

Uniting Perception and Reality in Human Nutrition: Integration of Qualitative and Quantitative Data to Understand Consumption

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9.1 INTRODUCTION

Nutrition and food consumption practices are gaining increasing attention in the academic community from both health and social sciences, as food has become a locus of health-related discussion in the general population. While food studies are certainly not a new topic, the breadth of new food studies has moved beyond either quantitative nutrition measurement or qualitative, culturally-based food use. Food research has historically treated eating and nutrition as separate spheres that were essentially either social or scientific processes (Johnston, 1987; Macbeth and MacClancy, 2004; Pelto et al., 2000). The emergence of research that adapts a more biosocial approach indicates a recognition that food and eating are complex intertwined processes that are heavily influenced by the social framework in which eating is entrenched (MacClancy and Macbeth, 2004). The meanings associated with a specific food item cannot be separated from the nutritional content of that food because the decision to consume a food can be based—at least partially—on nutrition, but also has consequences for the nutritional adequacy of an individual. As a result, nutrition studies cannot be conducted in the absence of the qualitative context of food, and phenomenological studies of food meanings cannot be divorced from the nutritional outcomes of consumption choices (McGarvey, 2009). Qualitative and quantitative methods, however, generate disparate data types that are designed to measure fundamentally different things. This paper will discuss how qualitative research methods, such as interviews and pile sorts, can be united with a quantitative survey approach to produce a unique answer to a research

question. A case study on perceptions of calcium and vitamin D intake in young adults is used to explore the benefits and challenges of this approach. This paper is not designed to be a thorough review of the case study results and methodology, but instead will provide a reflection on the process of integrating data sets and the methodological and theoretical issues that arise.

9.2 STUDYING FOOD AND NUTRITION

Human nutrition studies are important for assessing the nutritional status of populations, which is necessary for monitoring and maintaining population health. The goal of applied nutrition studies involves identifying adequate patterns of consumption for a variety of nutrients so that interventions can be designed to modify intakes (Becker and Welten, 2001; Briefel et al., 1997; Cook et al., 2000; Creed-Kanashiro et al., 2003). Most research into human nutrition focuses on the evaluation of nutrient intake in comparison to set national dietary reference intakes (DRI) (Atkinson, 2011; McPherson et al., 2000; Rizek and Pao, 1990; Ulijaszek, 2004; Whiting et al., 2011). DRIs are generated by the Institute of Medicine (IOM) and serve to identify thresholds of consumption for individual nutrients based on identified population needs (Atkinson, 2011; Health Canada, 2012). The two most commonly used measures are the recommended dietary allowance (RDA) and the estimated average requirement (EAR), which are the amounts of a nutrient needed to satisfy the requirements for 95% and 50% of a population, respectively (IOM, 2010). While the assessments designed to use these standards provide information on the nutrient gaps of individuals and populations, they do not incorporate the role that individual perceptions play in decisions about nutrition.

Decision-making in regards to nutrition relies not only on food and nutrition knowledge, but also upon individuals' perceptions of their intake and their beliefs about food. Perceptions provide a necessary framework within which nutrition knowledge is understood and food decisions are made (Wilson, 2002). The context of food decision-making serves to explain the observed patterns (MacClancy and Macbeth, 2004). Therefore, in order to holistically interpret the food data that are collected through nutrition studies, it is necessary to understand how and why people make specific food choices (Wilson, 2002). Since one goal of human nutrition studies is to design

public education or intervention programs that correct over- or under-consumption (Becker and Welten, 2001; Briefel et al., 1997; Garriguet, 2008), the context in which decisions are made becomes essential for designing effective programs.

9.3 USING A MIXED METHODS APPROACH

Mixed methods research holds a contentious place in anthropological research methodology. While proponents of mixed methods research support it as a third paradigm that draws on the best traits of qualitative and quantitative research, purists feel that the fundamentally different nature of the two types of data make them difficult to integrate (Burke Johnson and Onwuegbuzie, 2004). The nature of the debate centers on the epistemological differences in the roles of objectivity and generalizability between qualitative and quantitative methods (Burke Johnson and Onwuegbuzie, 2004; Johnson et al., 2007; Teddlie and Tashakkori, 2003). The social sciences view behavior and belief as concepts that are in flux, and so they are naturally and necessarily subjective, whereas food and nutrition science is required to conceptualize the phenomena they study as having static and objective components because they are searching for measurable truths (Creswell, 2008). Essentially, qualitative approaches are interested in and often centered around context, whereas most quantitative methods are not (Burke Johnson and Onwuegbuzie, 2004). The positivist stance that drives quantitative research is placed in opposition to the relativism of most qualitative methods.

It is these differences in the underlying goals of the methods that lead to problems in their evaluation and integration. Quantitative standards of validity and reliability are held as the ultimate tests for all research methods and are applied to both qualitative and quantitative studies (de Garine, 2004). Reliability and validity assume that there is an objective truth that can be identified, which is viewed as fundamentally in conflict with the relativism of qualitative methods (Golafshani, 2003). The purpose of a mixed methods approach, therefore, is to encourage a pragmatic blending of the social and mental reality of qualitative methods with the physical tangible reality of quantitative methods (Burke Johnson and Onwuegbuzie, 2004). Using a combination of inductive and deductive reasoning expands the breadth of data that can be gathered and proposes a more holistic way of approaching and

answering research questions that is more akin to how individuals and researchers actually behave (Driscoll et al., 2007). This means that mixed methods research has the potential to unite multiple lines of evidence to produce more detailed answers to research questions that reflect the complexity that underlies human life and behavior.

An anthropological mixed methods approach to human nutrition studies offers the ability to combine nutrient data with social context. Hubert (2004) presents the study of nutrition as a nested process using multiple methodologies, where qualitative interviews are used to elicit the social context of food and foodways, and quantitative surveys return information on nutrient intake. Since ideas surrounding food are highly contextualized, Hubert (2004) argues that social data on food is necessary for the interpretation of quantitative variables. This means that effective nutrition studies need to include both traditional nutrient intake measurements and beliefs or perceptions about intake (de Garine, 2004; Hubert, 2004). Measuring nutrient intake is generally a quantitative process done using food frequency questionnaires (FFQ), 24-hour food recalls, or food diaries that use recollection or active measurement of intake to provide quantities of foods that are broken down into specific nutrient constituents (Hubert, 2004; Quandt, 1986; Ulijaszek, 2004). These studies produce an intake value for a specific nutrient that can then be compared to the DRI for that population. Perceptions about food use rely on qualitative approaches that are descriptive in nature and explore the meanings behind food decisions and food choice, such as focus groups, interviews, or pile sorts (Edstrom and Devine, 2001; Quintiliani et al., 2008; Vallianatos and Raine, 2008). Uniting these two methodologies creates the potential to either provide social context for observed quantitative trends in food or nutrient intake, or to use qualitative themes to design effective quantitative tools for large populations.

9.4 THE CASE STUDY: MATERIALS AND METHODS

The case study discussed here used an integrated mixed methods approach concerning the importance that calcium and vitamin D played in food decision-making for Canadian young adults, but was specifically geared to assessing the differences in the actual intake of calcium and vitamin D compared to the perceived intake by young adults. Ethics approval was granted by the McMaster University

and Mohawk College Internal Review Boards and written consent was obtained from all participants before participation in the study. Sixty male and female (30 of each gender) young adults (17–30 years old) were first given an FFQ specific to calcium and vitamin D, and then participated in a pile sort activity and an in-depth interview. Participants were recruited on campus and from the community and were required to be within the age range and able to give consent to be in the study. No participants were eliminated and none refused to participate. The young adults represented four different education levels: college (2-year program), university (4-year program), postsecondary graduates, and students who had never attended any postsecondary education. The FFQ was designed and validated on a multiethnic Canadian sample and contained 37 food items related to calcium or vitamin D for which participants were asked to indicate the amount consumed and frequency (Wu et al., 2009). The pile sort activity required participants to sort 32 cards that depicted food items into categories for high, medium, or no calcium and yes or no for vitamin D. The pile sort was developed by the researcher for this study and was field tested on a sample of 15 participants before use in the study. Participants were then asked to explain the rationale for each card choice, which led into an in-depth interview on beliefs about nutrition and food choice. All interviews were conducted by the researcher and included questions such as, “do you get enough calcium/vitamin D?” and “how important is nutrition to your daily life?” The goal of the interviews and pile sorts was to explore the degree of conscious choice young adults exercised in food and micronutrient consumption and to assess their nutrition knowledge as a framework for their informed decision-making. The interview lasted between 45–60 minutes and was audio recorded and later transcribed verbatim. The questions ranged from general discussion about nutrition and health to specific questions about vitamin D and calcium.

Analysis of the FFQ involved calculating an average daily intake for calcium and vitamin D using the equation provided by the IOM for the measurement of individual nutrient intake (IOM, 2000). The resulting value was compared to the EAR, a threshold established for these nutrients as set by the IOM to produce a measure of the individuals that were consuming inadequate amounts of calcium and vitamin D (IOM, 2000). Binary logistic regression and Mann-Whitney U tests were used where appropriate to explore the relationship

between age, gender, education, and income on consumption patterns. In order to avoid overestimating the individual requirement for a specific nutrient, the IOM recommends using the EAR (IOM, 2000). Analysis of the interviews and pile sorts followed the method for qualitative content analysis described by Bernard (2011). Thematic analysis was conducted on the transcribed interviews and pile sorts, which used a combination of a priori and new codes that reflected the meanings and beliefs raised by the participants. A priori codes were generated before analysis began by establishing broad codes that related to the research question. For example: “importance of nutrition,” “knowledge of calcium and vitamin D,” and “health as a priority” were a priori codes designed to help guide interpretation in relation to the specific research question. As analysis progressed, new codes were added as themes emerged through a close reading of the data, such as fitness, body image, and individual responsibility. Once coding was complete, codes were reorganized, which involved combining duplicate codes and organizing codes into thematic hierarchies that allowed for easier visualization and contextualization of the data (Bernard, 2011).

9.5 OVERVIEW OF RESULTS AND DISCUSSION

Quantitative assessment of nutrient adequacy indicated that 55% ($n = 33$) of the participants in the sample were found to have inadequate intakes of calcium and 61% ($n = 37$) were found to have inadequate intakes of vitamin D when compared to the EAR for age. When perceptions of intake were integrated with the FFQ data, more than half of the young adults in this study perceived themselves as adequate consumers of calcium (57%, $n = 19/33$) and vitamin D (78%, $n = 29/37$), when they were inadequate according to the FFQ.

When the qualitative data were considered, two themes can be identified that helped contextualize participants’ beliefs in the adequacy of their intakes: nutrition misinformation and nutrition as a low priority. Participants showed poor knowledge of the sources of vitamin D and calcium. Participants located calcium and vitamin D in more foods than they actually are present in, which led them to perceive their intake as greater than it actually was. “[I get enough] because it’s in everything I eat. It’s in the cheese that I have on everything. It’s in milk that I drink straight. It’s in vegetables when I eat them” (Male, 29, Graduate). The view of these nutrients as ubiquitous

led participants to assume that general food consumption, especially of healthy foods, would provide enough nutrients. “Yup. I think [I get enough]. Because I eat my greens and I eat my veggies and I get enough sun” (Male, 26, College). Additionally, the labeling of calcium and vitamin D as micronutrients led participants to think that they only needed to be present in their diets in small amounts and so it was easy to obtain enough without actively seeking out these nutrients.

The second theme is more general and concerns the low priority that most participants placed on nutrition. These young adults were generally not concerned about nutritional content of foods as a factor that affected their food purchasing. In fact, nutrition was placed as a low priority unless it was tangentially related to another interest, such as fitness or weight loss. “I don’t think at the moment it’s directly important just because I’m young and I don’t really think about that kind of stuff” (Female, 24, University). Perhaps their age and lack of previous medical problems made health a low priority for them. Nutrition was viewed as nonessential for their current life stage as it could be corrected when they were older and it became more important to eat healthfully. As one participant indicated, nutrition was only considered when it was connected to weight loss. “The first thing I look at is the fat and calories. I don’t pay attention to any sort of the percentage of other nutrients that they have” (Male, 28, College). This statement echoes the sentiment of many participants who saw nutrition as an intervention for weight loss or fitness, rather than a daily priority.

Overall, the qualitative results suggest that the participants’ perceptions of dietary adequacy can be linked to their overall knowledge about nutrition and their beliefs about specific nutrients. Since they perceive their intake of calcium and vitamin D to be higher than it actually is, this is an issue to address in future communications. Raising awareness means reaching those young adults who believe their intake is adequate and encouraging them to question their consumption practices and to listen to prevention education. At the same time, the results suggest that current prevention education targeting older adults and individuals who are already concerned about their intake will not be effective with these younger adults as they do not perceive themselves as being at risk of inadequate calcium and vitamin D intake.

Information needs to be connected to topics that interest young adults, such as fitness or weight loss, in order to catch and hold their attention to nutrition as a whole. Targeting Canadian young adults means designing education that promotes awareness of calcium and vitamin D consumption in individuals who do not consider themselves at risk and encouraging individuals to question their intake before presenting them with nutrition information.

9.6 CHALLENGES AND LIMITATIONS

An issue that was at the forefront of the challenges experienced in this study was the difficulty in determining how to integrate the results in order to speak to the research question as a whole (Burke Johnson and Onwuegbuzie, 2004; Caracelli and Greene, 1993; Creswell, 2008; Onwuegbuzie and Leech, 2006; Teddlie and Tashakkori, 2003). Since each method measured something that was fundamentally different, bringing them together posed a problem. The methods were not simply two ways of measuring the same phenomenon and the data types themselves contained very different limitations. Identifying how these methods could be used in tandem required recognizing that they provided different perspectives on the research question and together could be used to explain the problem. The research question sought to explore how young adults understood their perceived intake in comparison to their actual intake, with a focus on why there might be discrepancies. The FFQs gave a sense of how much calcium and vitamin D young adults were consuming, which provided a measurement of their actual intake. The interview data provided the information on their perceptions, using a series of questions that ranged from the explicit to more general questions surrounding the importance of calcium and vitamin D to help provide context for their actual intake. The degree to which young adults understood their nutrition and considered micronutrients as an aspect of nutrition could provide the context for how reliable their assessment of their own intake was and, when specifically explored in the young adults that over- or underconsumed calcium and vitamin D, could aid in explaining the observed patterns.

While the outcome of this study revealed the importance of using a mixed methods approach, there were a number of inherent challenges. In order to maximize data collection, the FFQs and interviews were

conducted at the same time, so that the FFQs were monitored and no data points were lost. In this case participants had to complete all three parts of the study or the data could not be used, which made it time-intensive. The interviews were concerned with broad beliefs and the FFQs were designed only to measure reported intake. Integrating the two required careful design of a research question that incorporated the types of data generated by each method.

The methods themselves contain inherent limitations. The FFQ required participants to recall their intake over the past month and then reduced it down to a single measurement of daily intake. This has the potential to misrepresent participants' actual intake of calcium and vitamin D. Interviews are also subject to a series of commonly experienced limitations as described by [Bernard \(2011\)](#). Calculating vitamin D is problematic as vitamin D is both consumed and synthesized after exposure to UVB radiation, however, this limitation was mediated by administering the FFQs only during the winter months when vitamin D cannot be synthesized.

The importance of the research question to a mixed methods approach is underscored by [Onwuegbuzie and Leech \(2006\)](#), since the design of the research question dictates the methods and analysis. When the intention from the outset is to blend methods, the research question had to be formulated to take advantage of the specific types of data that the methods can generate. A broad, exploratory research question that contained a comparative question was found to be more conducive to data amalgamation than a specific question as it created more space for probing relationships and allowing for questions concerning the "how" and "why" of food consumption patterns ([Onwuegbuzie and Leech, 2006](#)).

The decision to use the qualitative data to create context for the quantitative data follows accepted procedures for mixed methods, where data is integrated in phases that begin with one data type informing the collection of the second data type ([Driscoll et al., 2007](#); [Onwuegbuzie and Leech, 2006](#)). In this case the quantitative data was collected first, which allowed for the qualitative data to build upon the initial results through inductive exploration of the topic. This approach minimized the risk of one method overwhelming the other and did not preference one approach or data set over the other; each was treated as equally valuable and revealing.

One of the major concerns was the potential that contradictory data would pose for analysis. This issue was mediated by the use of broad, open-ended questions in the interviews in order to generate data that could be used to explore multiple different FFQ results. However, contradictory data is not necessarily a problem as it could indicate that the issue being investigated is more complex than the research question or analysis allows for. While this approach could be viewed as limiting the detail that could be gathered, it allowed for integration of the data in a meaningful way that could later be used to create more detailed questions once larger trends had been established. Ongoing assessment of the FFQs during the data collection process and immediate transcription and cursory analysis of the interviews were essential in ensuring the two data sets could be used together.

9.7 EPISTEMOLOGICAL QUESTIONS IN MIXED METHODS: VALIDITY AND RELIABILITY

The concepts of validity and reliability frame the understanding of contemporary scientific research and, for this reason, warrant a specific discussion here. The issues of validity and reliability underscore all qualitative and quantitative studies, but represent standards that are much more difficult for qualitative studies to meet. Validity is a measurement of the accuracy of data, which is the degree to which a technique measures what it is designed to measure (Burrows et al., 2010; Quandt, 1986). From the positivist perspective, validity is the degree to which a method provides the objective truth which, from a scientific standpoint, is understood to both exist and be attainable through the correct methodologies (Golafshani, 2003). Reliability is the ability to obtain the same result every time the method is repeated (Quandt, 1986). While both FFQs and interviews rely on self-reported data, which has known limitations, the FFQ can be subjected to the standard tests of validity and replicability as it is possible to know the amount of calcium/vitamin D consumed and to repeat this measurement successfully as the amount of calcium/vitamin D should not change significantly provided all variables remain consistent. Since FFQs are limited by the potential for retrospective errors and the self-reported nature of the method, they often require validation using additional methods (Burrows et al., 2010; Johnson, 2010; Krall et al., 1988). Previous tests of validation on the FFQ used here have supported its use in a young adult Canadian

population, as the FFQ was combined with 7-day food diaries and repeated with large sample sizes on multiple occasions (Wu et al., 2009).

Problems emerge when the standards of validity and reliability are applied to qualitative methods as they are interested in the attitudes, beliefs, perceptions, and experiences of individuals and so it becomes more difficult to satisfy validity and reliability (Hart et al., 2002; Ulijaszek, 2004). The assumption of an objective truth that underlies validity is more difficult to apply to personal opinions regarding abstract concepts. There is often no knowable objective truth and looking for an objective truth lies outside the assumptions on which most qualitative methods are based. Qualitative methods, such as interviews and focus groups, are concerned with the process of how people create meaning through their experiences and perceptions of the world (Golafshani, 2003; Hubert, 2004; Pope and Mays, 1995; Sofaer, 1999). The goal is to describe these processes and to identify the common themes that underlie them. Using a standard that requires an objective truth misconstrues the purpose of using a qualitative method (Golafshani, 2003). A similar problem exists for reliability because people are not static. People live in a state of “being in” the world and as a result their perceptions are constantly being affected by their experiences (Bernard, 2011). Qualitative data are not designed to be subjected to the same standards of replicability, since individual beliefs and perceptions can change, even as a consequence of discussing them with an interviewer. While this type of data provides essential context to intangible phenomena, its results are less generalizable than those achieved using quantitative data. So while the FFQ data may be replicated in other populations, the interview and pile sort data may differ because populations are different or because perceptions change making its applicability more limited.

Using a mixed methods approach therefore involves rethinking the positivist principles that underlie approaches to research design and accepting that the contributions that qualitative research can make are a direct result of the type of data produced. Rather than holding all methods to the same scientific standards of validity and replicability it is important to recognize the limitations of both data types and use them in ways that most effectively draw on their strengths. Interviews and pile sorts should not be used to identify objective truths in perceptions, but to provide essential context for understanding the intake behaviors identified in the FFQs. While these results are not

necessarily generalizable and may change with individual experiences, this does not detract from the ability of interviews to explain the context of the specific reported intake values and to aid in drawing conclusions about behaviors.

9.8 CONCLUSION

The importance of collecting data using multiple methods is paramount as multiple lines of evidence both strengthen results and introduce new perspectives. The challenges inherent in a mixed methods approach need to be recognized and considered because mediating them must be integrated into the design of a study, not just in analysis and interpretation. Uniting disparate lines of data requires the researcher to think carefully about the research question, theory, methodology, and analysis in order to be familiar with the specific strengths and limitations of the methods and frameworks that are being applied. The pragmatic theory that underlies mixed methods recognizes the need to compromise between data types in order to create a whole that draws on the preferred traits from each method and combines them in a way that generates new and interesting perspectives on the research question. When applied to anthropological questions, and specifically to food studies, the desired outcome is a melding of the social and biological that speaks to actual practices and social beliefs.

The application of a mixed methods approach to this case study allowed a more nuanced understanding of how young adults develop and apply beliefs about nutrition to their consumption processes. Integral to the exploration of this issue was the ability to apply two different types of data to a single research question in order to create multifaceted results. What emerged from this process was information on both the nutritional adequacy of the young adult respondents and the perceptions and beliefs that underlie nutrient consumption and directly influence adequacy. The same population was used to collect both sets of data in this study, rather than conducting separate studies on different populations, and so inferences can be made about correlation. The identification of this context means that more detailed recommendations, beyond simply increasing education, can be made for the creation of programs that directly address nutrient inadequacy of comparable Canadian young adults. The contribution of mixed methods in this context was the generation of a dataset that provided

social context for food intake on a single study population in order to show how perceptions can influence action and create tangible recommendations for change.

While there are limitations to using mixed methods and it is not suitable for all data types or research questions, the benefits of such an approach are invaluable in accessing the complexity of human behavior. Quantitative studies can produce measurable information on human behaviors, but applying this information or modifying behaviors requires going beyond observation to access meaning in order to identify ways of instigating change. The use of mixed methods offers the tools for a more efficient and dynamic study of human behavior.

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