the hips were shifted so the left hip was moved back toward the right and aligned with the midline of the body. The knees then were lowered to the left. Stay in this position for 30 seconds to 1 minute with natural breathing. Inhaling and the knees and head were brought back to the centre. Uncross the legs and repeat the pose on the other side.

Bridge Pose (Setu Bandhasana)

In a supine position, bending knees and setting feet on the floor, heels were placed as close to the sitting bones as possible. By exhaling push the tailbone upward toward the pubis and lift the buttocks off the floor. Thighs and inner feet were kept parallel. Clasp the hands below the pelvis and extend through the arms to help stay on the tops of the shoulders. Knees were kept directly over the heels, pushed forward and away from the hips. Firm the outer arms, broaden the shoulder blades, and try to lift the space between them at the base of the neck. Breathing was done against for 5-6 times. Release with an exhalation, rolling the spine slowly down onto the floor.

Variation: Bridge with One Leg Lift

With right leg up pointing toward the ceiling and breathing was done against for 5-6 times, lowering down the leg and placing firmly on the floor. Release with exhalation and rolling the spine slowly down onto the floor. This was repeated for the left side.

Corpse Pose (Shavasana)

From a supine position, bringing the palms up to roll the shoulders open. The shoulder blades were settled to flat against the floor. Keeping legs and hips relax so as to allow the feet to roll to the outside. Close the eyes and relax the muscles of the face. Breathe in natural pattern and allow the body and mind to sink deeper into relaxation with each breath. This is the last pose to be performed in each lesson as a part of relaxation. The duration of performing this pose was about three to five minutes.

Preparation exercise for Plow Pose

This is not a traditional pose, it is an exercise for strengthening the muscles that involving in performing the Plow Pose. Starting with a supine position, bringing both legs together and up with the legs pointing toward the sky. The legs were then lowered down to about 60 degrees and 45 degrees to the floor. In each level, holding the legs in the air for 30 seconds. The exercise will be repeated for 2-3 times.

Plow Pose (Halasana)

A folded blanket was placed under the shoulders. The head and neck were off the blanket. Lying on the back with both legs straight and together, then lifting both legs over the head until the toe touch the floor behind the head by using abdominal muscles. Keeping the arm straight and the shoulders away from the ears with the hips over the shoulders. Breathing was done for five times. Using the abdominal muscles to lift both legs up and lower them down slowly back to the floor.

Reclining Bound Angle Pose (Supta Baddha Konasana)

Perform Bound Angle Pose. Exhaling, the back was lowered torso toward the floor and leaning on the hands. The topmost thighs were gripped and inner thighs were rotated externally. The outer thighs were pressed away from the sides of the torso. The outer knees were widened away from the hips. Pushing the hip points together, so that while the back pelvis widens, the front pelvis narrows. The arms were laid on the floor, angled at about 45 degrees from the sides of the torso, palms up. Staying in this pose for one minute and keeping natural breathing. To exit, the thighs were pressed together, then rolling over onto one side and pushing the body away from the floor, head trailing the torso.

Side-Reclining Leg Lift (Anantasana)

Starting with a supine position, roll over onto the right side. Bending the right arm and bringing the right hand under the head with the fingers toward the chin. Flexing both feet. The whole body was kept in one line. Bending the left knee, and take hold of the left big toe with the left hand. The left leg was straightened toward the sky as much as possible. The balance was maintained on the side without rolling. Breathing was done for five times. Repeat the pose on the left side.

Supported Shoulder Stand (Salamba Sarvangasana)

From Plow Pose, bending the elbows and bringing the hands onto the back with the fingertips facing upward. The elbows were kept shoulder-width apart. The legs up were lifted off the floor toward the sky. The hips were aligned over the shoulders and feet were aligned over the hips. Breathing was done for six times. Then the feet were brought back over the head through Plow Pose and rolled out from Plow Pose.

Prone Poses

Bow (Dhanurasana)

Starting with a prone position, exhaling and bending the knees, the heels were brought close to the buttocks. Both hands were reached back to hold the ankles. Keeping knees hip-width for the duration of the pose. Inhaling, the heels were lifted away from the buttocks and thighs were lifted away from the floor. The shoulder blades were squeezed together and the tops of the shoulders were drawn away from ears in order to open the chest and shoulders. Gazing forward and breathing was done 5-6 times. Exhaling and releasing hands in order to return to a prone position.

Cobra (Bhujangasana)

Starting with a prone position, the hands were brought under the shoulders and pointing the fingers forward. Pressing the upper arms aside. The shoulder blades were moved toward the hips and the pelvis was tucked under to lengthen the spine. The chest was lifted forward and up with inhalation. The spine was lengthened with inhalation and the shoulders were sunk down away from the ears. The hip was kept on the ground. Breathing was done for five times. Lowering the torso and returning to the prone position.

Locust (Shalabhasana)

Starting with a prone position, turning the big toes toward each other to inwardly rotate the thighs. Exhale and lift the head, torso, arms, and legs away from the floor. Pressing the chest forward and both feet were stretched away from the body. The body was lifted and lengthened as breathing slowing and deeply. Breathing was done for 5-6 times. Releasing with an exhalation and returning to the starting position.

Upward Facing Dog (Urdhva Mukha Shvanasana)

Starting with a prone position, the elbows were bent and spread the palms on the floor beside your waist. Inhaling and pressing the inner hands firmly into the floor and slightly back. The arms were straightened and the torso was lifted up. The legs were then a few inches off the floor with inhalation. The thighs were kept firm and slightly turned inward, the arms firm and turned out so the elbow creases face forward.

Press the tailbone toward the pubis and lift the pubis toward the navel. Narrow the hip points. Firm the shoulder blades against the back and puff the side ribs forward. Lift through the top of the sternum. Maintain length in the neck and take the focus upward. Breathing was done for five times and return to the prone position with exhalation.

Arm Support Poses

Cat Cow (Durga Go)

The hands and knees were placed on the floor. The hands were directly below the shoulders and the knees were directly below the hips. Inhaling, lifting head and look up, allowing the belly to relax and the back to curve gently. The shoulders were kept low and relaxed and the neck was kept extended. This is the "Cow" pose. Exhaling, lowering the head and arching the back. Concentrate on curling of the spine, from your neck to your pelvis. This is "Cat." Repeat for five times.

Variation: Cat Cow with One Leg Lift

Add a leg lift when performing Cat Cow. Each time inhaling and looking up, the leg was stretched out behind. When exhaling, leg was brought back down to the floor. Alternates legs with each repetition.

Four –Footed Tabletop Pose (Chatus Pada Pitham)

Starting with a seated position with the legs in front, the hands were placed a couple of inches behind the buttocks and shoulder-width apart with the fingers spread out and facing towards the feet. Bending the knees and placing the feet on the floor in hip-width apart. Inhaling, the hips were lifted, keeping the shoulders open and the head in line. Breathing was done for 5-6 times. Exhaling and lowering the buttocks to the floor.

Plank (Utthita Hasta Padangusthasana)

Starting from Forward Bend Pose, palms were placed on the floor directly under the shoulders. Inhaling and the spine was lengthen to open the shoulder and chest. Exhale and step feet back. Curl the toes under. The legs were kept straight and the heels were pressed back. Breathing was done for five times. And Body was lowered toward the floor to transit to another pose.

Table Top Exercise

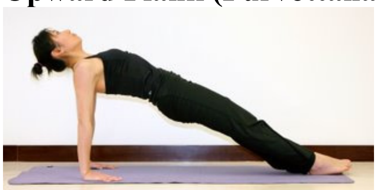
This is a variation of the Table Top Pose. It is an exercise for strengthening the core muscles. The hands and knees were placed on the floor.

The hands were directly below the shoulders and the knees were directly below the hips. The fingers were spread out and pointing forward. Keeping the curvature of the spine during the following movements: Stretching the left arm out to the front and right leg out to back of the room, with an exhalation. Breathing was done for five times. Lowering down the left arm and right leg with an inhalation. Stretching the right arm out to the front and left leg out to back of the room, with an exhalation. Breathing was done for five times. Lowering down the right arm and left leg with an inhalation. Repeat the exercise for 3-4 times.

Side Plank (Vasishthasana)

Starting from Plank Pose, the body weight was shifted onto the right hand. The left foot was lifted off the floor and rolled the outside of the right foot against the floor. The left foot was rested on the top of the right. Rotate the front of body away from the floor so as to the left hip and shoulder were stacked over the right hip and shoulder. The left hand was rest on the left hip. The body weight was supported on the right palm and right foot. The right fingers were pointing away from the body. Exhale and the left arm was lifted up. Turn to look at the left hand. Breathing was done for five times. Exhale and the body was rotated back into plank, and practice the opposite side.

Upward Plank (Purvottanasna)



Starting in a seated position with the hands several inches behind the hips and the fingers pointing forward, the knees were bent and the feet place on the floor, big toes turned inward, heels was placed at least a foot away from the buttocks. Exhaling, pressing the inner feet and hands down against the floor, and lifting the hips until coming to a reverse tabletop position, torso and thighs approximately parallel to the floor, shins and arms approximately perpendicular. Without losing the height of the hips, straighten the legs one at a time. Press the shoulder blades against the back torso to support the lift of the chest. Drop the head back without compressing the back of the neck. Breathing was done 5-6 times. Exhaling and returning to the seated position.

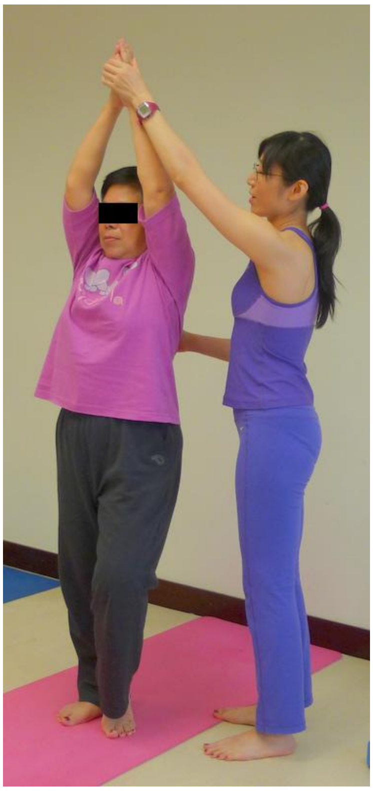
Appendix I Photo taken in Hatha Yoga Classes

Subjects under the instructions of yoga teacher

Simple spinal twist

Seated forward bend

Lunge (variation)



Mountain Pose


Warrior II


Warrior I

Subjects practiced yogic postures during the classes


Abdominal breathing practice


Head-to-knee


Downward facing dog


Child's Pose

Appendix J Hatha Yoga Class Handout for Study One

哈達瑜伽 (Hatha Yoga)

第一堂

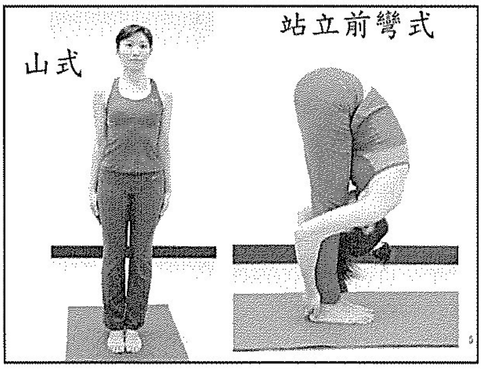
導師:劉凱琳小姐 (Caren)

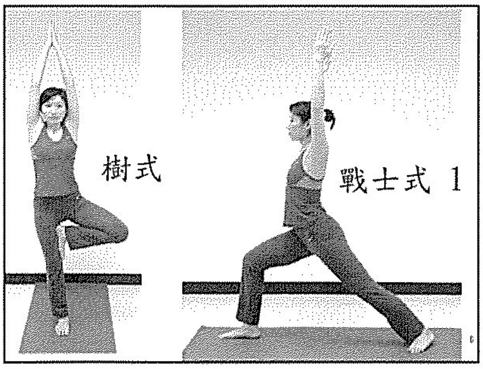
1

今天我們一起練習了以下式子

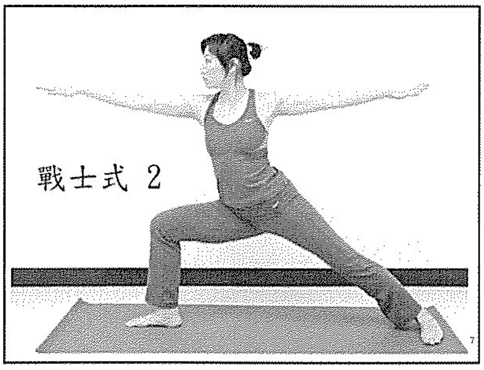
- 站立式子
  - 椅子式(Chair Pose)
  - 側角伸展式(Extended Side Angle Pose)
  - 山式(Mountain Pose)
  - 站立前彎式(Standing Forward Bend)
  - 樹式(Tree Pose)
  - 戰士式 1(Warrior I)
  - 戰士式 2(Warrior II)
- 坐式子
  - 束角式(Bound Angle Pose)
  - 單腿頭觸膝式(Head-to-Knee Pose)
  - 坐前彎式(Seated Forward Bend)
- 跪式子
  - 孩童式(Child' s Pose)
- 仰臥式子
  - 橋式(Bridge Pose)
  - 躺姿扭轉(Belly Twist)
  - 膝到胸式(Apana)
  - 大休息(Corpse Pose)
- 俯伏式子
  - 向上狗式(Upward Facing Dog)
  - 蝗蟲式(Locust Pose)
- 臂支撐式子
  - 平板式(Plank Pose)

2





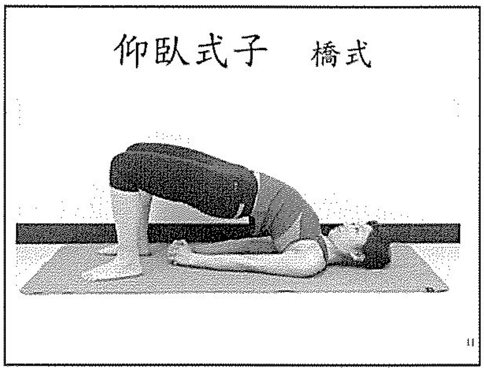
1


戰士式 2
7


坐式子
束角式
8

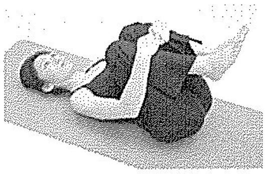

單腿頭觸膝式
坐前彎式
9


跪式子
孩童式
10

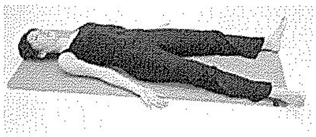

仰臥式子
橋式
11


躺姿扭轉
12

膝到胸式

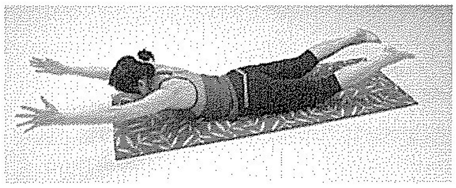


大休息



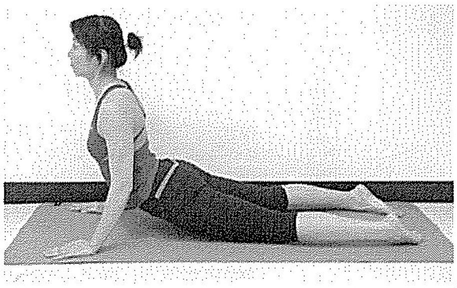
13

俯伏式子 蝗蟲式



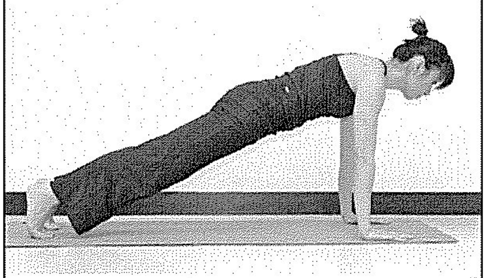
14

向上狗式



15

臂支撐式子 平板式



16

哈達瑜伽 (Hatha Yoga)

第二堂

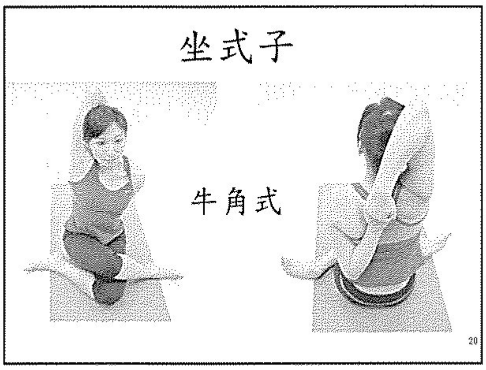
導師:劉凱琳小姐 (Caren)

今天我們一起學習了以下新的式子

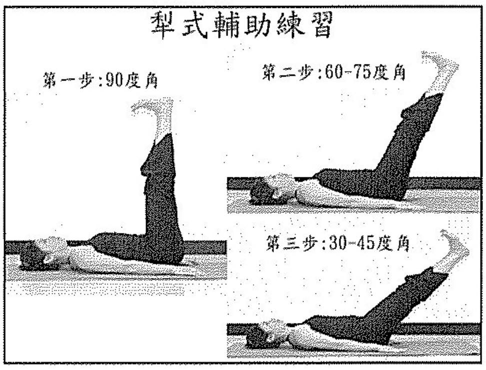
- 站立式子
  - 扭轉側角伸展式(Revolved Side Angle Pose)
- 坐式子
  - 牛角式(Cow Face)
- 仰臥式子
  - 犁式輔助練習(Preparation exercise for Plow Pose)
  - 躺束角式(Reclining Bound Angle Pose)
  - 神聖戒士努休息式(Side Reclining Leg Lift)

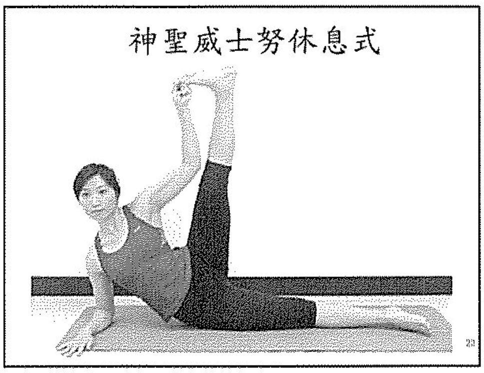
18

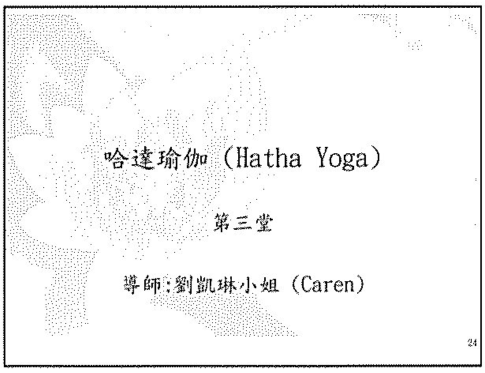

站立式子 扭轉側角伸展式


坐式子
牛角式


仰臥式子 躺束角式


犁式輔助練習
第一步:90度角
第二步:60-75度角
第三步:30-45度角


神聖威士努休息式

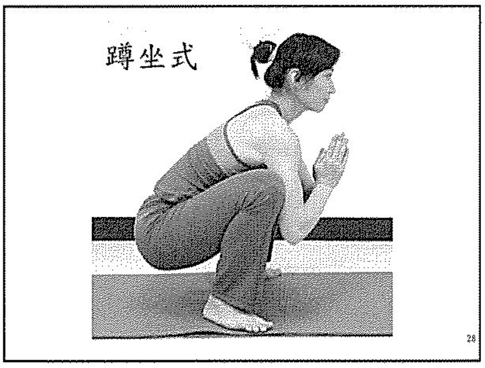

哈達瑜伽 (Hatha Yoga)
第三堂
導師:劉凱琳小姐 (Caren)

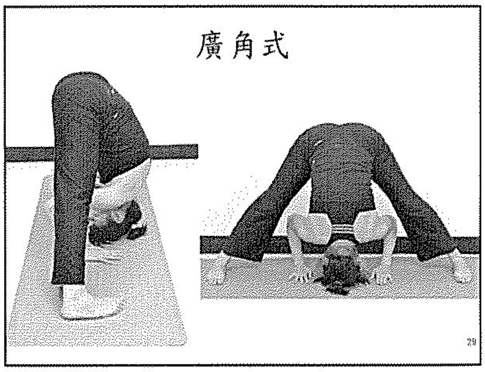
4

今天我們一起學習了以下新的式子

- 站立式子
  - 椅子式〔變化：轉身〕(Chair with Torso Twist)
  - 單腿站立伸展式(Extended Hand-Toe Pose)
  - 蹲坐式(Squat-Sitting-Down)
  - 廣角式(Wide-Stance Forward Bend)
- 坐式子
  - 扭轉單腿頭觸膝式(Revolved Head-to-Knee Pose)
- 仰臥式子
  - 橋式〔難度提升：舉腳〕(Bridge with One Leg Lift)

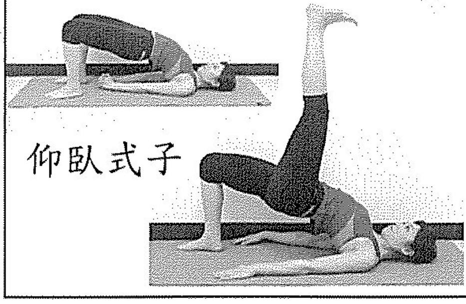
25





5

橋式〔難度提升:舉腳〕



仰臥式子

31

哈達瑜伽 (Hatha Yoga)

第四堂

導師:劉凱琳小姐 (Caren)

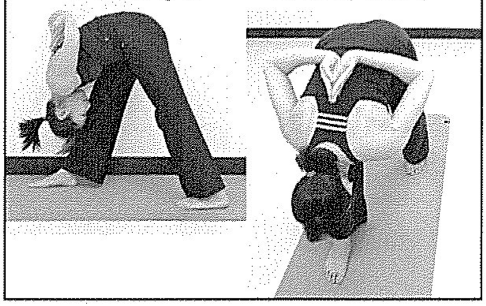
32

今天我們一起學習了以下新的式子

- 站立式子
  - 側面伸展式(Intense Side Stretch)
  - 三角式(Triangle Pose)
- 坐式子
  - 船式(Boat Pose)
  - 坐廣角式(Seated Wide Angle Pose)
  - 半魚王式(Half Lord of the Fishes Pose)
- 跪式子
  - 駱駝式(Camel Pose)
  - 半月式輔助練習(Modified Half Moon)
- 仰臥式子
  - 犁式(Plow Pose)

33

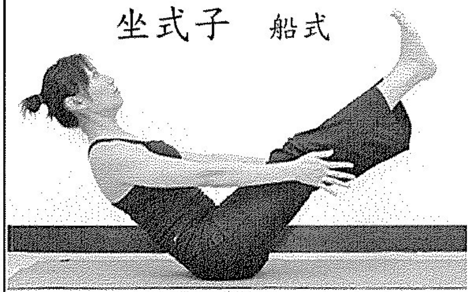
站立式子　側面伸展式



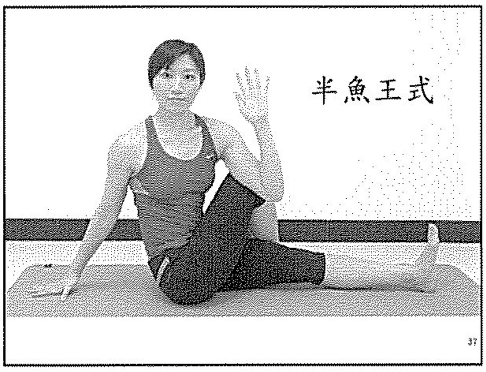
三角式

35

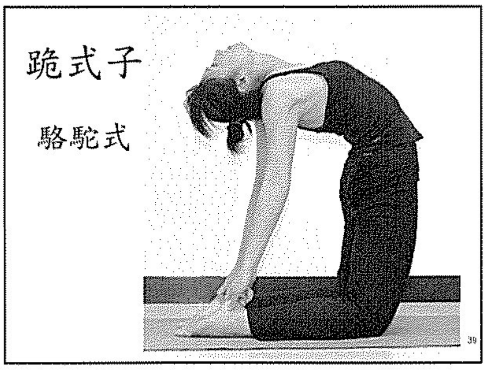
坐式子　船式

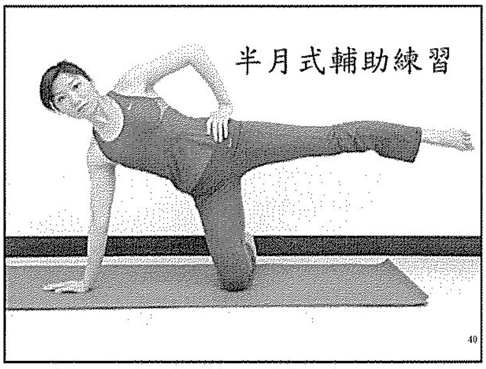


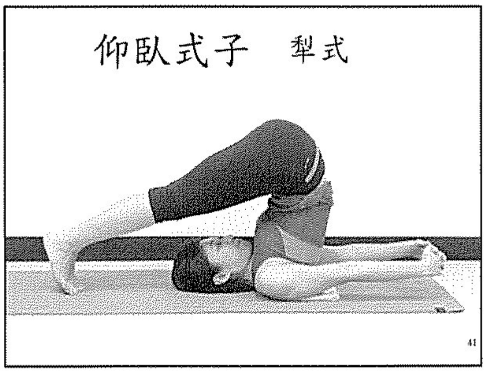
36

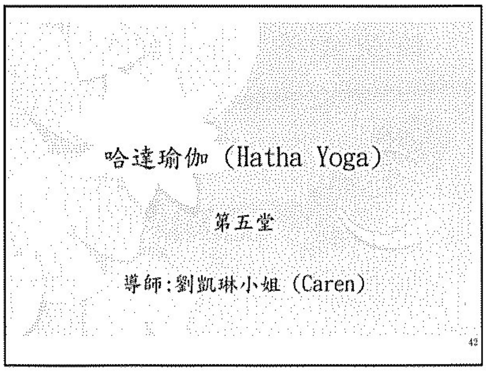

半魚王式
37


坐廣角式
38


跪式子
駱駝式
39


半月式輔助練習
40

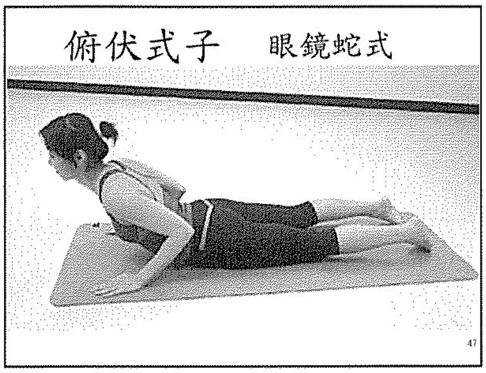

仰臥式子　犁式
41


哈達瑜伽 (Hatha Yoga)
第五堂
導師:劉凱琳小姐 (Caren)
42

今天我們一起學習了以下新的式子

- 站立式子
  - 弓箭步式(Lunge)
  - 扭轉三角式(Revolved Triangle Pose)
- 跪式子
  - 單腿鴿王式(One Legged Royal Pigeon Pose)
- 俯伏式子
  - 眼鏡蛇式(Cobra Pose)

43



哈達瑜伽 (Hatha Yoga)

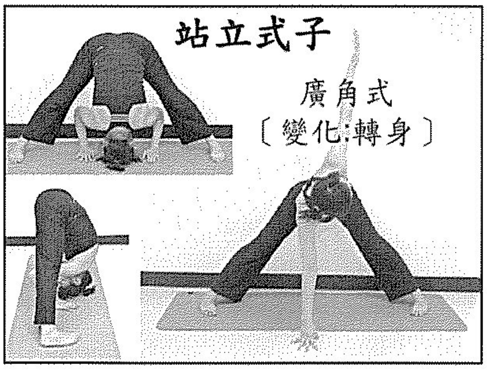
第六堂

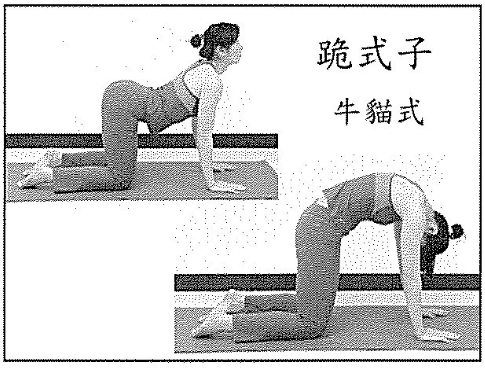
導師:劉凱琳小姐 (Caren)

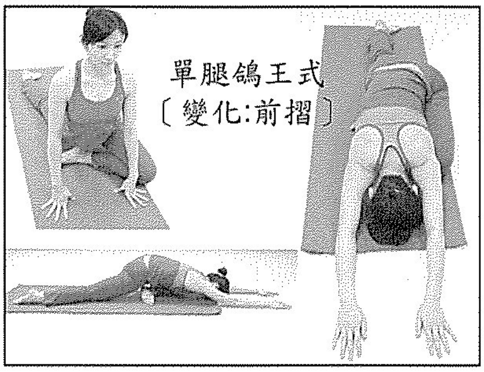
今天我們一起學習了以下新的式子

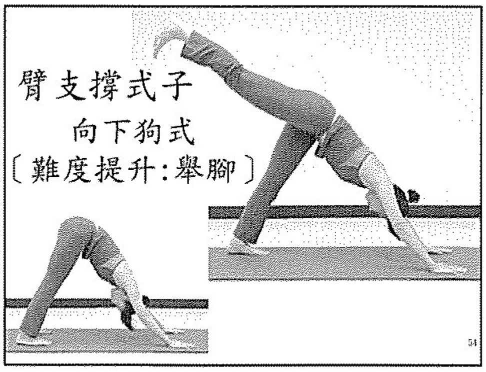
- 站立式子
  - 廣角式〔變化:轉身〕(Wide-Stance Forward Bend with Torso Twist)
- 跪式子
  - 牛貓式(Cat Cow)
  - 門閂式(Gate Pose)
  - 單腿鴿王式〔變化:前摺〕(One-Legged Royal Pigeon - Folded Forward)
- 臂支撐式子
  - 向下狗式〔難度提升:舉腳〕(Downward Facing Dog with One Leg Lift)
  - 四腳桌子式(Four-Footed Tabletop)

49









9

哈達瑜伽 (Hatha Yoga)

第七堂

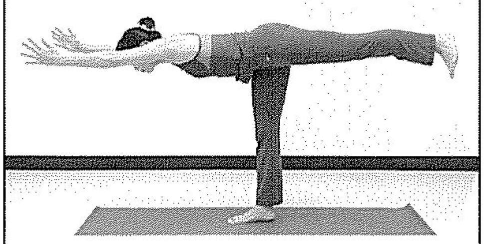
導師:劉凱琳小姐 (Caren)

今天我們一起學習了以下新的式子

- 站立式子
  - 戰士式 3(Warrior III)
- 臂支撐式子
  - 向上平板式(Upward Plank Pose)

56

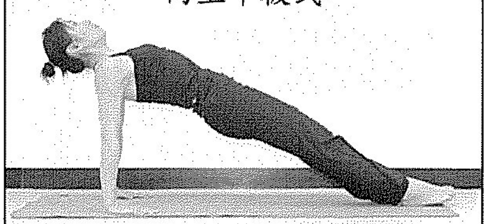
站立式子 戰士式 3



57

臂支撐式子

向上平板式



58

哈達瑜伽 (Hatha Yoga)

第八堂

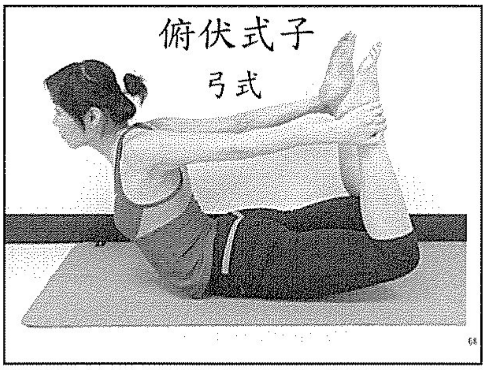
導師:劉凱琳小姐 (Caren)

59

今天我們一起學習了以下新的式子

- 站立式子
  - 半月式(Half Moon)
  - 舞王式(King of Dancers)
  - 扭轉弓箭步式(Revolved Lunge)
- 坐式子
  - 摩利支式 1(Marichi I)
- 仰臥式子
  - 肩倒立式(Supported Shoulder Stand)

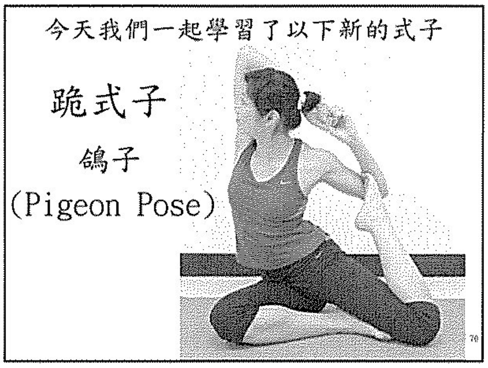
60



哈達瑜伽 (Hatha Yoga)

第十堂

導師:劉凱琳小姐 (Caren)



Appendix K Yoga Self Practice Weekly Record Sheet
(English and Chinese Versions)

Yoga Self Practice Weekly Record Sheet

Name: ________________ Subject code: _________ Week: ________

Day	1	2	3	4	5	6	7
Date							
Duration (mins)							

☺ Practice on your own pace every day ☺

☺ Please complete the sheet and return it to the research assistant in the next lesson ☺

☺ See you next week ☺

瑜伽自習紀錄表

姓名: ____________ 研究編號: ________ 第____週

自習日	1	2	3	4	5	6	7
日期							
自習時間 (分鐘)							

☺ 請按自己的進度每天持之以恆地自習 ☺

☺ 請填妥記錄表並於下次上瑜伽堂時交給研究員 ☺

☺ 下星期見 ☺

Appendix L Information sheet for Study Two (English and Chinese Versions)

Department of Medicine and Therapeutics
Faculty of Medicine
The Chinese University of Hong Kong

Benefits and Barrier of Regular Yoga Practice

Purpose of the study

Yoga originated in Indian more than 5000 years ago, its principle is to achieve the integration of body, mind, and spirit. It consists of poses, breathing exercises and meditation. Nowadays yoga is a kind of popular recreation activity and low intensity physical activity. Regular practicing yoga can help improve flexibility, muscular endurance and balance, and reduce stress. Recently there are many publications about the health benefits of yoga, yet the influence of yoga on physical and mental health has not been fully examined and local evidence of qualitative study is lacking. Therefore the results of this study would help explore the perceived benefits and barriers of regular yoga practice, and the factors to initiate and continue the practice.

Procedures

The way of data collection for this study will be focus group which is a discussion with 6-10 individuals who interact with each other and the researcher who uses a question list to stimulate the discussion. If you agree to participate in the study, you will be scheduled to attend one session of focus group and the session will last for about 1 hour. The session will be audio-taped, and the audio-tapes and/or video-tapes transcribed, to ensure accurate reporting of the information that you provide, and the researcher will make observational notes during the discussion. No one's name will be asked or revealed during focus groups. However, should another participant call you by name, the researcher will remove all names from the transcription. The audio-tapes and/or video-tapes will be stored in locked place before and after transcription. Tapes and transcriptions will be destroyed within 1 year after the completion of the study.

Benefits

There may be no direct benefits by participating in the study.

Eligibility

According to the procedure, the researcher will discuss the research topic with the participants, therefore the participants should fulfill the following criteria:

- Aged 18 or above
- Chinese and able to communicate in Cantonese
- Without suffering major psychiatric illnesses
- Feeling at ease to discuss research topic with strangers
- Accepting that the discussion session will be audio/video-taped.

Confidentiality

If you choose to participate, you will not be asked your name at the focus group. You will not need to use your name in the focus groups. If by chance, you or someone you know address you by name in the sessions, the researcher will delete all names from the transcription. There will however be no names attached to the tapes or transcriptions, and there will be no identifying information or names used in any written reports or publications which result from this study. Your participation in the study will be strictly confidential. All findings used in any written reports or publications which result from this study will be reported in aggregate form with no identifying information. It is, however useful to direct quotes to more clearly capture the meanings in reporting the findings from the study in focus group approach. You will be asked at the end of the focus group if there is anything you said which you do not want included as a quote, and we will ensure they are not used.

香港中文大學醫學院內科及藥物治療學系

恆常瑜伽練習的益處及和障礙之探討研究招募

研究目的

瑜伽是一種源於印度的古文化，是一系列的修身養心方法，包括調身的姿勢、調息的呼吸法、調心的冥想法等，以達至身心的合一。瑜伽也是近年受大眾歡迎的消閒活動，亦是一種低強度的運動，能鍛練柔軟度、肌肉耐力和平衡力及舒緩情緒壓力。過往已有許多研究報告指出運動對身心的益處，但對現存有關瑜伽的對身心健康之研究證據仍未完善，而本地亦缺乏嚴謹的定質的實驗來驗證瑜伽對身心健康的影響，所以本研究之結果將有助更全面的了解恆常瑜伽練習的益處及和障礙及開始和持續瑜伽練習的原因。

研究程序

本研究將透過進行聚焦小組以收集數據，聚焦小組是一種小組討論，研究人員會預備一些有關研究題目所探討的相關問題，帶領 4 至 8 位參與者進行討論。如果閣下同意參加本研究，閣下將被安排出席一次長達一小時的聚焦小組。聚焦小組的過程將會被錄音和/或錄像，而研究人員會為在聚焦小組中的觀察做筆記，以確保準確記錄各參與者於聚焦小組所提供的資料。研究人員將不會於聚焦小組內提及閣下的名字而閣下亦不需要於聚焦小組內使用閣下的名字。若碰巧閣下或閣下所認識的人於聚焦小組內提及閣下的名字，研究人員將閣下的名稱從抄本中刪除。在任何時間錄音帶和/或錄像磁帶及抄本將被儲存在上鎖的地方，磁帶和抄本將於本研究完成後一年內被銷毀。

利益

閣下不會因參與這研究而取得任何金錢利益，而本研究亦不會各閣下收取任何費用。

參加者資格

根據研究程序，參加者會在研究人員帶領下進行跟研究相關題目的討論，因此閣下必須要符合以下條件：

- 性別不拘，年齡 18 歲或以上
- 中國籍並能以廣東話溝通
- 沒有患上情緒病或精神病
- 能在陌生環境下跟陌生人就研究相關題目進行討論，並在這情況下不會感害羞及不安
- 能接受在聚焦小組的過程中閣下所說的話將會被錄音和/或錄像

機密處理

參加者所提供的一切資料只供研究用途使用，而研究人員將不會於聚焦小組內提及閣下的名字而閣下亦不需要於聚焦小組內使用閣下的名字。若碰巧閣下或閣下所認識的人於聚焦小組內提及閣下的名字，研究人員將閣下的名字從抄本中刪除。閣下的名字和一些能夠確認個人身分的資料將不會在任何與這份研究有關的報告內提及。閣下參與這項研究將被嚴格保密。直接引用參與者的說話是聚焦小組報告結果的常見做法，這種方法含義更清楚表達到參與者的意見。於聚焦小組結束前研究人員會問閣下所說的話當中有甚麼內容是不想被引用的，研究人員將會確保不會引用閣下所說的話。

Appendix M Enrollment form for Study Two (English and Chinese Versions)

Benefits and barrier of regular yoga practice

Enrollment form

Name： Sex：

Date of birth: Age：

Telephone： Email：

Answer the following questions and delete as appropriate:
Qualification: No education / Primary / Secondary / Tertiary

Occupation: Full Time / Part Time / Unemployed / Housewife / Retired / Student

Marital status: Single / Married / Widowed

Experience of yoga practice: Nil / Experienced， ______month(s)

The information provided will be research purpose only and kept strictly confidential, submission of the form will indicate that you have read and understand the recruitment information.

恆常瑜伽練習的益處及和障礙之探討

報名表格

姓名（中文）： 性別：

出生日期： 年齡：

聯絡電話： 電郵：

以下問題請*刪除不適用*的答案:
最高學歷: 沒有接受正規教育 / 小學 / 中學 / 大專或以上

職業: 全職 / 兼職 / 待業 / 家庭主婦 / 退休人士 / 學生

婚姻狀況: 單身 / 已婚 / 寡婦或鰥夫

閣下之瑜伽練習經驗: 沒有 / 有，______月

＃閣下所填寫之資料只供本研究使用，資料會以保密處理，而閣下遞交表格即代表閣下已細閱及明瞭本研究的招募資料。

Appendix N Consent form for Study Two (English and Chinese Versions)

Department of Medicine and Therapeutics
Faculty of Medicine
The Chinese University of Hong Kong

<u>Written Consent</u>

Title of study
Benefits and barrier of regular yoga practice

Investigator
Ms. LAU, H. L. PhD Student, the Chinese University of Hong Kong (CUHK)

Invitation to Participate & Purpose of the study
You are being invited to participate in the captioned study. Thank you for your consideration of participation in this study.
Yoga originated in Indian more than 5000 years ago, its principle is to achieve the integration of body, mind, and spirit. It consists of poses, breathing exercises and meditation. Nowadays yoga is a kind of popular recreation activity and low intensity physical activity. Regular practicing yoga can help improve flexibility, muscular endurance and balance, and reduce stress. Recently there are many publications about the health benefits of yoga, yet the influence of yoga on physical and mental health has not been fully examined and local evidence of qualitative study is lacking. Therefore the results of this study would help explore the perceived benefits and barriers of regular yoga practice, and the factors to initiate and continue the practice.

Voluntary Participation
Your participation in this study voluntary, and you have the right to withdraw from it anytime if you wish to. Participation or withdrawal of the study will not affect the treatment you will receive. If you choose to withdraw, any information derived from your participation will be deleted from the study.

Procedures
The way of data collection for this study will be focus group which is a discussion with 6-10 individuals who interact with each other and the researcher who uses a question list to stimulate the discussion. If you agree to participate in the study, you will be scheduled to attend one session of focus group and the session will last for about 1 hour. The session will be audio-taped, and the audio-tapes and/or video-tapes transcribed, to ensure accurate reporting of the information that you provide, and the researcher will make observational notes during the discussion. No one’s name will be asked or revealed during focus groups. However, should another participant call you by name, the researcher will remove all names from the transcription. The audio-tapes and/or video-tapes will be stored in locked place before and after transcription. Tapes and transcriptions will be destroyed within 1 year after the completion of the study.

Confidentiality
If you choose to participate, you will not be asked your name at the focus group. You will not need to use your name in the focus groups. If by chance, you or someone

you know address you by name in the sessions, the researcher will delete all names from the transcription. There will however be no names attached to the tapes or transcriptions, and there will be no identifying information or names used in any written reports or publications which result from this study. Your participation in the study will be strictly confidential.
All findings used in any written reports or publications which result from this study will be reported in aggregate form with no identifying information. It is, however useful to direct quotes to more clearly capture the meanings in reporting the findings from the study in focus group approach. You will be asked at the end of the focus group if there is anything you said which you do not want included as a quote, and we will ensure they are not used.

Risks
There are no anticipated physical risks to participants. Focus group members will be asked to keep the information provided in the groups confidential.

Benefits
There may be no direct benefits by participating in the study.

Questions
The investigator has discussed with me and offered to answer my questions. If you have further questions, you may phone Miss Lau can be researched through telephone at 51122449 or email her at carenlau@cuhk.edu.hk.

Agreement
You will be given a copy of this consent form to keep for your records. Your signature signed below indicates that you agree to participate in this study and you understand the information in this consent form.

Once again, we thank you for your time to participate in this study.

Participant's Signature: ________________________

Investigator's Signature: ________________________

Participant's Name: ____________________________

Investigator's Name: Lau Hoi Lam

Date: ________________________________

香港中文大學醫學院內科及藥物治療學系

書面同意書

研究名稱
恆常瑜伽練習的益處及和障礙之探討

研究員
劉凱琳小姐（香港中文大學醫學院的博士生）

研究參與邀請及目的
瑜伽是一種源於印度的古文化，是一系列的修身養心方法，包括調身的姿勢、調息的呼吸法、調心的冥想法等，以達至身心的合一。瑜伽也是近年受大眾歡迎的消閒活動，亦是一種低強度的運動，能鍛練柔軟度、肌肉耐力和平衡力及舒緩情緒壓力。過往已有許多研究報告指出運動對身心的益處，但對現存有關瑜伽的對身心健康之研究證據仍未完善，而本地亦缺乏嚴謹的定質的實驗來驗證瑜伽對身心健康的影響，所以本研究之結果將有助更全面的了解恆常瑜伽練習的益處及和障礙及開始和持續瑜伽練習的原因。

自願參與研究
閣下明白參加這項研究屬自願性質，知道閣下可以在這項研究進行的任何階段退出，而參加與否絕對不會影響閣下在醫院的治療。如閣下選擇退出研究，所有有關閣下的資料將會被刪除。

研究程序
本研究將透過進行聚焦小組以收集數據，聚焦小組是一種小組討論，研究人員會預備一些有關研究題目所探討的相關問題，帶領 6 至 8 位參與者進行討論。如果閣下同意參加本研究，閣下將被安排出席一次長達一小時的聚焦小組。聚焦小組的過程將會被錄音和/或錄像，而研究人員會爲在聚焦小組中的觀察做筆記，以確保準確記錄各參與者於聚焦小組所提供的資料。研究人員將不會於聚焦小組內提及閣下的名字而閣下亦不需要於聚焦小組內使用閣下的名字。若碰巧閣下或閣下所認識的人於聚焦小組內提及閣下的名字，研究人員將閣下的名稱從抄本中刪除。在任何時間錄音帶和/或錄像磁帶及抄本將被儲存在上鎖的地方，磁帶和抄本將於本研究完成後一年內被銷毀。

機密處理
如果閣下選擇參加，研究人員將不會於聚焦小組內提及閣下的名字而閣下亦不需要於聚焦小組內使用閣下的名字。若碰巧閣下或閣下所認識的人於聚焦小組內提及閣下的名字，研究人員將閣下的名字從抄本中刪除。閣下的名字和一些能夠確認個人身分的資料將不會在任何與這份研究有關的報告內提及。閣下參與這項研究將被嚴格保密。
直接引用參與者的說話是聚焦小組報告結果的常見做法，這種方法含義更清楚表達到參與者的意見。於聚焦小組結束前研究人員會問閣下所說的話當中有甚麼內容是不想被引用的，研究人員將會確保不會引用閣下所說的話。

潛在風險
本研究不會對參與者構成能夠預期的健康風險。而參與者必須爲於聚焦小組的內容保持保密。

利益
閣下知悉閣下不會因參與這研究而取得任何利益。

問題查詢
研究人員已和閣下解釋研究內容及解答所有疑問。如閣下還有問題查詢，可聯絡劉小姐（手提電話：51122449，電郵：carenlau@cuhk.edu.hk）。

協議
閣下將獲得此同意書的副本作爲記錄。閣下於下面的簽署將代表閣下同意參加本項研究及了解此同意書之內容。
再次，我們感謝閣下參與本研究！

參與者簽名: ______________________________

研究員簽名: ______________________________

參與者姓名: ______________________________

研究員姓名: 劉凱琳小姐

日期: ______________________________

Appendix O Ethic Approval for Study One

香港中文大學醫學院
Faculty Of Medicine
The Chinese University Of Hong Kong

醫院管理局
新界東醫院聯網
Hospital Authority
New Territories East Cluster

Joint Chinese University of Hong Kong-New Territories East Cluster
Clinical Research Ethics Committee
香港中文大學-新界東醫院聯網 臨床研究倫理 聯席委員會

Flat 3C, Block B, Staff Quarters, Prince of Wales Hospital, Shatin, HK
Tel : (852) 2632 3935 / 2144 5926 Fax : (852) 2646 6653 Website : http://www.crec.cuhk.edu.hk

To: Prof. Jean WOO (Principal Investigator)
Dept. of Medicine & Therapeutics
Prince of Wales Hospital

29 APR '10

Ethics Approval of Research Protocol

CREC Ref. No.:	**CRE-2010.115**
Date of Approval:	**27 April 2010***
Study Title:	**Effects of a 12-week hatha yoga program on individuals with and without metabolic syndrome**
Investigator(s):	**Jean WOO, Alice Pik Shan KONG and Wing Yee SO**

I write to inform you that ethics approval has been given for you to conduct the captioned study in accordance with the following document(s) submitted:

- Research Protocol, dated February 2010
- Patient Informed Consent Form (main study), English Version, revised on 14 April 2010
- Patient Informed Consent Form (main study), Chinese Version, revised on 14 April 2010
- Patient Informed Consent Form (pilot study), English Version, revised on 14 April 2010
- Patient Informed Consent Form (pilot study), Chinese Version, revised on 14 April 2010
- PAR-Q, English and Chinese Version, revised on 14 April 2010
- Scientific and historical background to the Study, revised on 14 April 2010
- "Yoga and Health Questionnaire", Chinese Version
- Demographic Data Sheet, English and Chinese Version
- Physical Fitness Assessment Record Sheet, English and Chinese Version
- Hatha Yoga Class Handout
- Yoga Self Practice Weekly Record Sheet, English and Chinese Version

This ethics approval* will be valid for 12 months. Application for further renewal can be made by submitting the Ethics Renewal and Research Progress Report Form to the CREC (Download the electronic form template from the http://www.crec.cuhk.edu.hk or http://ntec.home/Research%20Ethics/main.asp). You are kindly requested to report to the Committee upon completion of the project.

The Joint CUHK-NTEC Clinical Research Ethics Committee is organized and operates according to ICH-GCP and the applicable laws and regulations.

Miss Winkie Lui
CREC Officer
Joint CUHK-NTEC
Clinical Research Ethics Committee

Encl.
WL/ci

Appendix P Ethic Approval for Study Two

THE CHINESE UNIVERSITY OF HONG KONG

M E M O

To : LAU Hoi Lam
Department of Medicine and Therapeutics
(PhD student in Medical Sciences)

From : Secretary
Survey and Behavioural Research Ethics Committee (SBREC)

Tel. : 2609 6238

Date : 2 Mar 2011

Survey and Behavioural Research Ethics

I write to inform you that the SBREC has granted approval to you for conducting the following research:

Project Title : Benefits and barrier of regular yoga practice

Source of Funding : Nil

Reference, if any : Nil

Thank you for your attention.

Sulan Wong

c.c. Panel Secretary concerned