

FOOD CHOICES OF AFRICAN AMERICANS COMPARED TO OTHER RACIAL/ETHNIC  
U.S. POPULATIONS USING NHANES, 2003-2006, DIETARY SURVEY DATA

by

CARRITA A. HIGHTOWER

B.S., Tennessee State University, 2000  
M.S., Kansas State University, 2006

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Department of Human Nutrition  
College of Human Ecology

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## Abstract

Food consumption continues to be an area of focus for nutrition, health, and consumer research. Eating adequate amounts of fruits and vegetables, appropriate levels of dairy products, increasing whole grains, and switching to lean meat and fish all are associated with managing weight and reducing the risk of chronic diseases including cancer, diabetes, hypertension, and cardiovascular disease. Research has shown that food consumption rates vary across segments of the U.S. population depending on several socio-demographics including race/ethnicity, gender, and age.

The purpose of this research was to examine consumption of various foods including fruits and vegetables, dairy products, selected types of grain and starchy vegetable foods, and meat and legume products based on race and ethnicity, age, and gender using 24-hour recall dietary data from survey years 2003-2006 of the National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and the United States Department of Agriculture.

The 2003-2006 NHANES 24-hour dietary recall data, known as *What We Eat In America*, were used for analysis of food consumption. Two non-consecutive days of 24-hour dietary recall and demographic information were analyzed to assess consumption patterns of participants who: 1) were at least two years of age, 2) had complete and satisfactory dietary recall data, and 3) were members of a selected racial/ethnic group. The sample size was 17, 885 males and females: 4,994 African Americans (non-Hispanic); 7,525 Whites (non- Hispanic); and 5,366 Hispanics (Mexican American and other Hispanics). Individual Foods Files (IFF), containing foods coded for each individual, were accessed via the NHANES website to use for the consumption comparison analysis. There were food files for each of the two recall days of each survey year, 2003-2004 and 2005-2006.

These findings indicate that there are racial/ethnic, age, and gender differences in the consumption of various foods. Fruits, vegetables, and dairy products were only consumed by 70-80% of the sample populations. Only 18-42% of the respondents reported eating whole grain breads, legumes, nuts, and seeds. However, meat and meat product consumption was reported by more than 75% of the sample. African Americans consumed fewer fruits, vegetables, whole grains, and dairy products compared to Whites and Hispanics. African Americans had a

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This research demonstrates that the types of foods eaten for all groups of food products vary by racial and ethnic population, and age or gender subgroups. African Americans' fruit and vegetable consumption trends are distinct in many cases. This research serves as a current baseline for future research exploring the relationship of dietary intake and race and ethnicity. Given that African Americans have higher incidences of chronic diseases, there is a need to continue to develop culturally sensitive dietary counseling and intervention programs. Furthermore, this study highlights areas of opportunities to expand research involving African Americans from a sensory, business and promotional perspective capitalizing on the diversity of food habits.

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Approved by:

Major Professor  
Edgar Chambers IV

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## **Dedication**

To my mother, Carolyn W. Hightower

*Thanks for always helping your little bird to fly*

## CHAPTER 1 - Introduction

Food preferences, choices, and intake habits are influenced by the complex interaction of several factors including “psychosocial” factors such as nutrition knowledge, attitudes, beliefs, and perceptions of food, and “socio-demographic” factors such as income, gender, age, and race/ethnicity- culture (James 2004; Conner and Armitage 2002; Kittler and Sucher 2007; Axelson 1986) .

Kittler and Sucher (2007) describe culture as “the beliefs, attitudes, values, customs, and habits accepted by a community of individuals.” Cultural practices can determine what, how, when, where, and how often foods are eaten within an ethnic group. For example, some African American diets are characterized by eating what is known as ‘*soul food*’. The foods include fried, baked, boiled poultry, pork, and beef along with greens, sweet potatoes, black eyed peas, and cornbread. Furthermore, African Americans enjoy these foods especially during holidays and during Sunday dinners, a traditional time in which families gather in the African American culture. The selection of foods from one’s culture is a way individuals can express and identify with their ethnic heritage (Devine et al. 1999; Kittler and Sucher 2007). Food behaviors developed during childhood expand into adulthood (Mikkilä et al. 2005; Haire-Joshu et al. 2004). Therefore, cultural practices and eating of certain foods introduced and established during the childhood years are often maintained throughout adulthood.

American food cuisine has been shaped by the foodways of indigenous people and immigrants from countries around the world. Corn, beans, peanuts, tomatoes, sweet potatoes, and white potatoes are a few foods with different origins that have come together to become staples of the American diet. Foods such as pizza, spaghetti, egg rolls, tacos, and frankfurters are foods that originated in various cultures and have become recognizable items of American cuisine and diets (Kittler and Sucher 2007). The interaction of foods from various cultures through historical presence in the United States, immigration, and acculturation has contributed importantly to the American diet.

## Factors Impacting Food Choice/Preferences

Socio-economic and demographic factors determine preferences and consumption of foods. Income status affects the type, quantity, quality, and where foods are consumed. Income has been shown to affect the consumption of fruits, vegetables, whole grains, and eating foods away from home (Stewart and Blisard 2008; Lang and Jebb 2003). For example, the consumption of fruits and vegetables tends to be lower among low-income households because of fruit and vegetable cost and the spending of finances on meat, shelf-stable, and convenience foods (Dong and Lin 2009; Stewart and Blisard 2008; Shankar and Klasse 2001). Lin et al. (2001) reported that low-income households consume fewer amounts of fresh potato and canned potato products compared to higher-income households. Research on beef and pork consumption of a nationally representative sample showed that individuals of low-income status consumed more of these foods compared to high-income consumers (Davis and Lin 2005; Davis and Lin 2005b).

Other factors such as where people live influence the eating of certain foods. For example, people living in the Southwest area of the U.S. may consume more chili peppers compared to individuals residing in the Northeast. Research has shown that persons living in the Midwest consume more beef than individuals living in the Northeast (Yen et al. 2008). Lucier and colleagues (2000) reported that the highest consumption of cooked dry beans was in the Southern and Western regions of the U.S.

Barriers and personal beliefs, values, and perceptions impact food choices, preferences, and habits. There is a large body of research examining the impact of barriers and biases on the consumption of such foods as dairy, fruit and vegetable, grain, and legumes (Lucan et al. 2010; Yeh et al. 2008, Wooten et al. 2004; Chase et al. 2003). Some barriers include cost, convenience, accessibility, awareness of health benefits, physiological response, and taste preferences for foods. For example, lactose intolerance or the idea of being intolerant has been shown to impact dairy consumption among African Americans (Wooten et al. 2004). Qualitative research with various racial/ethnic populations identified cost, grocery store accessibility, and perishability as barriers to fruit and vegetable consumption (Yeh et al. 2008).

Race/ethnicity plays a role in food choices and ultimately in dietary intake. Research has shown that intake of foods is culturally relevant. Mitchell et al. (2008) examined the consumption of dry beans, peas, and lentils among multi-ethnic groups. The research demonstrated that Hispanics were more likely to be consumers of beans than African Americans and Whites. Dairy consumption research has shown that African Americans and Hispanics prefer high-fat milk products over low-fat and skim milk options (Robb et al. 2007). Bartholomew et al. (1990) examined the relationship of food consumption and socio-demographics (i.e. ethnicity, age, sex, income) for Mexican Americans and Whites. Mexican Americans used more saturated fats for cooking, consumed more poultry, sugar, avocados and olives. However, Whites ate more beef, fruits and vegetables, breads, and skim milk. This suggests that individuals select foods which they are familiar and culturally accustomed to eating, and race/ethnicity is a key factor impacting food intake.

### **Diet and Disease**

The relationship of dietary intake and the risk of chronic diseases is firmly established throughout research literature. Research has shown that diets adequate in fruit and vegetables, whole grains, low-fat dairy, lean meats, and legumes mitigate the risk of certain cancers, cardiovascular disease, osteoporosis, type-2 diabetes, and obesity (Zemel et al. 2009; Hung et al. 2004; Jiang et al. 2002; Bazzano et al. 2001). Furthermore, dietary intake investigations have shown that there are racial/ethnic differences in the consumption of disease preventive foods therefore explaining health disparities across diverse populations. For example, many African Americans tend to have diets high in saturated fat, processed meats, refined grains, and low in fruits and vegetables while having high prevalence of diabetes, hypertension, and cancer (Dong and Lin 2009; Deshmukh-Taskar et al. 2007; Hajjar and Kotchen 2003; Cleveland et al. 2000).

The 2005 Dietary Guidelines and Food Guide Pyramid outline strategies to improve health and reduce disease risk. It is recommended that Americans consume at least five servings of fruits and vegetables per day. However, research studies have shown that Americans are not consuming at least 4 ½ cups of fruit and vegetables on a

daily basis (Dong and Lin 2009; Stark-Casagrande et al. 2007; Guenther et al. 2006). Eating adequate amounts of fruits and vegetables is associated with managing weight and reducing the risk of cancers, diabetes, hypertension, and cardiovascular disease (Hung 2004; Rolls, 2004; Bazzano et al. 2002).

Americans are advised to consume six to eight 1 ounce servings of grains per day with at least half of the servings coming from whole grain sources (USDHHS 2005). However, the consumption of whole grains remains below recommended levels (Bachman et al. 2008; Lin and Yen 2007; Cleveland et al. 2000). Low whole grain consumption, among other dietary deficiencies, increases the risk of chronic diseases in U.S. minority populations, especially African Americans (Weatherspoon et al. 2010; USDHHS 2010; Hajjar and Kotchen 2003; Cleveland et al. 2000).

According to the national guidelines, individuals are advised to consume two-six ounces of lean meat or other protein foods per day depending on one's age and gender (USDHHS 2005). Diets high in red and processed meats have been associated with increased risk of coronary heart disease, hypertension, diabetes, and obesity (Steffen et al. 2005; Krauss et al. 2000). Conversely diets rich in lean meats, legumes, and nuts reduce the risk of some chronic diseases (Jiang et al. 2002; Albert et al. 2002).

## **Dietary Patterns and Health**

Understanding dietary patterns is important for the development of nutrition policy and educational materials to promote healthy diets and minimize incidences of disease.

Research has shown that there are racial/ethnic differences in food consumption and dietary patterns (Kant et al. 2007; Patterson et al. 1995). There are many ways to understand food consumption patterns. For example, national survey research reports, many based on 24-hour dietary recall information, have shown that there are racial and ethnic differences in dairy consumption patterns (Beydoun et al. 2008; Fulgoni et al. 2007; Storey et al. 2006). Data from the Continuing Survey of Food Intakes by Individual Intakes (CSFII) and National Health and Nutrition Examination Survey (NHANES) indicated that African Americans consume less milk, cheese and yogurt

products; and have lower intakes of calcium, phosphorous, and magnesium compared to other racial/ethnic groups (Fulgoni et al. 2007).

Other research studies examining food consumption among different race and ethnic populations focused more on the number of servings, energy intake, nutrient intake, and diet proportions in terms of food groups (Yen et al. 2008; Stark-Casagrande et al. 2007; Ranganathan et al. 2005). Some studies have examined, classified, and named different food patterns (Satia et al. 2009; Fung et al. 2004). Fung et al. (2009) examined dietary patterns and the risk of type-2 diabetes. These researchers identify two dietary patterns: (1) 'prudent pattern' and (2) 'Western Pattern'. The prudent pattern indicated high consumption of fruits, vegetables, legumes, and lean meat. However, the Western pattern was high in red meats, sweets, and refined grains.

Few studies have examined specific types of foods consumed by different racial/ethnic, age, and gender subgroups (Nielsen et al. 2002; Popkin et al. 1996; Patterson et al. 1995). Further research is needed to illustrate consumption rates of specific types of foods in order to further understand dietary consumption patterns across racial and ethnic populations. This type of research will form a foundation for culturally focused programs in order to elicit permanent dietary behavior changes across various socio-demographic groups of the U.S. population.

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## CHAPTER 2 - Materials and Methods

### **NHANES Demographic and Dietary Recall Data- Identifying Food Consumption Patterns**

#### *Data Sources*

The 24-hr dietary recall data, known as *What We Eat In America* (WWEIA), of the National Health and Nutrition Examination Survey (NHANES) was used for analysis of food consumption. NHANES collects two days of dietary recall and demographic information from each participant in the national study. The dietary recall data was collected in two phases: (1) in-person interview; and (2) telephone interview. The in-person interview was conducted privately at the NHANES Mobile Examination Center (MEC), using measuring tools to help participants report amounts of food eaten. Three to ten days after the initial recall interview, a telephone interview was conducted. All recall interviews were conducted with trained personnel and monitored throughout data collection periods using established quality control and assurance measures (CDC, NHCHS 2006).

For this research, recall data from 2003-2006 was used to assess food consumption patterns of three selected racial/ethnic groups: African American (non-Hispanic), White (non-Hispanic), and Hispanic (Mexican American + other Hispanic/Latinos). It is important to note that NHANES used the terms Black, White, Mexican American, and Hispanic to identify the races/ethnicities of respondents. For the purpose of this research, African American, White, and Hispanic will be used to reference each group.

Food data sets containing foods coded for each individual were accessed via the NHANES website. The data sets, known as Individual Foods File (IFF), contain multiple records or lines for each respondent (Figure 2.1). In other words there is one line per food item for each survey respondent in the foods file. In each food record there is a range of information including the USDA code for the reported food, when/where the food was eaten, amount consumed, and nutrients supplied by the food item. There are food files for each recall day (1 and 2) for each survey year (2003-2004; 2005-2006). In

this research, four IFF data sets were used for consumption comparison analysis. The specific files were 2003-2004 Day 1 (*DR1IFF\_C*); 2003-2004 Day 2 (*DR2IFF\_C*); 2005-2006 Day 1 (*DR21IFF\_D*); and 2005-2006 Day 2 (*DR2IFF\_D*). Also, a Dietary Recall Status variable was included in the food file information for each participant identifying the quality and completeness of the responses. Only participants' data which were considered reliable as identified in NHANES with the dietary recall status variable. According to NHANES documentation, dietary recall data was consider reliable if all dietary recall variables had a value therefore serving as a complete record (USDA, CDC 2006, 2008).

Demographic data sets included both socioeconomic and personal information. Information regarding race, gender, age, marital status, education, family structure, citizenship, and more was gathered from each survey respondent. In this research, race/ethnicity, age, and gender information for selected participants were retained for data analysis.

### ***Sample Population***

Participants for NHANES were randomly selected to represent the United States population, with statistical consideration for population distributions and demographics. In each survey year, approximately 5,000 persons were surveyed in 15 various locations across the U.S. This research included NHANES survey years 2003-2006. In these years, demographic data were available for a total of 20,470 participants, ages 0 to 85+. There was over-sampling of African Americans, Mexican Americans, persons 12-19 and 60+ years old, and low-income individuals. Any respondent qualified for the 24 hour dietary recall section of NHANES. For this research, any persons 2 years and older with complete/satisfactory 2 days of dietary recall data and members of the selected racial groups were included in the sample set for data analysis. The sample size was 17, 885 individuals: 4,994 African Americans; 7,525 Whites; and 5,366 Hispanics. In table 2.1, racial/ethnic, gender and age characteristics of the sample population are described.

### ***Food Selection for Consumption Analysis***

Food groups were used to categorize and organize the food items for analysis. The food groups were fruits and vegetables, dairy, grains and selected starchy vegetables, and meats, meat products, and legumes. Initially, within each food group, “marker” foods were selected where we expected differences and where we did not expect differences to occur among the three racial groups. Marker foods were not selected based on any specific prior evaluation of the data, but were used to help narrow the number of foods evaluated. For example, the category “vegetables” could include hundreds of different foods. To make the analysis more manageable, commonly eaten vegetables such as tomatoes were automatically included. Then other vegetables where we did not necessarily expect differences in consumption (e.g. carrots) or where we did expect potential differences in consumption (e.g. collard greens) were included. Because every possible food in the FNDDS database could not be evaluated, food items were selected if they were commonly eaten, considered to show consumption similarities or differences, and listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007).

A total of 251 different food types and specific foods were analyzed for consumption comparisons. A sample list of the type of specific food items reviewed is provided in Figure 2.2.

Each food item in the IFF documents was assigned an 8-digit code. This code corresponded to codes and food descriptions in the USDA Food and Nutrient Database for Dietary Studies (FNDDS), which classifies food items by food groups and subgroups (USDA, FNDDS 2006, 2008). These food codes were used to identify foods used in the data analysis. For each food item, all consumption forms were combined to represent the food item. There are a total of 6,921 food codes listed in the FNDDS. In the current research, a total of 3,521 food codes from the FNDDS database were combined to determine consumption overall or individually by food type. Food codes for fats, oils, salad dressings, sugars, sweets, sweetened/alcoholic beverages, gravies, and desserts (i.e. cakes, cookies, pies, ice cream) were excluded from the analysis in an effort focus primarily on food items in the main food groups identified for this research.

## *Data Analysis*

Given that the purpose of the research was to study foods consumed rather than nutrients consumed, the study used reports of population consumption frequency (i.e. any food group product or a particular given product consumed during either of the two recall reporting days constitutes "consumption" of the food category or that particular food for that individual) unlike most nutrition research, which focused on mean serving, nutrient, and energy intakes to understand consumption patterns of foods across race/ethnic groups and age and gender subgroups (Bachman et al. 2008; Beydoun et al. 2008; Cleveland et al. 2000). For the purpose of this research, consumption frequency refers to the proportion of a sample population who reported eating a food group or item.

For the purpose of statistical analysis, dietary recall and demographic data were pooled over the two non-consecutive days and two survey years (2003-2004; 2005-2006). Specifically, the demographic data and the foods file (IFF) data were merged using a unique sequence number assigned to each survey participant for both recall days and across years. Therefore the demographic data for a respondent matched the dietary recall data in the IFF data set. A Pearson's chi-square test was used to determine if there were significant differences between the proportion of "consumers" and "non-consumers" of identified food items for each racial/ethnic category, using the FREQ procedure in SAS® 9.2 (SAS Institute Inc., 2008). Therefore, the FREQ procedure generated the number of persons from each racial/ethnic groups who reported eating a specific food item (i.e. the frequency of persons for a food item was calculated to assess consumption patterns).

After reviewing the consumption rates across food items, foods with greatest percentages across racial/ethnic groups and those that appeared to have distinct race and ethnic differences were analyzed to further descriptively examine race by gender and race by age food intake patterns.

## Table and Figures

**Table 2.1 Demographic characteristics of sample by race/ethnicity, age and gender from 2003-2004, 2005-2006 NHANES data**

n	African		
	American	Caucasian	Hispanic
<b>Age</b>			
2-17y	2465	2027	2683
18-29y	864	1159	976
30-49y	780	1522	843
50-65y	512	1142	456
66+ y	373	1675	408
<b>Gender</b>			
Males	2477	3668	2586
Females	2517	3857	2780
Sample Total, N= 17885			

**Figure 2.1 Example of dietary data from NHANES individual food files (IFF)**

SEQN	Food code	Line Number	Time of Eating Occasion	Calories from food	Calcium from food
27530	27510310	1	16:00	656	356
27530	92410550	2	20:00	254	12
30888	61210220	1	9:30	150	29
30888	61210220	2	9:30	229	44
30888	25221420	3	9:30	92	4
30888	32104900	4	9:30	169	77
30888	52103000	5	9:30	186	25
30888	14104010	6	9:30	114	204
30888	22600100	7	9:30	54	1
30888	57213000	8	10:30	354	13
30888	11112110	9	10:30	259	607
30888	63137150	10	11:00	213	17
30888	58108050	11	12:00	252	148
30888	27510370	12	13:30	933	436
30888	71401030	13	13:30	427	18
30888	74401010	14	13:30	15	3
30888	92410350	15	13:30	3	10
30888	75113000	16	18:00	17	22
30888	74101000	17	18:00	22	12
30888	73101010	18	18:00	15	12
30888	24100000	19	18:00	320	20
30888	83210100	20	18:00	24	1
30888	75109000	21	18:00	17	48
30888	42202000	22	18:00	753	55
30888	92410510	23	18:00	147	7
30888	64116020	24	22:30	145	21
30888	91745100	25	22:30	263	0

Source:

<http://www.cdc.gov/nchs/tutorials/dietary/SurveyOrientation/DietaryDataStructureContents/Info2.htm>

**Figure 2.2 Sample of food groups/items used in consumption analysis**

## Examples of Food Groups/Specific Foods

<p><b>Fruits/ Vegetables</b></p> <ul style="list-style-type: none"> <li>•Apple, avocado, berries</li> <li>•Mango, pears, watermelon</li> <li>•Tomatoes, sweet potatoes</li> <li>•Asparagus, broccoli, greens</li> </ul>	<p><b>Dairy</b></p> <ul style="list-style-type: none"> <li>•Milk- whole, 2%, skim, buttermilk</li> <li>•Cream, sour cream</li> <li>•Cheese- cheddar, brie, mozzarella, processed</li> </ul>
<p><b>Grains/Starchy Vegetables</b></p> <ul style="list-style-type: none"> <li>•Rolls, bagels, muffins</li> <li>•Rye, pumpernickel</li> <li>•Pancakes, waffles</li> <li>•Cornbread, hushpuppies, tortillas</li> <li>•Grits, oatmeal, RTE cereal</li> <li>•Rice- white, brown, Spanish</li> <li>•White potatoes- mashed, fries</li> <li>•Spaghetti</li> </ul>	<p><b>Meat/Legumes</b></p> <ul style="list-style-type: none"> <li>•Beef- steak, ground beef, roast</li> <li>•Pork- ham, bacon, chop, pig's feet</li> <li>•Poultry- fried chicken/turkey, chicken nuggets, fried eggs, turkey bacon</li> <li>•Fish- salmon, tilapia, tuna salad, shrimp</li> <li>•Ribs, frankfurters, chorizo</li> <li>•Pinto beans, black eyed peas, almonds, peanut butter</li> </ul>

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# **CHAPTER 3 - Fruit and Vegetable Consumption: Food Choices of African Americans compared to other racial/ethnic U.S. populations using NHANES 2003-2006 Dietary Survey Data**

## **Introduction**

Fruit and vegetable consumption continues to be an area of focus for nutrition, health, and consumer research. Eating adequate amounts of fruits and vegetables is associated with managing weight and reducing the risk of chronic diseases including cancer, diabetes, hypertension, and cardiovascular disease (Hung 2004; Rolls, 2004; Bazzano et al. 2002; Ford and Mokdad 2001). Research studies have shown that Americans are not consuming at least 4 ½ cups of fruit and vegetables on a daily basis (Dong and Lin 2009; Stark-Casagrande et al. 2007; Guenther et al. 2006). More specifically, fruit and vegetable consumption rates vary across segments of the U.S. population depending on several socio-demographics (Lin et al. 2004; Kant et al. 2007). For example, Lin et al. (2004) reported that children eat more apples than middle-age adults; women 40 years and older consume more spinach than teenage girls; and African Americans are the primary consumers of sweet potatoes.

Food choices and intake behaviors also are influenced by social and environmental factors, including income, education, gender, age, and race/ethnicity (Deshmukh-Taskar et al. 2007; Storey et al. 2006; James 2004). Furthermore, cultural differences in dietary habits have been shown for fruit and vegetable consumption in the U.S. (Kant et al. 2007; Lin et al. 2004). African Americans, who have greater incidences of chronic diseases (Hajjar and Kotchen 2003; Ghafoor et al. 2002), consume fewer fruits and vegetables compared with their White and Hispanic counterparts (Devine et al. 1999). Research studies involving African Americans have shown that their fruit and vegetable consumption practices may be affected by their childhood dietary behaviors (Haire-Joshu et al. 2004) in addition to cost, convenience, accessibility, availability

(Lucan et al. 2010, Yeh et al. 2008), nutrition and health awareness, and traditional diet and taste preferences (Moser et al. 2005; Yeh et al. 2008).

There are many ways to understand fruit and vegetable consumption patterns. One of the ways to fully understand these intake habits is to examine the intake behaviors from a cultural perspective (Kittler and Sucher 2007). Previous studies examining fruit and vegetable consumption among different race and ethnic populations focused on the number of servings, energy intake, nutrient intake, and diet proportions in terms of food groups (Stark-Casagrande et al. 2007; Serdula et al. 2004; Stables et al. 2002). There is limited published research on the types of fruits and vegetables consumed and the proportion of Americans by race and ethnicity eating these food items (Kant et al. 2007; Patterson et al. 1995). Information regarding the specific type of fruits and vegetables consumed among certain racial and ethnic groups not only needs updating but more focus on frequency values to further emphasize what is commonly eaten and what is not eaten. This type of research on specific food consumption patterns can help diet and health educators, counselors, consumer researchers, and food product developers craft education materials and food items tailored for various cultural groups.

The objective of this study was to examine the types of fruit and vegetables consumed based on race and ethnicity, age and gender using 24-hour recall dietary data from survey years 2003-2006 of the National Health and Nutrition Examination Survey (NHANES).

## Materials and Methods

### *Data Source/Sample Population*

The 2003-2004 and 2005-2006 NHANES 24-hour dietary recall data, known as *What We Eat In America* (WWEIA), were used for analysis of fruit and vegetable consumption. Two nonconsecutive days of 24-hour dietary recall and demographic information were analyzed to assess consumption patterns of participants who: 1) were at least two years of age, 2) having complete and satisfactory dietary recall data, and 3) were members of a selected ethnic group. From the entire two years of the respondent data, the sample size for this research study was 17, 885. The racial/ethnic, age, and gender characteristics of the sample are described in Table 3.1.

Individual Foods Files (IFF), containing foods coded for each individual, were accessed via the NHANES website to use for fruit and vegetable consumption comparison analysis. There were food files for each of the two recall days for each survey year, 2003-2004 and 2005-2006. Each food item in the IFF documents was coded with an 8-digit code. This code corresponded to codes and food descriptions in the USDA Food and Nutrient Database for Dietary Studies (FNDDS), which classifies food items by food groups and subgroups (CDC 2006, 2008). These food codes were used to identify fruit and vegetable food items used in the data analysis. For each food item, all consumption forms (i.e. raw, frozen, canned, cooked, etc.) were combined to represent the food item. A total of 1,351 food codes (340 codes for fruits; 172 green/leafy vegetables; 858 codes for other vegetables; 86 for tomatoes) from the FNDDS database were combined in this study to determine consumption overall or individually by food type.

In the case of mixed fruit or vegetable dishes, if the food description had the main ingredient and/or the phrase “with,” the food item was classified with the main ingredient for the count analysis. Initially, fruit and vegetables were selected, based the on researchers’ knowledge, where there would be potential differences in consumption rates among the three ethnic groups. In the vegetable category analysis, potato and starchy, protein rich bean items were excluded in an effort to focus on nutrient driven vegetables.

## *Data Analysis*

Given that the purpose of the research was to study foods consumed rather than nutrients consumed, the study used reports of population consumption frequency (any fruit or vegetable product or a particular given product consumed during either of the two recall reporting days constitutes "consumption" of the food category or that particular food for that individual) unlike most nutrition research, which focused on mean serving, nutrient, and energy intakes to understand consumption patterns of foods across race/ethnic groups and age and gender subgroups (Bachman et al. 2008; Beydoun et al. 2008; Cleveland et al. 2000; ). For the purpose of this research, consumption frequency refers to the proportion of a sample who reported eating a food group or item.

Because every possible fruit and vegetable product could not be evaluated, food items were selected if any of the following were true: commonly eaten, thought by the researchers to potentially show consumption differences or similarities, and listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007). All fruits and vegetables, except for dessert type items, in FNDDS listing were included for the total category count. To examine specific fruits and vegetables, a total of 21 fruits and 40 vegetables were analyzed for consumption frequency by race and ethnicity.

For the purpose of statistical analysis, dietary recall and demographic data were pooled over the two non-consecutive days and two survey years (2003-2004; 2005-2006). A Pearson's chi-square test was used to determine if there were significant differences between the proportions of "consumers" and "non-consumers" of identified food items for each racial/ethnic category, using the FREQ procedure in SAS® 9.2 (SAS Institute Inc., 2008). A significant difference was determined at 0.05 alpha level.

After reviewing the consumption rates across food items, foods with greatest percentages across racial/ethnic groups and those that appeared to have distinct race and ethnic differences were analyzed to further descriptively examine race by gender and race by age food intake patterns.

## **Results and Discussion**

### ***General***

Consistent with previous studies using NHANES/ CSFII data from 1971 to 2002, fruit and vegetable intake still continued to not meet recommended dietary guidelines (Tables 3.2 & 3.3), especially for African Americans (Dong and Lin 2009; Kant et al. 2007; Stark Casagrande et al. 2007; Guenther et al. 2006). This current research demonstrated that of those studied nearly 40% did not consume any fruits and vegetables over the two-day survey period. Dong and Lin (2009), using 1999-2002 NHANES dietary recall data, reported fruit consumption averaging less than two cups per day and vegetable consumption only about one cup per day. This highlights the idea that despite large efforts of interventions and educational materials focused on increasing fruit and vegetable intake (i.e. 5-A-Day, MyPyramid, Fruit and Vegetable Program) and more selection and convenience options, there is a trend that still too few Americans are eating sufficient amounts of fruits and vegetables. Essential vitamins, minerals, and fiber needed to protect and maintain body systems; reduce cancer risk, heart disease, type-2 diabetes, and weight management are not reaching recommend levels (Bazzano et al. 2002; Joshipura et al. 2001).

Overall, from this research, African Americans consumed fewer fruits and vegetables within the two-day survey period as compared with Whites and Hispanics. Previous research has suggested that cost, availability, accessibility, childhood preferences, convenience, and even shelf-life impact fruit consumption (Yeh et al. 2008; Haire-Joshu et al. 2004; Guthrie 2004). Moreover, individual characteristics and cultural elements (i.e. traditional diet, use and preparation of food, frequency and timing of meals) influence African American fruit and vegetable dietary habits (Weatherspoon et al. 2010; Kittler and Suchner 1998). Robinson (2008) emphasized the need to consider African Americans' culture among other factors in the development of dietary counseling and intervention programs, especially for fruit and vegetable intake. Diet and health intervention programs, such as the Eat for Life program, consider the influence of religion in African American culture. Thus, such programs have used church settings as part of their strategy to increase fruit and vegetable intake (Resnicow et al. 2001). The

current data can help expand the efforts of dietary literature and intervention programs by helping to identify fruits and vegetables that can be emphasized when communicating and working with specific racial and ethnic groups.

Also, this research showed that children consumed more fruits than vegetables. Taste preferences for sweet (as in fruit) rather than bitter (as in vegetables containing bitter phytochemicals) may be the driving factor in children's consumption of fruits (Drewnowski 1997).

### ***Fruit Consumption***

Reports of fruit consumption were less than 70% across the sample populations (Table 3.2). Only 57% of the African American respondents indicated they ate a fruit over the non-consecutive two-day survey period. More than 60% of both the White and Hispanic populations reported eating fruits.

Given the large sample size, there were significant differences ( $p < 0.05$ ) in reports of all fruit items analyzed except for pineapples, coconuts, and citrus items such as tangerines.

This data showed minimal consumption of tropical fruits including papaya, kiwi, and apricot. Although values for mango and avocado across the ethnic populations were less than 10%, more Hispanics reported consuming mango and avocado based foods compared with African Americans and Whites over the survey days. Hispanic preferences for mangos and avocados can be attributed to the fact that these items are a part of their traditional diets (Kittler and Sucher 2007; Bartholomew et al. 1990). These results support the argument that individuals tend to select foods in which they are familiar (Yeh et al. 2008).

Consumption of berries had less than 10% frequency reports. However, within the berry category Whites consumed more than African Americans or Hispanics. Berries are sold frozen and this consumption option demonstrates an opportunity to promote increased berry intake by marketing the convenience of frozen fruit (Pollack 2001).



### **Race/Ethnicity by gender and age comparisons**

Apple, banana, and orange based items were the most commonly consumed fruits across the racial and ethnic groups. Patterson et al. (1995) reported similar findings for apples and oranges. Convenience and cost impact fruit consumption. Bananas, apples, and oranges are convenient, easy to eat, healthy, and relatively inexpensive (Pollack 2001). Similar results for banana and orange items have been reported. Johnston et al. (2000) also identified bananas and orange juice as commonly consumed fruit items among adults in the examination of 24-hour recall data from the 1994-1996 CSFII data. Therefore, these top consumed items and all fruit ratios were further examined for race by gender and race by age consumption rates.

A higher percentage of females reported eating fruit compared with males (Figure 3.1). This is consistent with previous studies that have reported that women consume more servings of fruits than men (Deshmukh-Taskar et al. 2007; Patterson et al. 1995). Banana and orange intake trends were similar for White and African American male and female subgroups. African Americans, regardless of gender, reported consuming fewer banana items (< 15%) as compared with other racial and ethnic groups. NHANES dietary recall data from 1971-2002 demonstrated that African Americans had low intakes of potassium and calcium, key nutrients in bananas and oranges (Kant et al. 2007). Interestingly, fruit mixtures or salads were consumed more by African Americans than the other racial/ethnic groups. Hispanics tended to consume more apples and oranges as compared with the other sample populations within the survey time period. Pollack et al. (2003) reported orange product consumption as being greatest in Hispanics, with males and females consuming similar amounts.

Fruit consumption notably decreased from childhood ages (2-17 years) to young adult (18-29 years), and gradually increased from 30 years to 66+ years (Figure 3.2). More often than not, children prefer sweet tasting and familiar foods; whereas sweet preferences decrease with age (Mennella et al. 2005; Drewnowski 1997). Children, across racial/ethnic groups, ate more of apples, bananas, and orange items than adults, albeit less than 40% of children reported consuming these fruits. Research conducted by Perez et al. (2001) corroborates these findings indicating that fresh apple consumption is greatest in children and older adults. Adults (66+ years) had a tendency to consume more

fruits compared to adults 18-65 years. Senior Americans tend to focus more on improving and maintaining their health through diet (Perez et al. 2001).

### ***Vegetable Consumption***

In the two-day survey period, more than 60% of the participants reported eating vegetables (Table 3.2). Across ethnic groups, the most consumed vegetables were green or yellow beans, cucumbers, lettuce, carrot, and tomato- based items. Considering reports for all vegetables, women consumed more vegetables than men (Figure 3.3). Children tended to eat fewer vegetables than adults 30 years and older (Figure 3.4). Americans tend to consume more vegetables than fruits (Johnston et al. 2000; Patterson et al. 1995).

There were significant differences ( $p < 0.05$ ) in reports of all analyzed vegetable items except for garlic and tomato with other vegetable mixtures.

### **Race/Ethnicity by gender and age comparisons**

#### **Green and Leafy vegetables**

Whites consumed more dark green and leafy vegetables such as broccoli, cabbage, celery, and spinach than African Americans and Hispanics. There were low intakes of nutrient and antioxidant rich green vegetables including artichoke, asparagus, Brussels sprouts, and kale. However, these particular vegetables are bitter and disliked. Research on sweetness, bitterness, and intake of vegetables, demonstrated that bitterness was a predictor of preference: the less bitter a vegetable, the more it is preferred (Dinehart et al. 2006). Johnston et al. (2000), research based on 1994-1996 CSFII recall data, suggested that less than “one in five Americans” ate these cruciferous type vegetables. Cucumbers, lettuce and green or yellow beans were the most reported items during the two day reporting period. Hence, further examination of interactions of race by gender and age was conducted for these frequently consumed green or leafy vegetables.

In this research, Africans-Americans tended to consume more greens and green or yellow beans compared to other racial and ethnic groups. A total of 7% of African American respondents ate greens (collard, mustard, or turnip) on one of the two days

surveyed. Conversely, less than 1% of Whites or Hispanics reported eating greens. African American adults, 30 and older, ate greens more than children or young adults (18-29 years). Greens tend to have a bitter taste; therefore more than likely preferred less by children. The intake pattern of greens is a reflection that this vegetable is a core item in the African American diet (Weatherspoon et al. 2010).

Adults tended to eat more cucumber and lettuce-based items than children. Based on 24-hour recall data, Johnston et al. (2000) showed that 40% of adult Americans ate iceberg lettuce within the survey period. Furthermore, the current research demonstrates that adults 30-65 years old tend to consume more lettuce (i.e. salads) than other age groups. This group of adults probably consumes most of their vegetables away from home, and more than likely in the form of a salad. Patterson et al. (1990) reported that even among adults consuming one serving of vegetables, salad was the most frequently eaten vegetable compared with other vegetables. Hispanics tended not to eat green or yellow beans and cucumber vegetables, considering that these items are not typical vegetables in their diets (Kittler and Sucher 2007).

### **Other vegetables**

The other vegetable category included red, orange, yellow, and green pepper food items (Table 3.2). Tomato based items were consumed the most, consistent with existing data (Pollack 2001). Within this analysis category, carrots, corn, and onions were the most consumed items. There were few reports of eggplant, winter squash, and garlic consumption during the survey period. With less than 10% of the population reporting consumption, Whites ate more beets, cauliflower, summer squash, mushrooms, and peppers (green, red, or yellow) than African Americans or Hispanics. Specialty peppers such as Serrano, Chile, or banana were largely consumed by Hispanics. This builds on existing research showing there is a difference in the variety of vegetables consumed by a racial/ethnic group (Lin et al. 2004).

Carrots were consumed mostly by Whites, especially females (Figure 3.5). This vegetable is popular among the U.S. population, and consumption increases with age. This research echoes carrot intake patterns reported by Lucier and Lin (2007). African Americans, especially between ages 2-29, consumed fewer carrot items than their

racial/ethnic counterparts (Figure 3.6). Also, African Americans consumed the most sweet potato items- albeit the overall proportion of reports was below 10%. Sweet potatoes are notable foods of the African American diet (*soul food*), and this research supports the idea that dietary intake of culture based items can be an “expression of ethnic identity” (Kittler and Sucher 2007). However, low intake of vegetable sources rich in vitamin A and potassium by African Americans in this research is comparable to other reports (Kant et al. 2007; USDA 2005).

Tomato consumption accounted for more than 40% of all vegetable intakes. Hispanics, especially 30-49 year olds, reported the greatest consumption of tomato products. The proportion of African Americans eating tomatoes decreased with age. Within the tomato category, catsup, salsa, and general tomatoes were consumed most frequently (Table 3.3). Men consumed more of these tomato products compared with women (Figure 3.7). Catsup consumption decreased as age increased (Figure 3.8). Hispanics, especially 30-49 year olds, ate more salsa than African Americans and Whites. This demonstrates that salsa, a traditional Mexican tomato dish, consumption rate is dependent on race/ethnicity (Early and Brzezinski 2010). Tomatoes in general were consumed considerably less by children. This research supports findings on trends in tomato consumption (Lucier et al. 2000).

## **Conclusions**

Dietary intake of fruit and vegetables continues to be influenced by race and ethnicity, age, and gender among other social, behavioral, and economic factors. An ongoing understanding of these factors is needed to develop innovative ways to promote fruit and vegetable consumption.

This research demonstrates that the types of fruits and vegetables consumed by racial and ethnic populations, and age or gender subgroups are inherently different. African Americans’ fruit and vegetable consumption trends are distinct, and intake rates are low. This research serves as a current baseline for future research exploring relationship of dietary intake and race and ethnicity. Given that African Americans have higher incidences of chronic diseases, there is a need to continue to develop culturally

sensitive dietary counseling and intervention programs. Furthermore, this study highlights areas of opportunities to expand research involving African Americans from a sensory, business and promotional perspective capitalizing on the diversity of food habits.

## **Research Implications**

### ***Fruit***

There is an ongoing need to increase fruit consumption across different racial/ethnic, gender, and age segments of the US population. Nutrition and health professionals as well as food producers can use the current research to identify specific market segments and fruit items to use in strategic plans to encourage fruit consumption. For example, nutrition and health professionals can promote the consumption of fruit among African Americans by recommending fruit mixtures, apples, and oranges as options versus bananas. Fruit mixtures or salads are particularly useful consumption forms especially when introducing less consumed healthy foods such as berries and melons as part of one's diet. Nutrition educators can use these data to support research and promotional efforts to increase fruit consumption among males. This research is a resource for finding the type of fruits to incorporate into educational materials when working with certain racial/ethnic groups. For example, educational materials on fruit consumption for a Hispanic audience should include avocado, mango, and papaya fruit products as these items were shown to be consumed by this ethnic group.

Fruit producers and manufacturers can use this information as a baseline to identify market gaps and develop research plans to expand or focus on niche markets. For example, if a banana producer is seeking to increase banana consumption, this data demonstrates that there may be market opportunities among 2-29 year olds. The fruit producer can direct research efforts to further understand the reasons for banana consumption or not among individuals younger than age 30, and use the research to promote or develop products to meet the preferences of this age group. The current research can serve as guideline for future fruit consumption behavioral research to understand the reason fruit consumption changes after childhood.

## ***Vegetables***

In an effort to increase African American vegetable consumption and reduce chronic disease risk, professionals can use these findings to identify which foods to recommend and further research consumption potential among these individuals. For example, nutrition researchers can investigate how greens are prepared and eaten among African Americans. It is thought that greens often are cooked with added fat (e.g. ham hocks) and seasoned with salt. If researchers find this is the case, they can recommend healthier preparation alternatives to support green leafy vegetable consumption while minimizing the consumption of fat and salt, contributors to obesity and hypertension. Researchers investigating food consumption behaviors can use this vegetable consumption data as a basis for future studies to understand the effect of economic, personal preferences, and sensory characteristics on consumption of specific vegetable items such as carrots, squash, and okra. Food scientists and manufacturers can explore ways to make vegetables such as beets, asparagus, and artichokes appealing and available.

This research demonstrates that there is a particular need to increase vegetable consumption among males. Nutrition educators can use this information to develop materials and programs for male audiences that communicate the importance of eating adequate vegetables. These educational materials can provide ideas of how to increase vegetable consumption using specific types of vegetables such as lettuce, tomatoes-salsa, corn, and cucumbers.

## **Limitations**

A limitation of this study is that the overall categories of fruit or vegetables were coded based on the USDA food nutrient database coding scheme, with dessert items excluded. If fruit or vegetable items were consumed but coded outside the fruit and vegetable categories by the USDA (e.g. vegetables as ingredients in a meat pie), then those items were not included in the study.

It also is important to acknowledge that race/ethnicity and food consumption is confounded with other socioeconomic, lifestyle, and agricultural variables: income, education, geographic residency, family structure, eating occasions, food consumption at

home or away from home, food accessibility, availability, seasonality, familiarity, and attitudes and perceptions regarding different fruit and vegetable foods. Although it is possible to evaluate some of those variables using NHANES data, the primary focus of the research was to assess consumption of specific fruit and vegetable products by major racial/ethnic groups. Thus it is probable that race/ethnicity alone is not the driving reason for different consumption patterns.

It is critical to note that the objective of this research was not to imply that different racial/ethnic groups are genetically pre-disposed or limited to eating specific fruits and vegetables. The purpose was to understand dietary intake patterns using race/ethnicity as a differentiating factor, and gender and age as additional groupings.

## Tables and Figures

**Table 3.1 Demographic characteristics of sample by race/ethnicity, age and gender from 2003-2004, 2005-2006 NHANES data**

n	African		
	American	Caucasian	Hispanic
	4994	7525	5366
<b>Age</b>			
2-17y	2465	2027	2683
18-29y	864	1159	976
30-49y	780	1522	843
50-65y	512	1142	456
66+ y	373	1675	408
<b>Gender</b>			
Males	2477	3668	2586
Females	2517	3857	2780
Sample Total, N= 17885			



**Table 3.2 Fruit Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

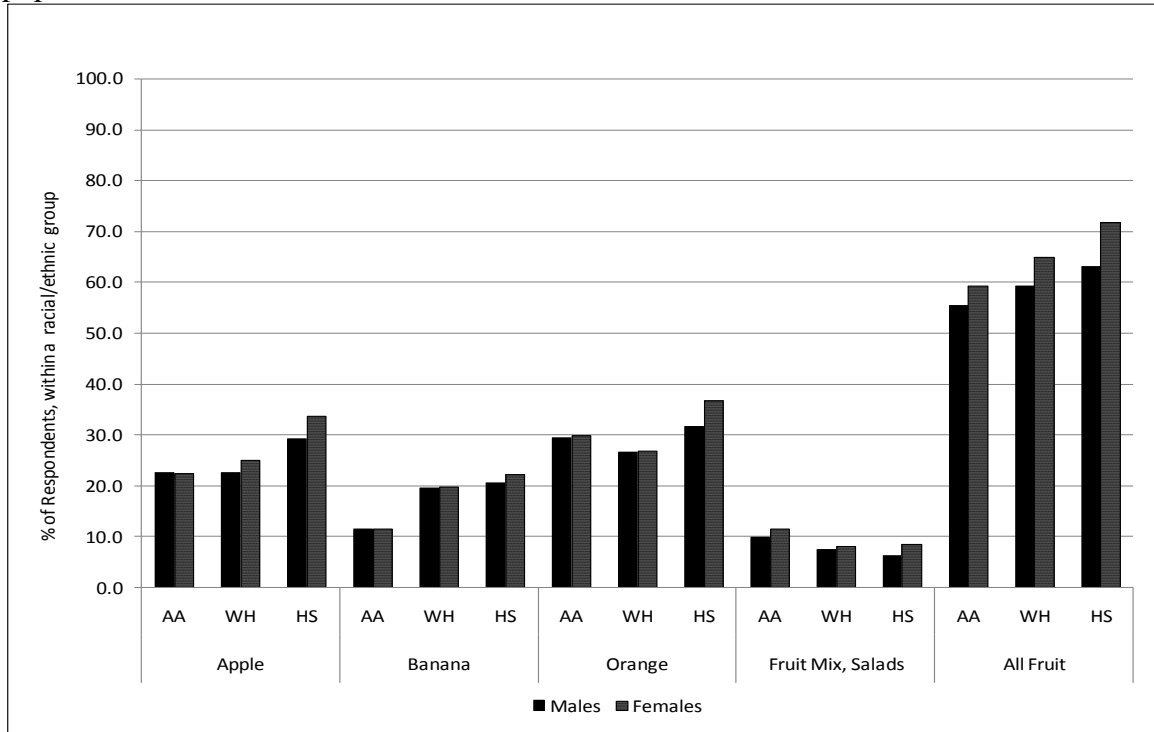
<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
All Fruits	57.3	± 0.7	62.2	± 0.6	67.6	± 0.6	<.0001
Apple	22.5	± 0.6	23.8	± 0.5	31.6	± 0.6	<.0001
Apricot	0.0	± 0.0	0.7	± 0.1	0.2	± 0.1	<.0001
Avocado	0.6	± 0.1	2.9	± 0.2	7.0	± 0.3	<.0001
Banana	11.5	± 0.5	19.7	± 0.5	21.4	± 0.6	<.0001
Berries (blue, black, raspberries)	1.0	± 0.1	4.7	± 0.2	0.8	± 0.1	<.0001
Cherries	0.6	± 0.1	1.5	± 0.1	0.5	± 0.1	<.0001
Citrus (i.e. tangerines)	1.3	± 0.2	2.0	± 0.2	1.5	± 0.2	0.0111
Coconut	0.2	± 0.1	0.2	± 0.1	0.2	± 0.1	0.7505
Fruit Mix, salads	10.7	± 0.4	7.8	± 0.3	7.3	± 0.4	<.0001
Grapefruit	1.1	± 0.1	1.9	± 0.2	0.9	± 0.1	<.0001
Grapes	10.8	± 0.4	12.1	± 0.4	8.8	± 0.4	<.0001
Kiwi	0.2	± 0.1	0.6	± 0.1	0.4	± 0.1	0.0022
Mango	0.7	± 0.1	0.6	± 0.1	4.1	± 0.3	<.0001
Melons	2.3	± 0.2	5.2	± 0.3	2.5	± 0.2	<.0001
Orange	29.6	± 0.6	26.8	± 0.5	34.3	± 0.6	<.0001
Papaya	0.1	± 0.1	0.1	± 0.0	0.9	± 0.1	<.0001
Peach	4.3	± 0.3	5.9	± 0.3	4.4	± 0.3	<.0001
Pear	1.9	± 0.2	3.5	± 0.2	3.7	± 0.3	<.0001
Pineapple	2.9	± 0.2	3.4	± 0.2	3.2	± 0.2	0.2283
Strawberry	2.7	± 0.2	6.8	± 0.3	3.7	± 0.3	<.0001
Watermelon	2.0	± 0.2	3.9	± 0.2	2.6	± 0.2	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

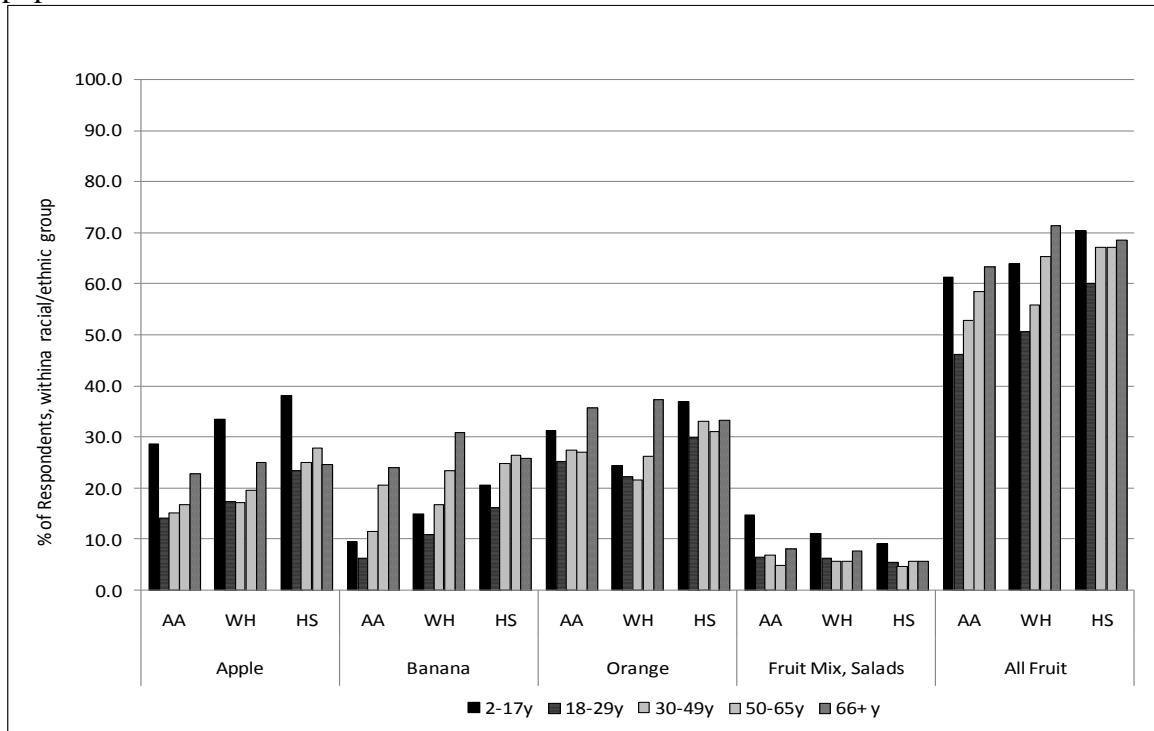
<sup>c</sup> P value for Pearson's chi-square test

**Figure 3.1 Fruit Consumption, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Fruits* and selected fruit items



AA= African American; WH= White; HS= Hispanic

**Figure 3.2 Fruit Consumption, Age by Race/Ethnicity:** Consumption percentages of populations for *All Fruits* and selected fruit items



AA= African American; WH= White; HS= Hispanic

**Table 3.3 Vegetable Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

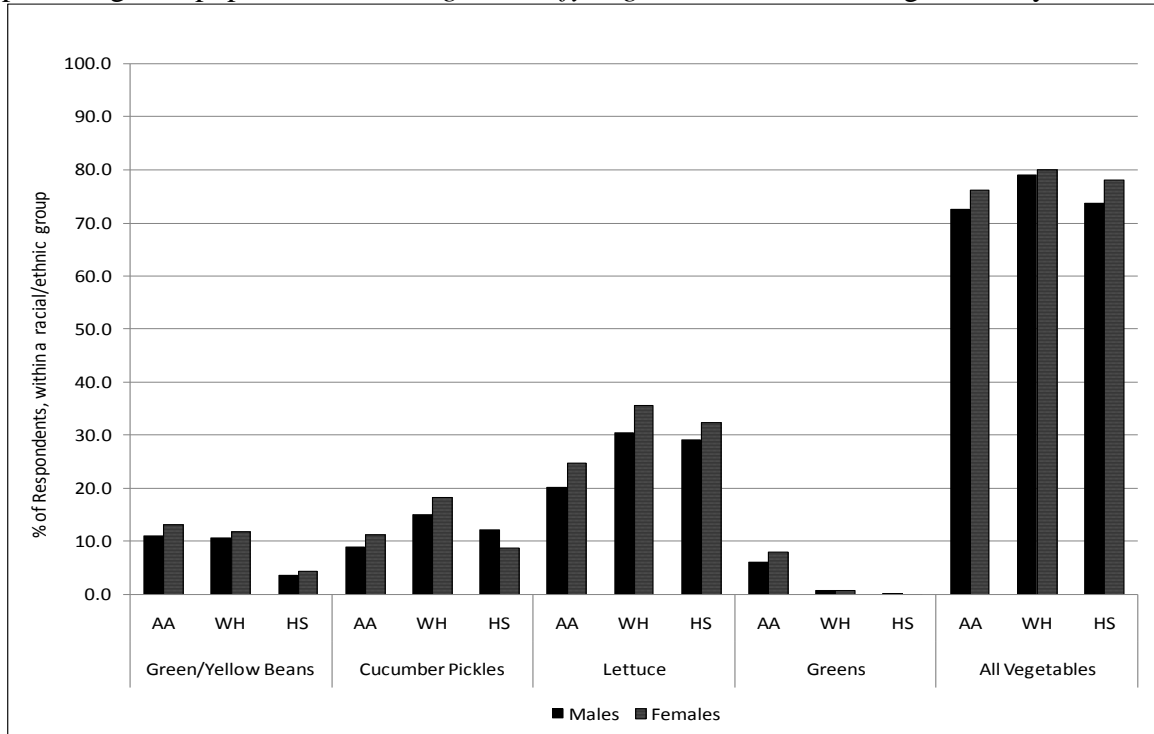
<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
All Vegetables	67.4	± 0.7	74.6	± 0.5	70.7	± 0.6	<.0001
<b><u>Green/Leafy Vegetables</u></b>							
Artichoke	0.0	± 0.0	0.5	± 0.1	0.1	± 0.0	<.0001
Asparagus	0.3	± 0.1	1.9	± 0.2	0.3	± 0.1	<.0001
Beans- green, yellow	12.0	± 0.5	11.2	± 0.4	4.0	± 0.3	<.0001
Broccoli	6.2	± 0.3	7.7	± 0.3	5.2	± 0.3	<.0001
Brussels Sprouts	0.1	± 0.0	0.3	± 0.1	0.1	± 0.0	0.0002
Cabbage- green, red	6.7	± 0.4	8.0	± 0.3	4.1	± 0.3	<.0001
Celery	1.1	± 0.1	4.0	± 0.2	1.5	± 0.2	<.0001
Coleslaw	2.5	± 0.2	4.1	± 0.2	0.8	± 0.1	<.0001
Cucumber, pickles	10.1	± 0.4	16.6	± 0.4	10.4	± 0.4	<.0001
Greens-collard, mustard, turnip	7.0	± 0.4	0.7	± 0.1	0.1	± 0.1	<.0001
Kale	0.3	± 0.1	0.1	± 0.0	0.0	± 0.0	0.0016
Lettuce	22.4	± 0.6	33.1	± 0.5	30.8	± 0.6	<.0001
Okra	0.8	± 0.1	0.5	± 0.1	0.1	± 0.0	<.0001
Peas, green	3.0	± 0.2	3.8	± 0.2	1.4	± 0.2	<.0001
Romaine, endive, chicory, escarole	1.0	± 0.1	3.6	± 0.2	1.4	± 0.2	<.0001
Sauerkraut	0.3	± 0.1	0.7	± 0.1	0.1	± 0.0	<.0001
<b><u>Other Vegetables</u></b>							
Beets	0.3	± 0.1	1.4	± 0.1	0.3	± 0.1	<.0001
Carrots	7.9	± 0.4	15.7	± 0.4	10.3	± 0.4	<.0001
Cauliflower	0.7	± 0.1	2.4	± 0.2	1.3	± 0.2	<.0001
Corn- white, yellow	10.7	± 0.4	11.3	± 0.4	7.7	± 0.4	<.0001
Eggplant	0.2	± 0.1	0.5	± 0.1	0.2	± 0.1	0.002
Garlic	0.2	± 0.1	0.2	± 0.1	0.2	± 0.1	0.7959
Mushrooms	0.7	± 0.1	3.9	± 0.2	1.0	± 0.1	<.0001
Onions- green, pearl, mature	9.2	± 0.4	16.4	± 0.4	14.1	± 0.5	<.0001
Peppers- green, red, yellow	3.8	± 0.3	6.9	± 0.3	2.9	± 0.2	<.0001
Peppers- banana, Serrano, chili	1.3	± 0.2	2.1	± 0.2	8.0	± 0.4	<.0001
Radish	0.4	± 0.1	1.9	± 0.2	1.6	± 0.2	<.0001
Squash- summer, green, yellow	0.7	± 0.1	3.0	± 0.2	1.6	± 0.2	<.0001
Squash- winter	0.1	± 0.1	0.5	± 0.1	0.1	± 0.0	0.0001
Sweet Potatoes	3.0	± 0.2	2.2	± 0.2	0.8	± 0.1	<.0001
Tomato	45.5	± 0.7	51.2	± 0.6	56.5	± 0.7	<.0001
Vegetable mixtures, soups	4.5	± 0.3	6.4	± 0.3	5.2	± 0.3	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

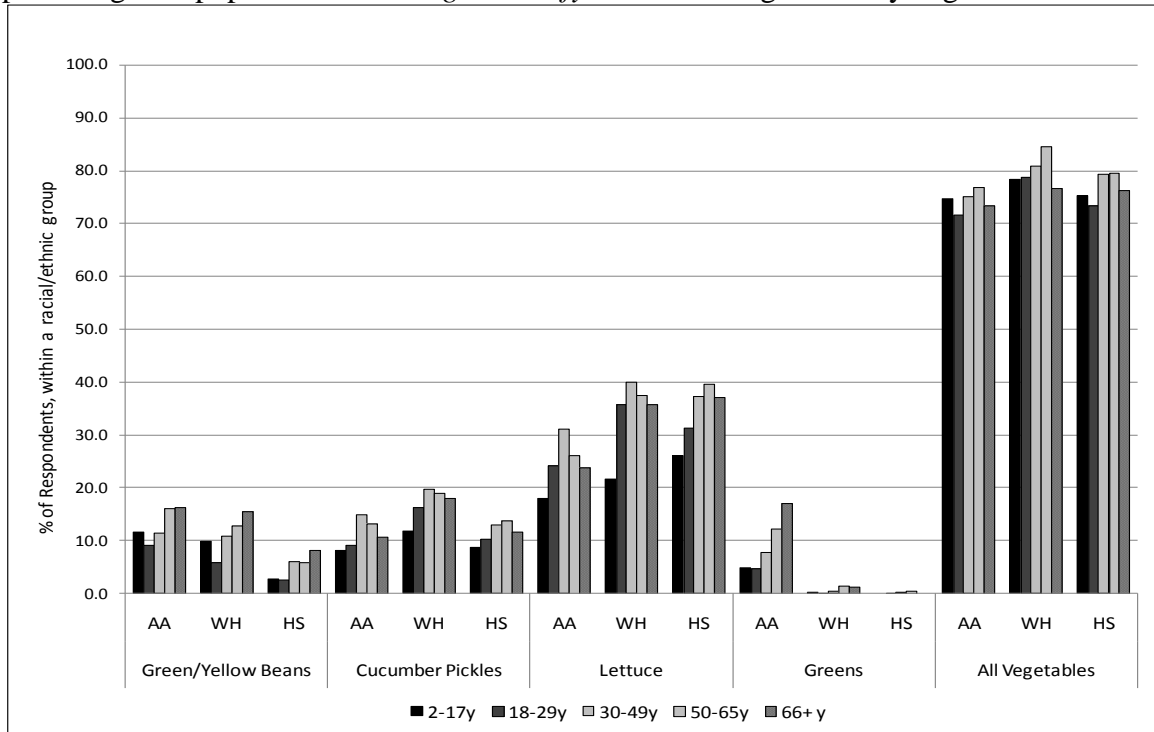
<sup>c</sup> P value for Pearson's chi-square test

**Figure 3.3 Green/ Leafy Vegetables, Gender by Race/Ethnicity:** Consumption percentages of populations for *All green/leafy vegetables* and selected green/leafy items



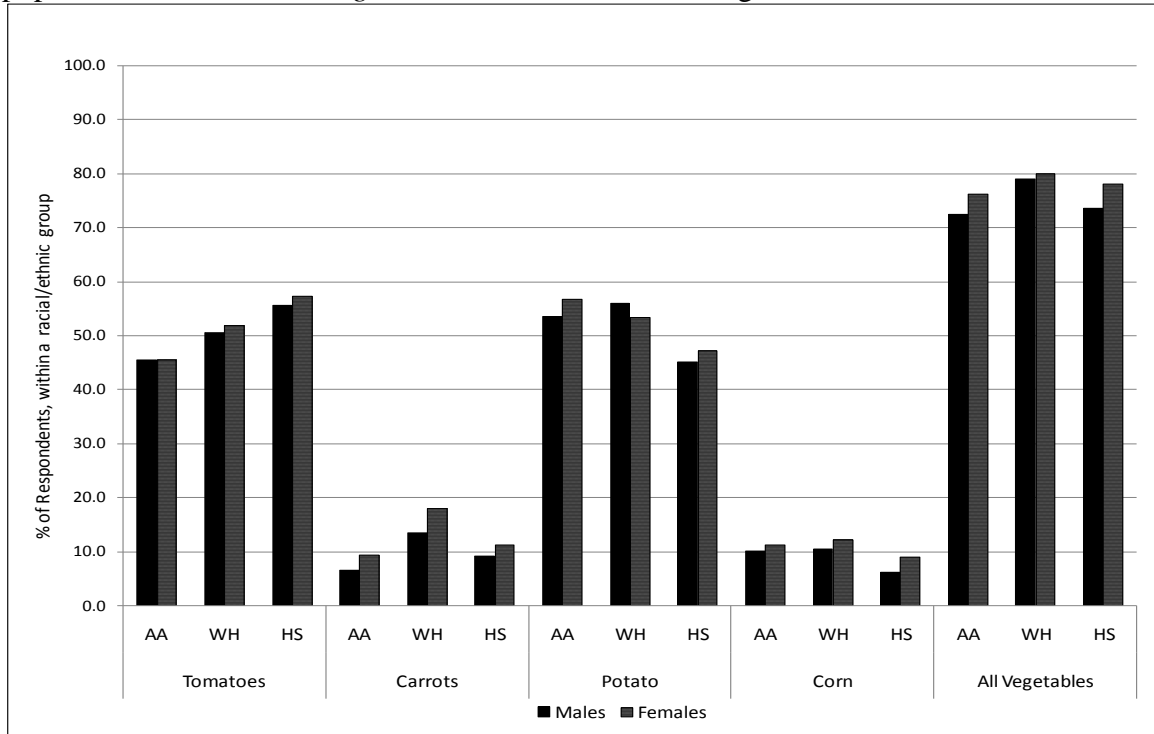
AA= African American; WH= White; HS= Hispanic

**Figure 3.4. Green/ Leafy Vegetables- Age by Race/Ethnicity:** Consumption percentages of populations for *All green/leafy* and selected green/leafy vegetable items



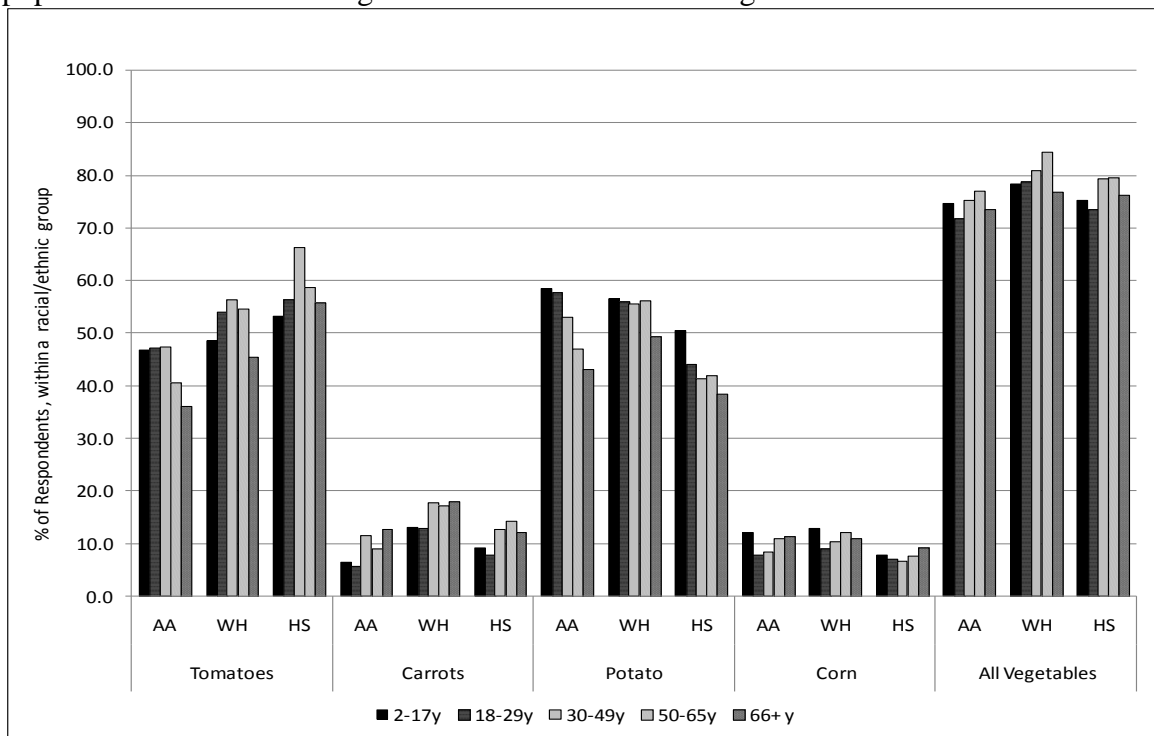
AA= African American; WH= White; HS= Hispanic

**Figure 3.5 Other Vegetables- Gender by Race/Ethnicity:** Consumption percentages of populations for *All other vegetables* and selected other vegetable items



AA= African American; WH= White; HS= Hispanic

**Figure 3.6 Other Vegetables- Age by Race/Ethnicity:** Consumption percentages of populations for *All other vegetables* and selected other vegetable items



AA= African American; WH= White; HS= Hispanic

**Table 3.4 Tomato Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

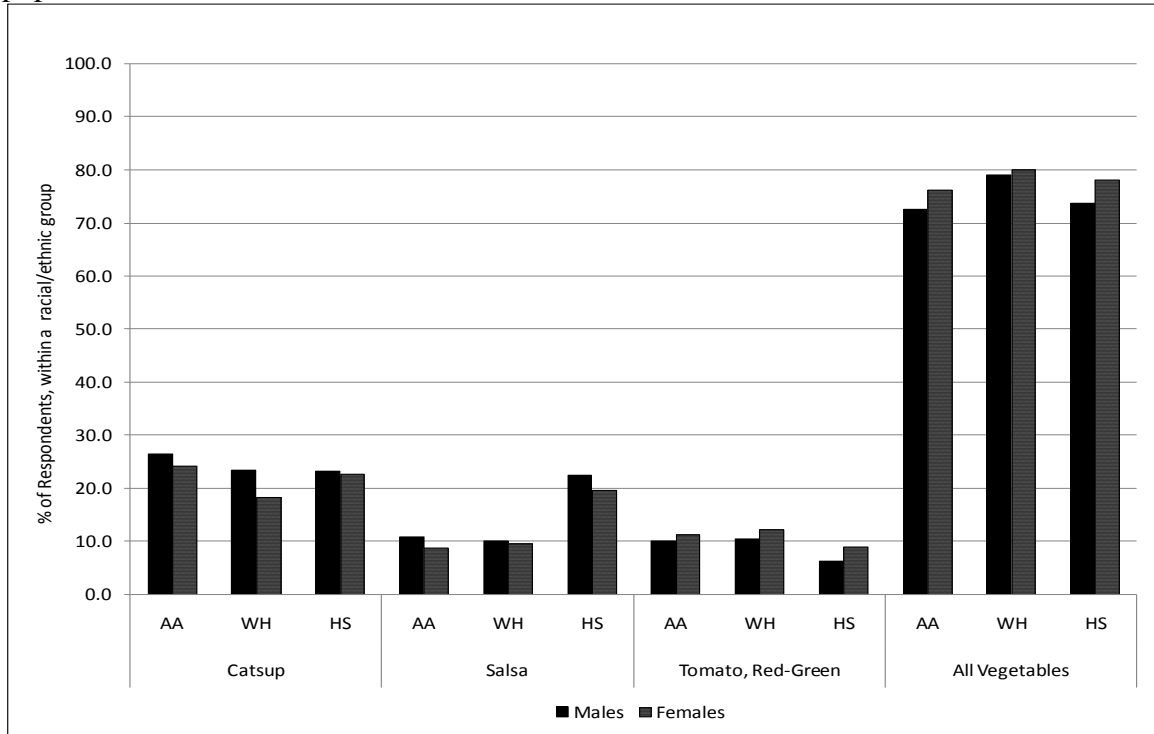
<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Catsup-tomato/chili based	0.4	± 0.1	0.5	± 0.1	0.6	± 0.1	<.0001
Juice, tomato	6.3	± 0.3	6.0	± 0.3	3.2	± 0.2	<.0001
Pasta Sauce	0.2	± 0.1	1.4	± 0.1	2.7	± 0.2	0.0022
Salsa	9.9	± 0.4	9.7	± 0.3	20.9	± 0.6	<.0001
Soup, tomato	1.6	± 0.2	2.4	± 0.2	2.5	± 0.2	<.0001
Steak, cocktail, BBQ sauce	0.4	± 0.1	2.2	± 0.2	0.7	± 0.1	<.0001
Tomato + other vegetables mix	25.4	± 0.6	20.8	± 0.5	22.9	± 0.6	0.3491
Tomato- red, green	45.5	± 0.7	51.2	± 0.6	56.5	± 0.7	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

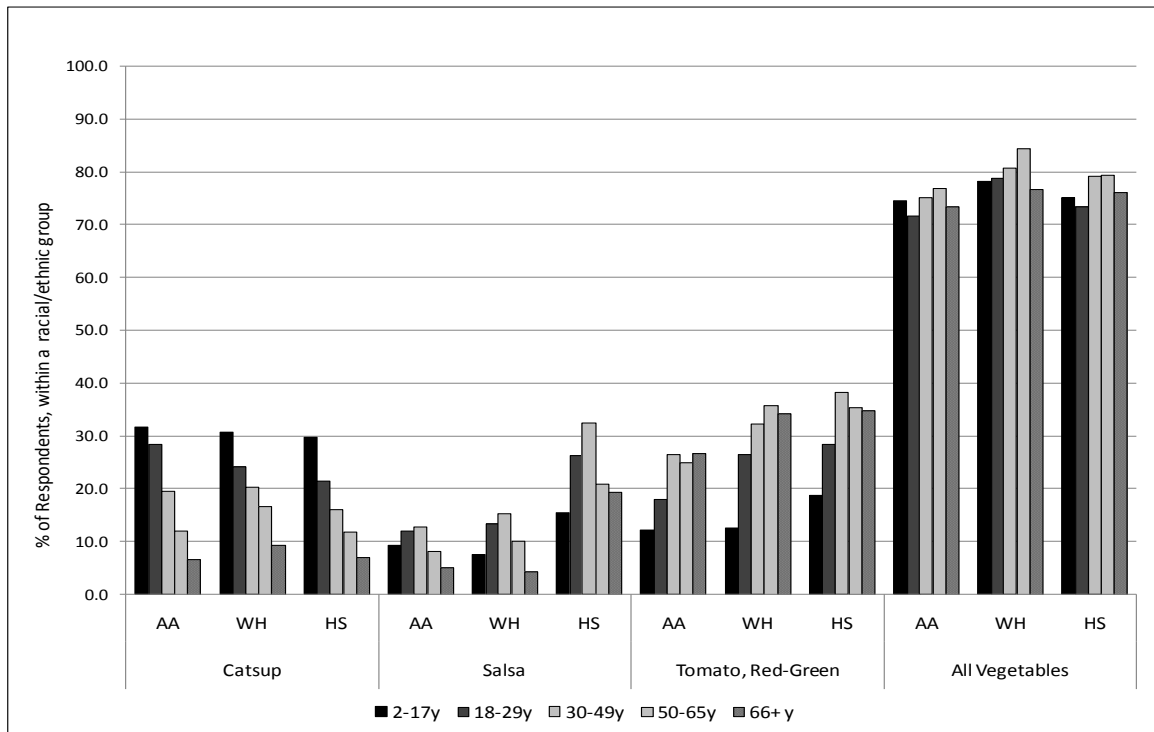
<sup>c</sup> P value for Pearson's chi-square test

**Figure 3.7 Tomato- Gender by Race/Ethnicity:** Consumption percentages of populations for selected tomato items



AA= African American; WH= White; HS= Hispanic

**Figure 3.8 Tomato- Age by Race/Ethnicity:** Consumption percentages of populations for selected tomato items



AA= African American; WH= White; HS= Hispanic

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# **CHAPTER 4 - Dairy Consumption: Trends of African Americans compared to other racial/ethnic U.S. populations using NHANES, 2003-2006, Dietary Survey Data**

## **Introduction**

The value of dairy foods in the American diet reaches well beyond the benefits of dental and bone health (ADA, 2010). Diets rich in dairy, particularly low-fat items, help reduce the risk of cardiovascular disease, some cancers, osteoporosis, type-2 diabetes, and obesity (Zemel et al. 2009; Beydoun et al. 2008; Wooten et al. 2004). These foods are major sources of essential nutrients including calcium, magnesium, phosphorus, and vitamins A and D (NDC 2010; Bowman 2009; Miller et al. 2007). Several of these vitamins and minerals are key factors in the regulation of blood pressure, bone maintenance, and weight (Wooten et al. 2004; Buchowski et al. 2002). Despite the health benefits of adequate dairy consumption, Americans consume an average of 1-2 cups of milk and milk products per day, less than the recommended three cups or more per day (Wells and Buzby 2008; USDHHS 2005). Among Americans whose dairy intakes are below dietary recommendations, African Americans have some of the lowest intakes of dairy products while also having the highest rates of hypertension, diabetes, and obesity (AHA 2010, Wells and Buzby 2008; Fulgoni et al. 2007; Hajjar and Kotchen 2003).

Several environmental, social and individual health factors, including personal food preferences, habits, and cultural practices, influence food choices (Wansink 2004; Conner and Armitage 2002). For dairy consumption, a primary factor is the lactose tolerance/intolerance status of the consumer or their perceptions of intolerance. The anxiety and gastrointestinal symptoms experienced after consuming dairy products serve as barriers to sufficient, if at all, consumption of milk and milk products, especially among African Americans (Wooten et al. 2004; Buchowski et al. 2002; Jackson and Savaiano 2001). Researchers recognize that minority populations tend to exhibit more symptoms of lactose intolerance than Whites, although prevalence estimates vary across research studies (NMA 2009; NDC 2008). It has been estimated that 75% of African

Americans are lactose intolerant or have symptoms of lactose intolerance (Byers and Savaiano 2005; Wooten et al. 2004). Interestingly, many individuals who report they are lactose intolerant have not been clinically diagnosed as being lactose intolerant and are able to consume dairy products with few digestive symptoms (NDC 2008; Buchowski et al. 2002). However, research evidence supports the notion that discomfort experienced after consuming dairy foods reaches beyond the physical ability to digest lactose and is related to cultural beliefs, attitudes, preferences, and practices of milk and milk product consumption (NDC 2008; Jarvis and Miller 2007). For example, Johnson and colleagues (1993) reported that one third of the African American women participants who were lactose intolerant reported some type of digestive discomfort both when they sampled milk with and without lactose. Similar findings have been reported in other research with African Americans (Buchowski et al. 2002). Whether real or perceived, lactose intolerance can be managed with portion control and the types of dairy products consumed, thereby minimizing the avoidance of milk and milk products and reducing the risk of chronic diseases, especially among minority populations (Jarvis and Miller 2007; Byers and Savaiano 2005; Wooten et al. 2004). Research exploring specific types of dairy products consumed by different race/ethnic populations will highlight dairy preferences and possible alternatives. Further research supporting previous studies on the consumption of various dairy products is needed to ensure adequate dairy intake regardless of lactose tolerance status.

National survey research reports, many based on 24-hour dietary recall information, have shown that there are racial and ethnic differences in dairy consumption patterns (Beydoun et al. 2008; Fulgoni et al. 2007; Robb et al. 2007; Storey et al. 2006; Ranganathan et al. 2005). For example, data from CSFII 1994-1998 and NHANES 1999-2000 indicated that African Americans consume less milk, cheese and yogurt products; and have lower intakes of calcium, phosphorous, and magnesium compared to other racial/ethnic groups (Fulgoni et al. 2007). Low consumption of dairy foods put this minority population at a high risk of low diet quality and chronic diseases (Bowman 2009; Basiotis et al. 1998). Although it is well established that racial/ethnic differences exist in dairy intake, it is important to identify specific types of dairy products consumed in order to further understand dairy consumption patterns across racial and ethnic

populations, and to form a foundation for culturally focused programs in order to elicit permanent dietary behavior changes.

The purpose of this research was to examine the types of dairy foods consumed based on race and ethnicity, age and gender using 24-hour recall dietary data from survey years 2003-2006 of the National Health and Nutrition Examination Survey (NHANES).

## Materials and Methods

### *Data Source/Sample Population*

The 2003-2006 NHANES 24-hour dietary recall data, known as *What We Eat In America* (WWEIA), were used for analysis of fruit and vegetable. Two non-consecutive days of 24-hr dietary recall and demographic information were analyzed to assess consumption patterns of participants who: 1) were at least two years of age, 2) had complete and satisfactory dietary recall data, and 3) were members of a selected ethnic group. The sample size was 17, 885 males and females: 4,994 African Americans (non-Hispanic); 7,525 Whites (non- Hispanic); and 5,366 Hispanics (Mexican American and other Hispanics)- (Table 4.1).

Individual Foods Files (IFF), containing foods coded for each individual, were accessed via the NHANES website to use for dairy consumption comparison analysis. There were food files for each of the two recall days of each survey year, 2003-2004 and 2005-2006. Each food item in the IFF documents was assigned an 8-digit code. This code corresponded to codes and food descriptions in the USDA Food and Nutrient Database for Dietary Studies (FNDDS), which classifies food items by food groups and subgroups (USDA, FNDDS 2006, 2008). These food codes were used to identify the specific dairy product items used in the data analysis. For each food item, all consumption forms (i.e. lactose free, reconstituted) were combined to represent the food item. A total of 568 food codes (421 codes for milk and milk products; 36 codes for cream; 111 codes for cheese) from the FNDDS database were combined in this study to determine consumption overall or individually by food type.

For yogurt items, frozen yogurt was excluded from the analysis because this product often is eaten as a dessert and varies tremendously from fresh yogurt. Initially, milk and milk products were selected based the on researchers' knowledge of where there would be potential differences in consumption rates among the three racial/ethnic groups.

## *Data Analysis*

Considering that the purpose of the research was to study foods consumed rather than nutrients consumed, the study utilizes reports of population consumption frequency (i.e. any dairy product or a particular given product consumed during either of the reporting days constitutes "consumption" of dairy or that particular food for that individual) unlike most nutrition research, which focused on mean serving, nutrient, and energy intakes to understand consumption patterns of dairy foods across race/ethnic groups and age and gender subgroups (Bachman et al. 2008; Beydoun et al. 2008; Fulgoni et al. 2007; Sebastain et al. 2006).

Since every possible dairy product could not be evaluated, food items were selected if any of the following were true: commonly eaten, thought by the researchers to potentially show consumption differences or similarities, and listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007). All dairy products, excluding dessert and sauces, in the FNDDS listing were included for the total category count. Three individual categories (fluid milk, cream, and cheese) were analyzed as a group prior to analysis of specific items within each group. To examine specific dairy foods, a total of 26 dairy foods were analyzed for consumption frequency by race/ethnicity.

For statistical analysis, dietary recall and demographic data were pooled over the two non-consecutive days and two survey years (2003-2004; 2005-2006). A Pearson's chi-square test was used to determine if there were significant differences between the proportions of "consumers" and "non-consumers" of identified food items for each racial/ethnic category, using the FREQ procedure in SAS® 9.2 (SAS Institute Inc., 2008). A significant difference was determined at 0.05 alpha level.

After reviewing the consumption rates across food items, foods with greatest percentages across racial/ethnic groups and those that appeared to have distinct race and ethnic differences were analyzed to further descriptively examine race by gender and race by age food intake patterns.



## Results and Discussion

### *General*

From the NHANES data studied in this research, 67-70% of participants reported consuming a dairy product on one of the two day reporting periods (Table 4.2). There were significant differences in racial/ethnic reports of consumption for all foods analyzed. This research along with other research studies demonstrated a trend that not all Americans are consuming dairy products and there are racial/ethnic differences in dairy food preferences (Wells and Buzby 2008; Deshmukh-Taskar et al. 2007; Ranganathan et al. 2005).

Based on this research analysis, cheese, milk, and milk products were the primary sources of dairy consumption, with at least 40% consumption in each racial/ethnic group. African Americans had the lowest consumption regardless of the type of dairy product. It has been well documented that African Americans are not large consumers of dairy foods with the milk and milk products consumed most by African Americans eaten as desserts, in mixed dishes, and as cheese (James 2009; Kant et al. 2007; Wooten et al. 2004; Kittler and Sucher 2007). Although overall yogurt and sour cream consumption was less than 10%, African Americans consumed these products at half the rate of Whites and Hispanics. Females had a tendency to consume cream and yogurt more than their male counterparts. Children, except among African Americans, reported eating yogurt more than adults. This probably is due to the convenience, many flavor options, and the fact yogurt is good source calcium and vitamin D, nutrients to needed to build bones during childhood. Given that lactose intolerance maybe a barrier to African American consumption of dairy products, this study emphasizes that yogurt consumption is low among this group of people and, therefore, there is potential for this to be an area to increase dairy consumption. Several studies and informational brochures have recommended that consumption of yogurt with active cultures as an option to increase dairy consumption while minimizing digestive discomfort, especially for persons with lactose intolerance (NDC 2010; Jarvis and Miller 2007; Wooten et al. 2004).

Overall, consumption of all dairy products was comparable among men and women (Figure 4.1). Within specific dairy items, women tended to consume more cream

and yogurt products than men. Hispanic women reported more consumption of fluid milk and cheese products compared to Hispanic men. However, overall the findings suggest that dairy consumption, in general, is not influenced by gender.

Milk and cheese were large contributors to the overall dairy consumption percentages. Therefore, specific milk and cheese items were further analyzed to examine the relationships of race by gender, race by age, and consumption proportions.

### ***Fluid Milk Consumption***

Fewer than 65% of respondents consumed fluid milk products during the survey period (Table 4.2). There was minimal consumption of condensed, evaporated, and buttermilk products. The proportion of respondents consuming soy milk, a "non-dairy" substitute included in this study, was less than 2%.

African Americans had the lowest consumption rate of milk items. These results agree with previous research citing that African Americans had low intakes of milk and, therefore, low intakes of calcium and other nutrients supplied by milk and milk products (Beydoun et al. 2008; Fulgoni et al. 2007; Storey et al. 2006). According to WWEIA nutrient intake tables for 2005-2006, an African American's average intake of calcium for a single day of dietary survey data was the least of all racial/ethnic groups. African Americans consumed approximately 200 fewer milligrams(mg) of calcium from food than Whites (USDA 2008b).

However, African Americans and Hispanics consumed more whole milk and chocolate milk products compared to Whites. Interestingly, as the fat content of the cow-based milk products decreased so did the frequency reports of consumption among African Americans and Hispanics. Conversely, Whites consumed more reduced fat and non-fat milks. Similar findings demonstrated that African Americans and Hispanics were more likely to consume high-fat milk options (Robb et al. 2007; Patterson et al. 1995). Specifically, Robb et al. (2007) reported that only 29% of African Americans, from CSFII 1994-1996,1998 survey data, were as likely as Whites to consume low-fat milk. These findings suggest that milk taste preferences vary by race and ethnicity. Also, this research shows that there is a need to encourage the consumption of reduced fat and non-

fat milks among African Americans as means of supporting the 2005 Dietary Guidelines, which recommend daily intakes of low-fat or fat-free dairy products (USDHHS 2005).

Of the small percentage of soy milk users, Whites consumed more soy milk products than African Americans and Hispanics. Research suggests that the choice of soy products is driven by taste preferences and health-benefit reasons (Wansink 2003). Although soy milk has been shown to be an effective part of weight reduction and blood pressure (Lukaszuk et al. 2007; Rivas et al. 2002), this research suggests that few Americans in major race/ethnic populations are consuming this product or taking advantage of nutritional and health benefits provided by soy milk. Dietary educators, counselors, researchers, and members of the food industry can use this analysis as a basis for future research and promotion of soy milk consumption among various racial/ethnic market segments.

### **Race/Ethnicity by gender and age comparisons**

Depending on race/ethnicity, males and females consumed various milks differently (Figure 4.3). White males tended to consume more whole milk and 2% milk products than White females. However the inverse was demonstrated between Hispanic males and females.

Regardless of race/ethnicity, whole milk, 2% milk and chocolate milk consumption declined after childhood ages 2-17 (Figure 4.4). Less than 50% of young adults reported consuming fluid milk. The consumption of milk declined from childhood ages (2-17 years) to young adult ages (18-29 years) and remained low among 30-65 year old African Americans and Whites. Similar associations between age and dairy intake have been shown (Larson et al. 2009; Fulgoni et al. 2007; Robb et al. 2007). As children age, milk beverages tend to be replaced with soft drinks and fruit drinks (Sebastian et al. 2009). Given the current study results, it is probable that one of the reasons fluid milk consumption declined after age 17 was because other beverage options were selected over milk. Skim milk consumption increased with age, especially among Whites. Patterson et al. (1995) research showed milk consumption differed by race/ethnicity and gender. Children and adults age 66 and older had the highest reports of fluid milk consumption in the two day survey period. Greater consumption levels of milk in

children and older adults probably is a reflection of the emphasis milk in congregate meal programs, such as school lunch and senior center meals, and on building and maintaining bones for growth and prevention of osteoporosis (NDC 2010; Wooten et al. 2004).

Consistent with overall results, African Americans 66 years and older consumed fewer dairy products compared to their White counterparts. Bowman (2009) reported that older adult Whites' average intakes of milk and milk products were more than twice that of older African Americans.

These results support the argument that milk consumption patterns vary by race/ethnicity, gender, and age. These factors should be considered in the development of culturally sensitive educational materials and food items aimed to positively change intake patterns of milk and other dairy foods.

### ***Cheese Consumption***

According to Table 4.3, cheddar/American and processed/imitation cheeses were consumed the most over the two day survey period, particularly among African Americans. It is a positive sign that African Americans, a high risk group for lactose intolerance, tend to consume natural, hard and processed cheeses, which are recommended as dairy alternatives because of their low lactose levels (NDC 2010b; Wooten et al. 2004). Although the proportion of respondents consuming other cheese items was less than 10 %, Whites tended to consume more of a variety of cheese products compared to their African American and Hispanic counterparts. Not surprisingly, Hispanic and Mexican cheese blends were consumed more by Hispanics than by both Whites and African Americans. This research evidence corroborates the arguments that there are cultural preferences in dairy food consumption and people tend to eat foods with which they recognize the most (Kittler and Sucher 2007).

Given that cheddar/American, processed/imitation, and mozzarella cheeses were largely consumed or recommended as a cheese alternatives for lactose intolerant individuals, additional analyses were used to explore race by gender or age consumption patterns.

### **Race/Ethnicity by gender and age comparisons**

The proportion of African American males and females consuming cheddar/American, processed/imitation, and mozzarella cheeses were similar (Figure 4.5). Hispanic and White females had greater reports of consumption of mozzarella cheese compared to their male counterparts. Hispanics, regardless of gender, consumed less cheddar/American and processed/imitations cheeses compared to African Americans and Whites.

Rates of consumption of the selected cheeses had a tendency to decrease with age (Figure 4.6). Adults 66 years and older across race/ethnicity groups were the lowest consumers of cheddar/American, processed/imitation, and mozzarella cheeses, with less than 15% consumption among this age group. This research demonstrates that cheese consumption may be shaped by age and gender factors and a focus on cheese consumption in older age could serve as one means of increasing nutrients in the diet.

### **Conclusions**

This research suggests that there are differences in the types of dairy products consumed by racial/ethnic populations as well as differences among age and gender subgroups. African Americans' low intake of dairy foods and trends for higher fat products are evident. The results of this study form the foundation for future research investigating the associations of race/ethnicity, age, and gender with dietary dairy consumption. Also, this study expands the knowledge base for research examining dietary intake patterns from food group/ type consumption perspectives using less traditional analytical methods to describe consumption patterns (James 2009; Newby et al. 2004).

In an effort to improve dietary and overall health, particularly for African Americans, there is a need for intervention strategies which encourage and enable dietary changes within cultural contexts. This research demonstrates that identifying specific dairy food items can be used to meet the needs and deficiencies of consumers within various race/ethnic groups or other market segments. Also, product improvements targeted to specific groups such as African Americans or various age groups may be

needed to enhance palatability of certain products. Furthermore, additional research is warranted to find innovative ways to effect permanent changes in dairy consumption behaviors.

## **Research Implications**

### ***Fluid Milk and Milk Products***

The research finding indicated that there are important and critical differences in the consumption patterns of milk across race/ethnicity. These patterns are important because they showed that African Americans consumed high fat milk products which have been shown to be related to obesity and other health problems such as high cholesterol. There is a need to create and promote low fat milk products that capture the same appeal as high fat products. In order to accomplish this, it would be necessary for food scientists and nutritionists to explore the taste preferences, reasons for selecting high fat products, and examine the strategies for modifying fat consumption in general.

In conjunction with the problematic behavior of an over consumption of high fat dairy products there is direct relationship to the low levels of yogurt consumption. While there are several positive health reasons to consume yogurt, there were low levels of yogurt consumption particularly for African Americans. Yogurt flavor, taste, and texture characteristics may be the reasons for low consumption. From a food scientist and manufacturer's perspectives, research is needed to improve the overall appearance, taste, and texture of yogurt so that it may have greater appeal to African Americans. Nutrition and health professionals must find creative measures to encourage individuals to try and subsequently to eat more yogurts. Furthermore, nutrition communities and the dairy industry can partner together to develop recipes and products that add appealing yogurt and low fat milk products to multicultural diets.

### ***Cheese***

Consuming cheese is an excellent dairy source for calcium and other minerals as well as an alternative to fluid milk for lactose intolerant individuals. The current investigation showed that few African Americans tend to consume cheese with the selections being cheddar/American or processed/imitation cheese, which should be

consumed in low amounts for better health. The consumption of a variety of hard and soft cheeses is limited. Nutritionists and cheese producers can use the research data to endorse the eating of more cheeses such as low-fat mozzarella, parmesan, and Swiss as alternatives to the high fat, processed cheeses that can increase the risk of cardiovascular disease and obesity. Cheese is versatile, convenient, and therefore a healthy snack option. This benefit should be emphasized to low cheese consumers. For example, nutrition educators can engage in campaigns targeted to African Americans and older adults that communicate how eating natural hard cheeses in appropriate portions is an option to managing lactose intolerance and reducing the risk of certain chronic diseases.

### **Limitations**

The overall categories of milk, milk products, and cheese were coded according to the USDA food coding schemes for the milk food group, excluding desserts. If milk and cheese products were reported for consumption but coded outside the milk and milk product category by the USDA (e.g. cheese toast), then those items were not included in the study.

The researcher acknowledges that race/ethnicity and food consumption is confounded with other socioeconomic, lifestyle, and agricultural variables: income, education, geographic residency, family structure, eating occasions, food consumption at home or away from home, food availability, familiarity, and attitudes and perceptions regarding different dairy foods. While it is possible to evaluate some of those variables using NHANES data, the main focus of the research was to evaluate the consumption of specific milk and cheese products by major racial/ethnic groups. Thus it is probable that race/ethnicity alone is not the driving reason for different consumption patterns.

Lastly, the objective of this research was not to imply that different racial/ethnic groups are genetically pre-disposed or limited to consuming certain milk and cheese products. The purpose was to examine dietary patterns intake using race/ethnicity as a differentiating factor, and gender and age as additional groupings.

## Tables and Figures

**Table 4.1 Demographic characteristics of sample by race/ethnicity, age and gender from 2003-2004, 2005-2006 NHANES data**

	<b>African American</b>	<b>Caucasian</b>	<b>Hispanic</b>
<b>n</b>	4994	7525	5366
<b>Age</b>			
2-17y	2465	2027	2683
18-29y	864	1159	976
30-49y	780	1522	843
50-65y	512	1142	456
66+ y	373	1675	408
<b>Gender</b>			
Males	2477	3668	2586
Females	2517	3857	2780
Sample Total, N= 17885			

**Table 4.2 Dairy Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
<b>Food Group/Item<sup>a</sup></b>							
All Dairy	67.1	± 0.7	78.1	± 0.5	76.6	± 0.6	<.0001
Milk+milk drink, fluid	48.3	± 0.7	61.4	± 0.6	64.4	± 0.7	<.0001
Cheese, all	39.2	± 0.7	52.7	± 0.6	46.5	± 0.7	<.0001
Cream, all	11.2	± 0.4	23.4	± 0.5	16.8	± 0.5	<.0001
Sour Cream	2.3	± 0.2	6.5	± 0.3	6.7	± 0.3	<.0001
Yogurt, except frozen	3.3	± 0.3	8.6	± 0.3	8.3	± 0.4	<.0001

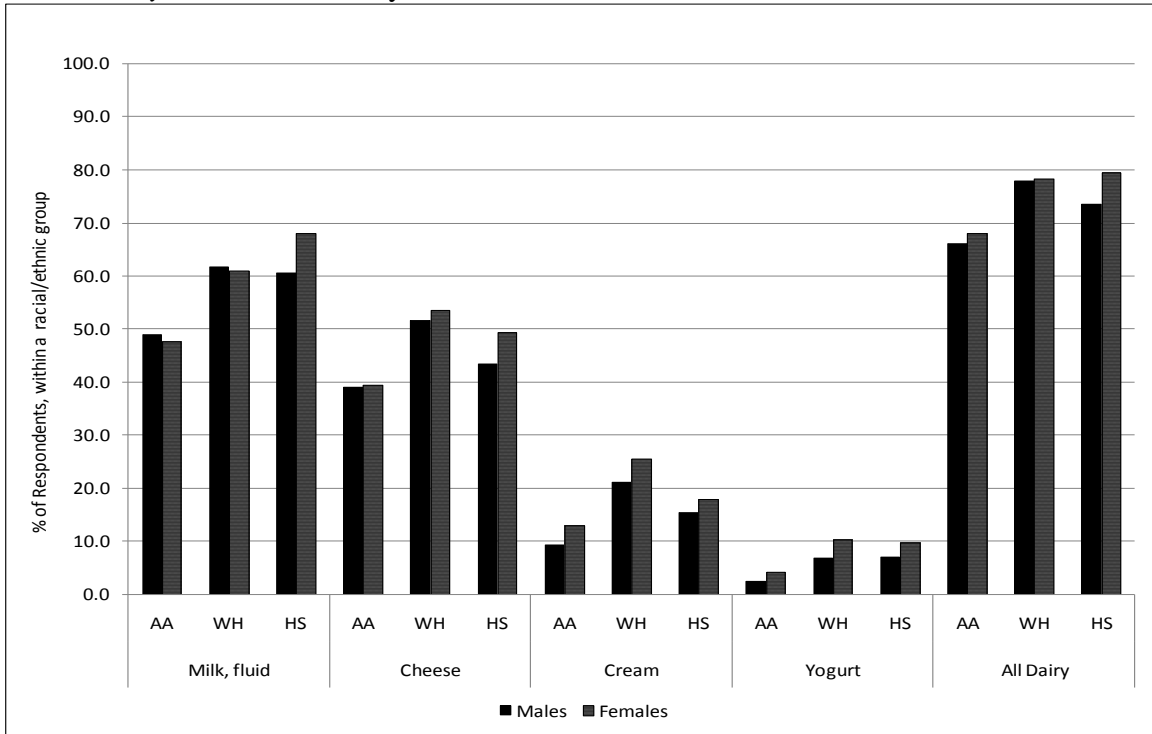
<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

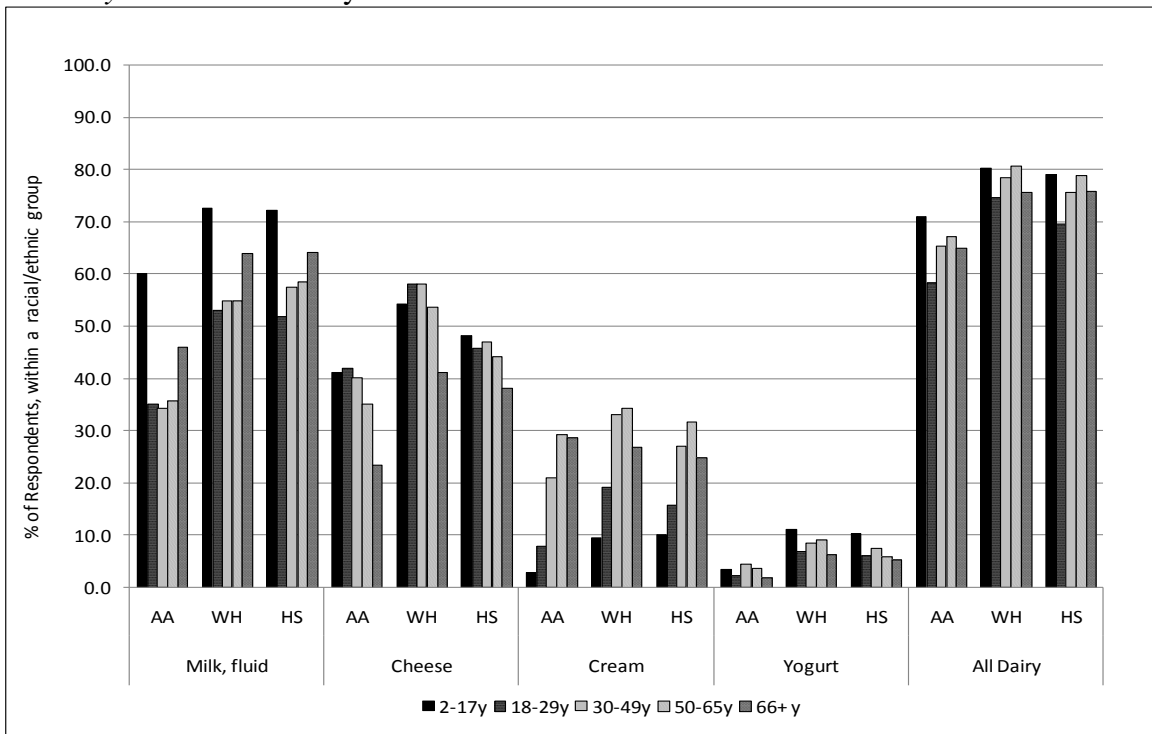


**Figure 4.1 Dairy, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Dairy* and selected dairy items



AA= African American; WH= White; HS= Hispanic

**Figure 4.2 Dairy, Age by Race/Ethnicity:** Consumption percentages of populations for *All Dairy* and selected dairy items



AA= African American; WH= White; HS= Hispanic

**Table 4.3 Fluid Milk Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Buttermilk	0.1	± 0.0	0.3	± 0.1	0.0	± 0.0	0.0065
Condensed milk	0.2	± 0.1	0.1	± 0.0	0.4	± 0.1	0.0009
Chocolate milk	7.3	± 0.4	5.3	± 0.3	8.8	± 0.4	<.0001
Whole, cow's milk	24.8	± 0.6	13.6	± 0.4	30.3	± 0.6	<.0001
2%, cow's milk	15.6	± 0.5	27.0	± 0.5	24.6	± 0.6	<.0001
1% cow's milk	3.5	± 0.3	10.0	± 0.3	7.3	± 0.4	<.0001
Skim, cow's milk	1.7	± 0.2	12.1	± 0.4	3.6	± 0.3	<.0001
Evaporated milk	1.1	± 0.1	0.3	± 0.1	0.4	± 0.1	<.0001
Soy milk	0.7	± 0.1	1.8	± 0.2	0.9	± 0.1	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

**Table 4.4 Cheese Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Blue/ Roquefort	0.1	± 0.0	0.8	± 0.1	0.0	± 0.0	<.0001
Cheddar, American	17.0	± 0.5	16.5	± 0.4	12.5	± 0.5	<.0001
Cheese- sauce,dip,soup	1.4	± 0.2	2.4	± 0.2	1.3	± 0.2	<.0001
Colby-Jack	0.5	± 0.1	1.4	± 0.1	0.7	± 0.1	<.0001
Cottage/ Ricotta	0.4	± 0.1	1.7	± 0.1	1.1	± 0.1	<.0001
Cream cheese	1.7	± 0.2	4.3	± 0.2	2.6	± 0.2	<.0001
Hispanic/ Mexican blends	0.2	± 0.1	0.6	± 0.1	9.9	± 0.4	<.0001
Monterey	0.2	± 0.1	1.2	± 0.1	2.7	± 0.2	<.0001
Mozzarella	2.4	± 0.2	5.3	± 0.3	6.7	± 0.3	<.0001
Muenster	0.2	± 0.1	0.5	± 0.1	0.5	± 0.1	0.0054
Parmesan	1.5	± 0.2	5.3	± 0.3	2.0	± 0.2	<.0001
Processed/ Imitation cheese	12.4	± 0.5	19.3	± 0.5	9.2	± 0.4	<.0001
Provolone	0.5	± 0.1	1.9	± 0.2	0.4	± 0.1	<.0001
Specialty cheeses <sup>d</sup>	0.3	± 0.1	1.9	± 0.2	0.7	± 0.1	<.0001
Swiss	2.3	± 0.2	4.7	± 0.2	1.7	± 0.2	<.0001

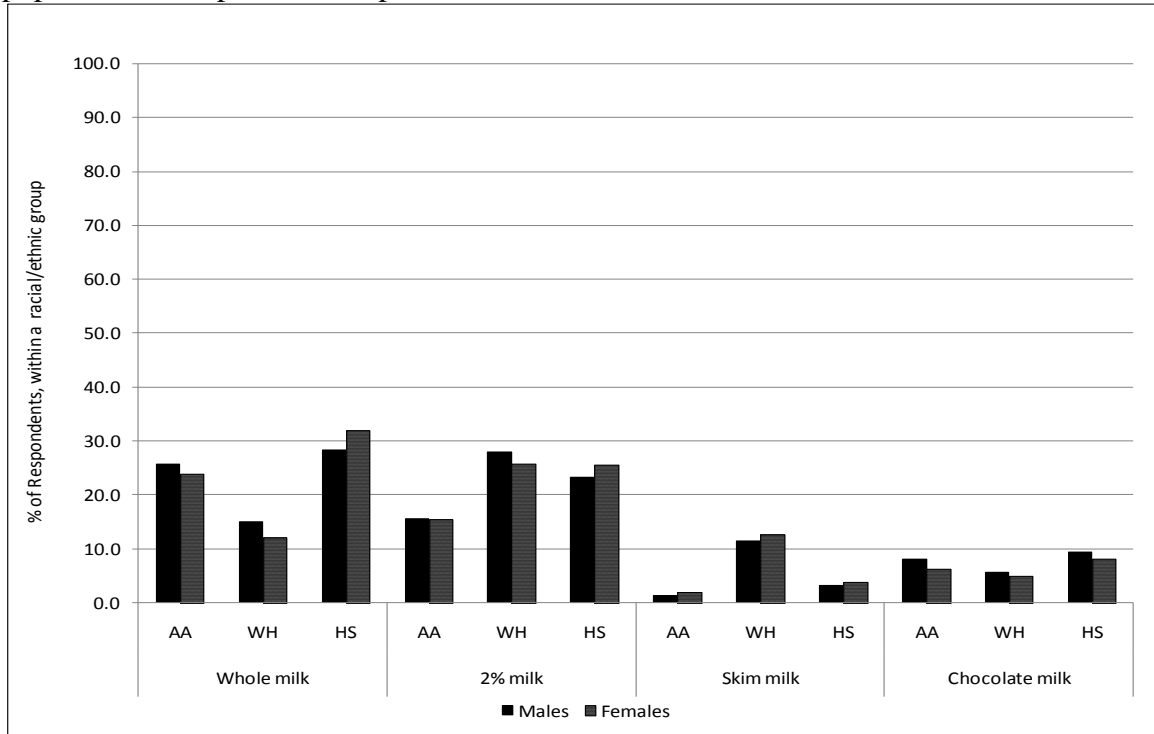
<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

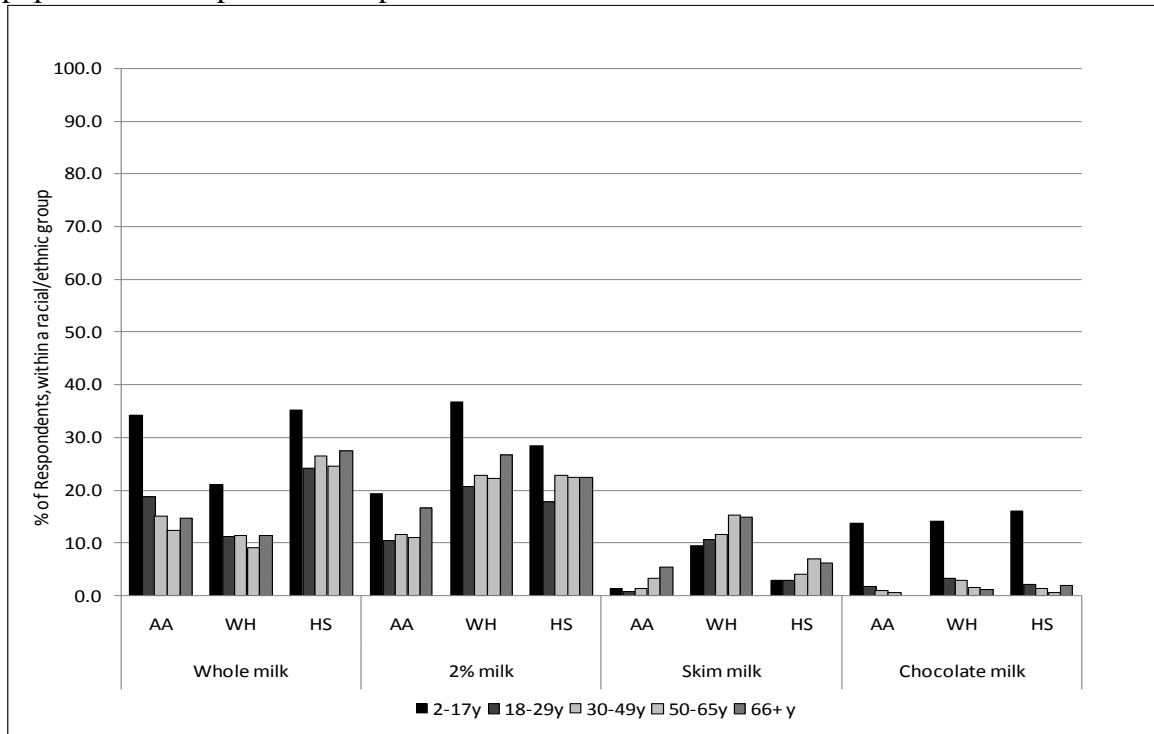
<sup>d</sup> Specialty cheeses - i.e. Gouda, Edam, brie

**Figure 4.3 Fluid Milk, Gender by Race/Ethnicity:** Consumption percentages of populations for specific milk products



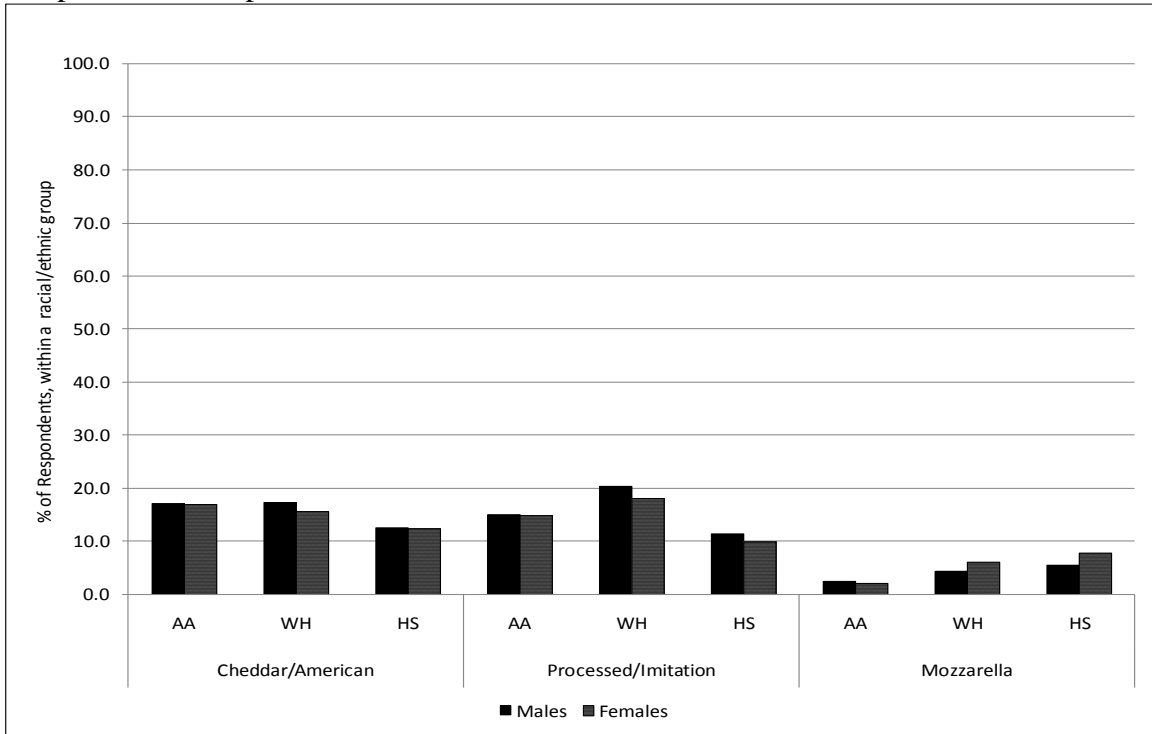
AA= African American; WH= White; HS= Hispanic

**Figure 4.4 Fluid Milk, Age by Race/Ethnicity:** Consumption percentages of populations for specific milk products



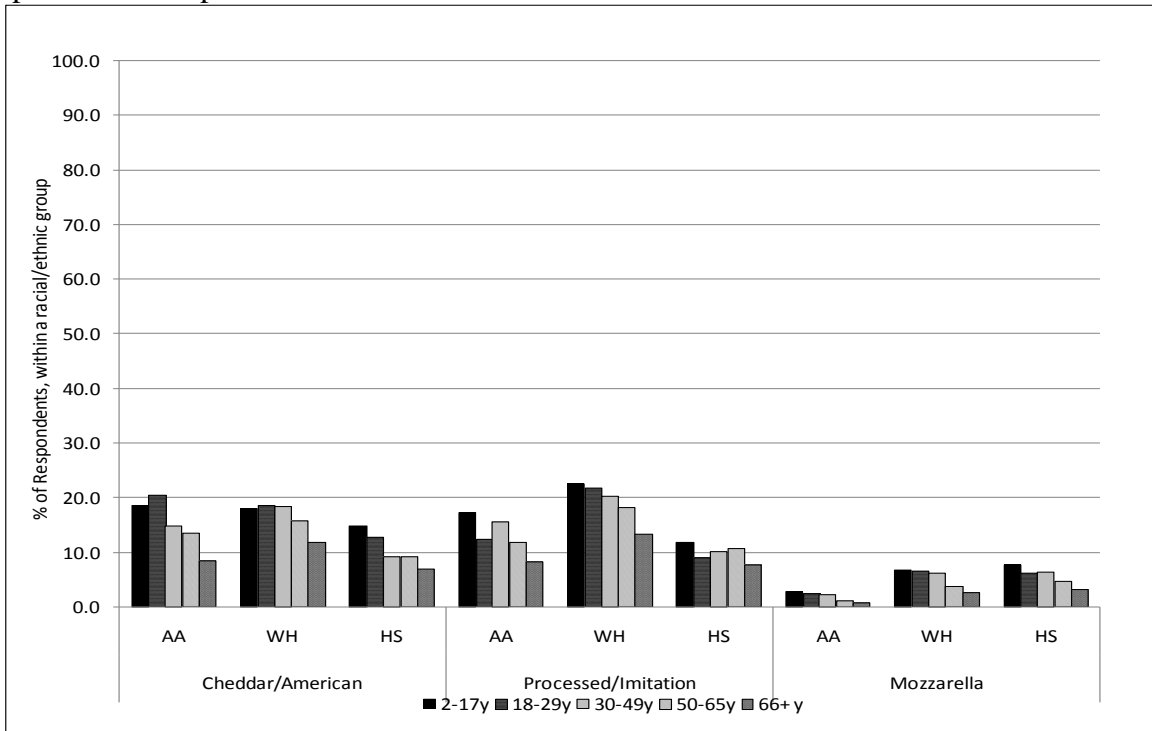
AA= African American; WH= White; HS= Hispanic

**Figure 4.5 Cheese, Gender by Race/Ethnicity:** Consumption percentages of populations for specific cheese products.



AA= African American; WH= White; HS= Hispanic

**Figure 4.6 Cheese, Age by Race/Ethnicity:** Consumption percentages of populations for specific cheese products.



AA= African American; WH= White; HS= Hispanic

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# **CHAPTER 5 - Grains and Starchy Vegetable Consumption: Food Trends of African Americans compared to other racial/ethnic U.S. populations using NHANES 2003-2006 dietary survey data**

## **Introduction**

Grain based foods and starchy vegetables are key sources of carbohydrates (energy), dietary fiber, vitamins, and minerals (USDHHS 2005; Flight and Clifton 2006). According to the 2005 Dietary Guidelines recommendations for a 2,000 calorie diet, individuals are advised to consume six to eight 1 ounce servings of grains per day with at least half of the servings coming from whole grain sources (USDHHS 2005). Research has shown that some Americans tend to exceed total grain consumption recommendations, with an average of 10-11 servings per day, but whole grain consumption remains low (Lin and Yen 2007; Mancino and Buzby 2005; Putnam et al. 2002).

Many grains and starchy vegetable foods are “economical, nutritious, versatile, and often easy to prepare” (Katz and Weaver 2003). This may explain the high consumption of these foods among Americans. For example, potato, a starchy vegetable, is a major source of complex carbohydrates, affordable, readily available, and appeals to consumers’ taste. This starchy food is the most frequent vegetable choice by Americans, particularly in the form of French fries (Guthrie 2004; Pollack 2001). Furthermore, consumption of cereals, especially at breakfast, supplies fiber, iron, folic acid, and promotes the consumption of milk (Albertson et al. 2008; Song et al. 2006). Cereal intake positively influences the consumption of other healthy foods and nutrients such as milk (Albertson et al. 2008; Siega-Riz and Popkin 1998). Grain based foods and potatoes often are eaten as components of other foods. For example, pizza containing a bread crust usually is eaten with tomato (vegetable) and cheese (dairy) and often eaten with other vegetable and meat items as toppings. Bread products often are served with spreads such as butter, cream cheese, nut butters, or jams or eaten as sandwiches with

mayonnaise with other ingredients. Pasta is typically eaten with a cream or tomato based sauce. Tortillas tend to be the base items for burritos, tacos, or enchiladas. Bread, cereals, rice, and pasta are diverse and widely available options to meet American taste desires and dietary requirements.

A caveat to the idea that grains and starchy vegetables are sources of energy as well as vitamins and minerals is the fact that excessive intake of these foods may increase the risk of certain chronic diseases and contribute to poor diets and overall health (Cleveland et al. 2000; Slavin 2003). Low cost and convenience of high calorie foods such as refined grains and fried potato products contribute to increased consumption leading to high incidences of overweight/obesity, type 2 diabetes, and low whole grain intake among Americans (Halton et al. 2006; Macino and Buzby 2005; Drewnowski 2004; Steffen et al. 2003). However, several research studies also have related the consumption of whole grain foods with a reduced risk of coronary heart disease, cancer, type 2 diabetes, and weight management (Albertson et al. 2009; Melanson et al. 2006; Liu et al. 2003; McKeown et al. 2002). Fiber in whole grains may increase the feeling of satiety, therefore reducing the need to intake in more calories than what is needed (Schroeder et al. 2009; Solah et al. 2007; Pai and Udipi 2005). Although Americans on average consume the recommended servings of grain, previous research has shown that the consumption of whole grains remained below recommended levels (Bachman et al. 2008; Lin and Yen 2007; Cleveland et al. 2000). Low whole grain consumption, among other dietary deficiencies, increases the risk of chronic diseases in U.S. minority populations, especially African Americans (Weatherspoon et al. 2010; USDHHS 2010; Hajjar and Kotchen 2003; Cleveland et al. 2000).

Several factors including economic, social and personal components impact the consumption of whole grains, as well as other foods (Wansink et al. 2009; Conner and Armitage 2002). More specifically, researchers have suggested that barriers to adequate intake of whole grains include consumers' knowledge and awareness of what foods are considered whole grains, availability, cost, texture, and taste (Black et al. 2009; Rose et al. 2007, Chase et al. 2003; Kantor et al. 2001). For example, research with college students and low-income mothers indicated that availability, cost, and family preferences determined whether or not whole grain foods were purchased and consumed (Rose et al.

2007, Chase et al. 2003). Therefore, grain consumption research has primarily focused on whole grain and fiber intake and the health advantages for reducing the risks of chronic diseases (Melanson et al. 2006; Liu et al. 2003; McKeown et al. 2002).

However, there is a need to understand the consumption patterns of grain and starchy vegetables in order to educate and encourage healthy food selections in order to reduce the prevalence of certain life threatening diseases.

There are a myriad of ways to describe and understand grain and starchy vegetable consumption patterns. Previous research examining dietary patterns of grains and starchy vegetables have done so in the context of nutrient and energy intakes (Bachman et al. 2008; Deshmukh-Taskar et al. 2007; Melanson et al. 2006; Cho et al. 2003). Research has shown that there are racial/ethnic differences in food consumption and dietary patterns (Black et al. 2009; Beydoun et al. 2008; Kant et al. 2007). Few studies have examined specific types of grain and starchy vegetable foods consumed by different racial/ethnic, age, and gender subgroups (Nielsen and Popkin 2003; Lin et al. 2001*b*; Popkin et al. 1996; Patterson et al. 1995). However, further research is needed to illustrate consumption rates of specific grain and starchy vegetables across various socio-demographics of the U.S. population.

The purpose of this research was to examine consumption of selected types of grain and starchy vegetable foods consumed based on race and ethnicity, age and gender using 24-hour recall dietary data from survey years 2003-2006 of the National Health and Nutrition Examination Survey (NHANES).

## Materials and Methods

### *Data Source/Sample Population*

The 2003-2004, 2005-2006 NHANES 24-hour dietary recall data, known as *What We Eat In America* (WWEIA), were used for analysis of grain and starchy vegetable consumption. Two nonconsecutive days of 24-hr dietary recall and demographic information were analyzed to assess consumption patterns of participants who: 1) were at least two years of age, 2) had complete and satisfactory dietary recall data, and 3) were members of a selected racial/ethnic group. The total sample size for the surveys was 17,885. The racial/ethnic, age, and gender characteristics of the survey samples are described in Table 5.1.

Individual Foods Files (IFF), containing foods coded for each individual, were accessed via the NHANES website to use for dairy consumption comparison analysis. There were food files for each of the two recall days of each survey year, 2003-2004 and 2005-2006. Each food item in the IFF documents was assigned an 8-digit code. This code corresponded to codes and food descriptions in the USDA Food and Nutrient Database for Dietary Studies (FNDDS), which classifies food items by food groups and subgroups (USDA, FNDDS 2006, 2008). These food codes were used to identify grain and starchy vegetables used in the data analysis. For each food item, all consumption forms were combined to represent the food item. A total of 1,510 food codes (387 codes- yeast/quick breads; 519 codes- pasta/grain mixtures; 386 codes- cereal/rice/breakfast bars; 59 codes- crackers; 159 codes- potato/starchy vegetables) from the FNDDS database were combined in this study to determine consumption overall or individually by food type.

Because every possible grain or starchy vegetable could not be evaluated, food items were selected if they were commonly eaten, considered to show consumption differences, and listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007). Pizza and tortilla based items were included in the analysis. Although these mixed grain based items are comprised of multiple ingredients, they are a major source of grains and the USDA food coding scheme classifies pizza, burritos, tacos, enchiladas, and other

tortilla based items as grain products therefore warranting inclusion in this research analysis.

### ***Data Analysis***

Considering that the purpose of the research was to study foods consumed rather than nutrients consumed, the study used reports of population consumption frequency (i.e. any grain or selected starchy product or a particular given product consumed during either of the two recall reporting days constitutes "consumption" of the grain/ selected starchy vegetable category or that particular food for that individual) unlike most nutrition research, which focused on mean serving, nutrient, and energy intakes to understand consumption patterns of foods across race/ethnic groups and age and gender subgroups (Bachman et al. 2008; Beydoun et al. 2008; Cleveland et al. 2000). For the purpose of this research, consumption frequency refers to the proportion of a sample population who reported eating a food group or item.

Given the large range of grain and selected starchy vegetable products available, every possible product could not be assessed. Therefore, food items were selected if any of the following were true: commonly eaten, thought by the researchers to potentially show consumption differences or similarities, or listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007). All grain and selected starchy root vegetable products, excluding dessert and snack items, in the FNDDS listing were included for the total category count. A total of six overall grain subcategories were analyzed. These subcategories were breads, cereal, pasta, rice, crackers, and starchy roots/vegetables. To examine specific grain or starch vegetables foods, a total of 54 items (constituting multiple food codes) were analyzed for consumption frequency by race/ethnicity.

For statistical analysis, dietary recall and demographic data were pooled over the two non-conservative days and two survey years (2003-2004; 2005-2006). A Pearson's chi-square test was used to determine if there were significant differences between the proportions of "consumers" and "non-consumers" of identified food items for each

racial/ethnic category, using the FREQ procedure in SAS® 9.2 (SAS Institute Inc., 2008). A significant difference was determined at 0.05 alpha level.

Following a review of the consumption rates across food items, foods with greatest percentages across racial/ethnic groups and those that appeared to have distinct race and ethnic differences were analyzed to further descriptively examine race by gender and race by age dietary patterns.

## Results and Discussion

### *Grains and Selected Starchy Vegetables Consumption*

More than 75% of all participants reported consuming a grain or selected starchy vegetable product in the 2 day period (Table 5.2).

According to Putnam et al. (2002), from the 1980s to the year 2000 the average grain consumption per person in the U.S. increased. Those authors noted that this increase was due to increased consumption of refined grain products. Interestingly, findings in the current investigation highlight the idea that intakes of certain grains have not changed much over a 10- year period. Our data shows a clear preference of refined grain products similar to that found in other research regardless of efforts by intervention, education, and research programs to increase whole grain consumption (USDHHS 2005; USDA CNPP 2010).

There were significant differences ( $p < 0.05$ ) between racial/ethnic consumption reports for all food items except the total pizza category, pizza with meat or seafood, and hash from white potatoes (Tables 5.7 & 5.8). Overall, yeast and quick breads (62-73%) were consumed the most followed by starchy root products such as white potatoes (47-56%) then all cereals (40-44%) comprising the three most consumed grain or starchy vegetable food categories. This research confirms other findings that grain and starchy vegetable consumption differs among various racial/ethnic, age, and gender socio-demographic groups (Black et al. 2009; Lin and Yen 2007; Putnam et al. 2002; Patterson et al. 1995).

**Whole Grains:** Some of the selected items were whole grain products including rye and pumpernickel breads, whole wheat pastas, and oatmeal. Whites consumed more of these foods than African Americans. These findings were consistent with research based on 1994-1996 CSFII dietary recall data (Kantor et al. 2001; Cleveland et al. 2000). Food beliefs, attitudes, and behaviors among African Americans may attribute to their low consumption of these healthy, disease reducing grains. Research exploring factors that influence African American food choices showed that some participants believed eating healthier food meant sacrificing parts of their culture and traditions as well as eating less tasteful foods (James 2004).

### ***Yeast/ Quick Breads Consumption***

More than 60% of all respondents reported eating some type of yeast or quick bread product (Table 5.2). As with previous research results from this study indicated that a majority of respondents tend to consume their grain products in the form of breads (Lin and Yen 2007; Putnam et al. 2002; Chase et al. 2003). However, whole grain breads were consumed by less than 30% of the reporting participants (Table 5.3). Whites tended to consume more of these grain type products (less than 30%) compared to Hispanics and African Americans (approximately 20% each). A probable reason for the gap in racial/ethnic consumption of whole-grains is differences in income, availability, taste preferences, familiarity, and awareness of nutritional benefits of whole grain foods (Chase et al. 2003; Putnam et al. 2002). The current investigation supports documented research that Americans tend to consume more refined grains than whole-grains (Wells and Buzby 2008; Lin and Yen 2007; Cleveland et al. 2000).

Overall, female and male consumption of all yeast/quick breads tended to be similar for African Americans and Whites (Figure 5.1). Hispanic females tended to have higher consumption of all bread/rolls type products compared to their male counterparts. Among age groupings, respondents 18-29 years had the lowest consumption rate of yeast/quick breads (Figure 5.2). USDA data show that the percentage of both males and females in their teens and twenties who eat breakfast is the lowest of all age groups (USDA, ARS 2009).

Examining selected yeast/quick bread products individually shows that items identified as bread were consumed the most (> 37%). Rolls were the second most consumed (> 25%) of the selected food items in the analysis. These findings suggest a trend of bread and rolls being staple yeast/quick breads in Americans' diets. It is probable to think that breads and rolls are components of other food items such as sandwiches and a meal side item.

African Americans consumed more cornbread and biscuits than Hispanics and Whites. Cornbread is a traditional food of the African American diet (Weatherspoon et al. 2010; Kittler and Sucher 2007). These racial/ethnic consumption differences for cornbread emphasize the influence of culture on dietary intake of some foods.



Although total consumption was low with less than 5% of the populations reporting consumption, Whites consumed more rye, pumpernickel and sourdough breads than African Americans and Hispanics. Interestingly, more than three times the number of Whites consumed rye breads compared to their racial/ethnic counterparts. Rye is one of many whole grains recommended for increased consumption by the 2005 Dietary Guidelines (USDHHS 2005). However, rye bread also is a traditional food of northern European countries and may be more familiar to some Whites of northern European descent which could explain the difference in consumption patterns.

Bagels, croissants and English muffins, breads often eaten for breakfast, were not frequently consumed among African Americans and Hispanics. Only 3%, 1%, and 0.5% of African Americans consumed bagels, croissants, and English muffins, respectively. Previous research demonstrated that only 1-2 servings of bagels or English muffins were consumed in a week (McKeown et al. 2002) indicating their low consumption frequency among all populations. African Americans also have been shown to eat breakfast less often than both White and Hispanic populations (USDA 2005) which may influence the choice of these particular bread products. Availability, cost, and familiarity food choice factors may be the reasons African Americans and Hispanics ate fewer bagel type breads.

Less than 10% of the surveyed populations consumed pancakes, waffles, or French toast. These batter or egg dipped breakfast type breads often require more preparation time and are less portable than breads such as bagels or English muffins.

Specialty breads such as focaccia, naan, rice or potato flour breads were not frequently consumed regardless of race/ethnicity (< 1% of each population reporting). Garlic and onion breads were consumed more by Whites than African American or Hispanic respondents.

Although less than 2% of each sample group reported eating stuffing or dressing type foods, African Americans tended to consume more compared to Hispanics and Whites. Although these foods traditionally are eaten by a variety of Americans during the Thanksgiving and Christmas holidays, African Americans eat stuffing/dressing type foods during the holidays and for celebrations, or special occasions (Weatherspoon et al. 2010).

Rolls, cornbread, tortillas, and loaf type breads (items labeled “bread” in USDA coding scheme, referred to as bread here after) were selected for further comparisons of racial/ethnic, age, and gender differences.

### **Race/Ethnicity by gender and age comparisons**

African American and White males tended to consume more total bread (white, wheat, multigrain) than their female counterparts (Figure 5.1). McKeown et al. (2002) reported that men consumed approximately six servings of white bread per week whereas women consumed five servings of this bread per week. As far as the consumption of rolls, males reported eating these grain items more frequently than females.

African American females consumed more cornbread than their male counterparts and both White and Hispanic males and females. There was trend of increased consumption of cornbread with age (Figure 5.2). The gritty texture and possible low flavor of cornbread are probable reasons for low intakes observed among children and young adults for this traditional food. The fact that cornbread often must be prepared instead of being purchased also may make it less popular among younger people who lack food preparation skills or the desire to cook.

Bread consumption was greatest among adults 66 years and older, with more than 45% of this population reporting consumption (Figure 5.2). Young adults, ages 18-29 years, reported the least consumption of “bread”. There was a decline in bread consumption between the 2-17 and 18-29 age groups. This decline may be attributed to more opportunities of eating out and transitional lifestyle changes from childhood to adulthood where bread consumption declines and consumption of other grain products increase. However, reports of eating bread increased for individuals age 30 and older.

Not surprisingly, Hispanic consumption of tortillas and tortilla based foods was more than double that of other racial/ethnic groups. Hispanic females consumed slightly more tortillas than males of this racial/ethnic group. Tortilla consumption among Hispanics increased from 2-17 years until 30-49 years. Tortilla foods such as burritos, tacos, and enchiladas are traditional foods of Hispanic cultures (Goody and Drago 2010; Kittler and Sucher 2007). This is a key example of individuals eating foods they identify with culturally. Interestingly, African Americans and Whites 50-66+ years had the

lowest reports of tortilla consumption. Tortilla based foods are convenient, high fat, quick foods probably eaten less by non-Hispanic older adults who may be less familiar with them.

This research provides evidence that there are racial/ethnic, age, and some gender differences in consumption of various yeast/quick breads. Also, these results show food items to promote among different racial/ethnic groups in an effort to increase whole grain consumption.

### ***Cereals Consumption***

Data analysis of cold and hot cereals along with breakfast/granola bars showed that there were consumption differences between African Americans, Whites, and Hispanics (Table 5.4). Forty to 44 percent of all racial/ethnic populations reported eating some type of cereal product. Cereal products are convenient, economical, and supplement a diet with carbohydrates, dietary fiber, and protein (Katz and Weaver 2003; Flight and Clifton 2006). In addition, many contain whole grains and companies have promoted that extensively. Therefore, a positive trend of cereal consumption is evident regardless of a person's racial/ethnic background.

Hispanic females (43%) consumed more cereal based items compared to their male counterparts (37%) (Figure 5.3). Research by Patterson et al. (1995) reported higher cereal consumption by women than men. Cereal consumption decreased with an increase in age until age 50 and older (Figure 5.4). Older adults' (50+ years) cereal consumption was higher than adults ages 18-49 years. Children tended to eat more cereal than adults, except for White adults 66 years of age and older. These findings suggest that this greater consumption by children probably is driven by the convenience and preparation ease of Ready-to-Eat (RTE) breakfast cereals. The availability of more convenient items in the food market and perception of having no time or "time scarcity" could explain consumption rates of particular cereal items (Jabs and Devine 2006).

Further comparisons of racial/ethnic, age, and gender differences were examined for grits, oatmeal, breakfast/granola bars, and RTE cereals.

### **Race/Ethnicity by gender and age comparisons**

Grits were consumed mostly by African Americans. This demonstrates the relationship of race/ethnicity and perhaps location on preference for a specific food item. Grits is a corn based cereal in the African American diet that has origins in the diets of West Africans (Weatherspoon et al. 2010; Opie 2008; Kittler and Sucher 2007). African American males and females had similar consumption rates for grits, with an overall increase of consumption with age (Figures 5.3 & 5.4). Less than 1 % of Whites and Hispanics ate grits on one of the two days during the survey period. Consumption differences of grits could be attributed to cultural and regional differences. Grits is traditional dish of the southern U.S. diet where approximately 56% of African Americans live (USDHHS, Minority Health 2010). This illustrates the influence of culture and geographical location on food intake.

Oatmeal was eaten mostly by Whites followed by African Americans, then Hispanics. Females tended to eat more of this type of hot cereal compared to males (Figure 5.3). Adults 50 years and older seemed to prefer oatmeal cereal more than children, young, and middle aged adults (Figure 5.4). There tended to be age differences for oatmeal consumption. The health benefits of eating this whole grain cereal perhaps are the reasons older adults consumed this hot cereal product (Melanson et al. 2006; Lang and Jebb 2003; McKeown et al. 2002; Cleveland 2000). Moreover, Lin and Yen (2007) reported that children preferred refined grain products over whole grain foods.

Although the proportion of participants consuming breakfast/granola bars was less than 10%, Whites consumed more of these items than African Americans and Hispanics. Males had fewer reports of consumption of the grain based bars compared to females (Figure 5.3). Whites 18-49 years of age consumed the most breakfast/granola bars. Preference of breakfast/granola bars varied according to age, gender, and race/ethnicity. This is a convenience item which can contribute to increasing the intake of grains, more importantly whole-grains, but shows low consumption among all groups.

More than 30% of each racial/ethnic group consumed some type cold or Ready-to-Eat (RTE) cereal during the two day reporting periods. Consumption of RTE cereals, especially for breakfast, supplies fiber, iron, folic acid, and promotes the consumption of

milk (Albertson et al. 2008; Williams et al. 2008; Song et al. 2006). It has been suggested that the convenience of RTE cereals encourages the consumption of breakfast (Song et al. 2006).

An examination of sweetened or flavor cereals showed that 19-23% of respondents ate this type of RTE cereal. This demonstrates that for many individuals RTE cereal consumption is more than just a plain, grain based cereal. Hispanic and African American females tended to eat more RTE cereals than males (Figure 5.3). This shows that there were some gender differences in consumption of RTE cereals.

Children consumed more RTE cereals than any other age group regardless of race/ethnicity (Figure 5.4). RTE cereal consumption has been shown to increase milk and fiber consumption among children (Williams et al. 2008; Barton et al. 2005). These consumption rates among children may have been driven by preferences for sweet, flavor filled and “character” cereal products or the ease with which most RTE cereals can be prepared and served before school. RTE cereals are convenient, easy to prepare for and by children, and, thus, often are eaten for breakfast. African American and White adults 66 years and older consumed more RTE cereals than their counterparts ages 18-65. Older adults perhaps were eating more of fiber and bran rich cereals for health benefits as well as convenience (Cho et al. 2003; Lang and Jebb 2003). This research study documents that RTE cereal consumption is impacted by age more so than gender and race/ethnicity.

Further research is needed to identify the proportion of individuals consuming specific RTE cereals for breakfast. However, this research denotes the need to promote consumption of RTE cereals in an effort to maintain and increase nutrient intakes.

### ***Pasta Consumption***

Approximately 29% of African Americans and Whites reported eating a type of pasta on one of the two days of the survey period. Less than 20% of Hispanics reported eating pasta (Table 5.2). Pastas are not traditional items in the Hispanic diet. The greater consumption by African Americans and Whites may be due to the historical influence of Italian foods on American culture and longer presence of these persons in the U.S.

compared with many Hispanics. Females tended to consume more pasta items compared to males (Figure 5.5). Interestingly, pasta consumption declined as age increased (Figure 5.6), which could be caused, in part, by the timing of the data collection for this survey. The period of data collection (2003-2006) overlaps several years where diets low in carbohydrates were popular, especially among adults trying to lose weight. The results show that grain consumption from pasta is impacted by gender and age as well as race/ethnicity.

Specific investigated pasta items were spaghetti, spaghetti with tomato sauce, lasagna, macaroni and cheese, ravioli, couscous, whole-wheat pasta, and any type of noodle (Table 5.5). There were racial/ethnic differences in consumption of these food items.

Approximately 8-10% of consumers reported eating spaghetti. This was almost half of the total percentages for any type of pasta eaten (Table 5.5). Moreover, spaghetti with tomato sauce had 7-9% consumption across the racial/ethnic groups. This suggests that most spaghetti was eaten with tomato sauce versus other sauce varieties or mixtures. African Americans tended to eat more spaghetti with tomato sauce than Whites and Hispanics (Table 5.5). Fewer than 4% of the sample participants reported eating lasagna, ravioli, couscous, noodles, and whole wheat pasta. Whites tended to consume more of these items than African Americans and Hispanics. African Americans consumed more macaroni and cheese food items than Whites and Hispanics (Table 5.5) perhaps because it is culturally appropriate and also because boxed macaroni and cheese products typically are inexpensive meal items. A larger portion of African Americans than Whites fall into low-income categories (USDHHS 2010).

### **Race/Ethnicity by gender and age comparisons**

Spaghetti with tomato sauce was comparable among males and females (Figure 5.5). Additionally, children ate more spaghetti with tomato sauce than did adults, perhaps because it is a popular item in the school lunch program and because there are canned spaghetti products that are promoted as easy, nutritious products for children.

Consumption rates for lasagna, ravioli, and noodles were comparable among males and females (Figure 5.5). However, age differences appear, particularly among

African American and Hispanic children who tended to eat ravioli more than adults (Figure 5.6). As with spaghetti, greater consumption of ravioli among children was probably due to convenience of canned products and availability at school lunch meals.

Females tended to eat more macaroni and cheese products than did males (Figure 5.5). Macaroni and cheese consumption decreased as age increased, with children having the greatest reports of consumption (Figure 5.6).

The results provide evidence that the proportion of Americans consuming pasta and specific pasta varieties is a function of several socio-demographic factors including race/ethnicity and age. Promotion of more healthful eating clearly needs to focus on targeting products that are culturally and age appropriate.

### ***Rice Consumption***

African Americans and Hispanics ate more rice, particularly white rice, during the survey period compared to their White counterparts (Table 5.2). These results are consistent with previous national survey data that indicated African Americans consumed more rice than Whites (Popkin et al. 1996). Rice and rice dishes are customary items in African American and Hispanic diets (Kittler and Suchner 1998). Whites (14%) consumed rice at half the rate as the other racial/ethnic groups.

White, brown/wild, fried, rice with beans/vegetables, and Spanish rice were selected for race/ethnic comparisons. Less than 5% of Whites reported eating these rice items (Table 5.6). These rice items and the all rice category were further analyzed to review the relationships of consumption frequencies and race/ethnic, age, and gender factors.

### **Race/Ethnicity by gender and age comparisons**

All race by gender and age comparison data for the selected rice products are shown in table six and figures seven and eight. Although males and females showed similar consumption (Figure 5.7), more females consumed white rice than males.

The descriptive statistics showed that rice consumption varied by age. The percentage of people eating rice tended to increase from ages 2-17 until age 49, then

decrease among the 50 and older respondents (Figure 5.8). African American and Hispanic adults 30-66+ years tended to eat more white rice than children and young adults of these two racial/ethnic groups. The trend of Whites consuming fewer refined grains such as white rice perhaps is attributed to racial/ethnic differences in education, income, healthy lifestyles, and nutrition knowledge regarding benefits of unrefined, whole grain foods (Kant et al. 2007; Lang and Jebb 2003; Kantor et al. 2001).

Only 1-2% of respondents consumed brown/wild rice. Of the few respondents who ate this type of rice, male and female consumption rates were comparable. Consumption of brown/wild rice was variable across the age groups. However, adults tended to consume more of this rice than children. Brown and wild rice products are considered whole grains, and items Americans should consider eating more of for better diet and health. This may be particularly useful when targeting racial/ethnic populations where rice consumption already is higher than in the White population.

Hispanics had the highest consumption rates of Spanish rice (Table 5.6). This is not surprising given that Spanish-style rice is inherently a Hispanic dish. Females in this racial/ethnic group consumed more Spanish rice than males (Figure 5.7). Among Hispanics, consumption of Spanish rice increased from childhood age (2-17 years) to middle adulthood (30-49 years) then decreases in among older adults (50-66+ years) (Figure 5.8).

African-Americans and Hispanics consumed more fried rice than Whites (table 5.6). African American females and Hispanic males reported eating more of this rice compared to their counterparts (Figure 5.7). African American and Hispanic young (18-29 years) and middle aged (30-49 years) adults ate more fried rice than children and adults 50 and older (Figure 5.8).

Although consumption frequencies were less than 5%, Hispanics consumed more rice with beans or vegetables than African Americans and Whites (Table 5.6). Hispanic males tended to consume more rice and bean with vegetable mixtures than Hispanic females (Figure 5.7). Within this racial/ethnic group, rice and bean/vegetable consumption tended to decrease after age 49 (Figure 5.8). Interestingly, African American consumption of rice and beans/vegetables was similar across the various age groups. Among African Americans, age did not seem to impact consumption rates.



Although rice and beans are noted items of the African American diet, this research demonstrates that few African Americans in this data set consumed this mixed rice product. This low consumption of rice and beans/vegetables may be due to convenience and eating occasion factors which can impact food intake patterns. However, these potentially inexpensive and nutritious products could be targeted for increased consumption because they are already culturally appropriate in the African American diet.

### ***Starchy Vegetables/Roots and Potato Consumption***

Starchy vegetable and roots products analyzed were white potato products, plantains, taro, cassava, and white sweet potato food based items. The researchers aim was to focus on the major starchy vegetable, white potato, and a few uncommon roots where starch, as with many grain products, is a main nutrient. Approximately 47-55% of the participants reported eating at least one of the selected starchy vegetables (Table 5.2). Less than 1% of the racial/ethnic sample populations indicated eating plantains, taro, cassava, or white sweet potatoes (Table 5.7). White potato products (hereafter referred to as potato) were consumed by more than 45% of the survey respondents. Of the potato foods, there were no significant differences in race/ethnicity consumption of white potato hash (approximately 3% of participants,  $p < 0.05$ ). While white potato soup consumption was low, Whites ate more of this product than African Americans and Hispanics.

Hispanic and African American females ate more of the selected starchy type vegetables than males in their racial/ethnic group (Figure 5.9). Among these racial/ethnic groups, as age increased consumption reports of the selected starchy vegetables tended to decrease (Figure 5.10). Conversely, White males consumed more these food items compared to their female counterparts, and this was consistent across age groups except for Whites 66 years or older.

All starchy vegetables and white potatoes as French fries, mashed, and other cooked forms were further examined to understand race/ethnicity as related to age and gender.

### **Race/Ethnicity by gender and age comparisons**

The race/ethnic, age, and gender comparisons for fries, mashed, and other cooked types of white potatoes are displayed in figures nine and ten.

Among the selected white potato items analyzed, fries were consumed the most with 22-30% of the survey respondents indicating they ate this product (Table 5.7). Lin and colleagues (2001) using Continuing Survey of Food Intake by Individuals (CSFII) data indicated that 13% of the survey respondents ate fries. Furthermore, potatoes that are fried tend to be a frequent choice of “vegetable” among Americans (Guthrie 2004; Pollack 2001). African American males and females tended to eat more French fries than Whites and Hispanics (Figure 5.9). White males ate more fries than their female counterparts whereas the opposite was shown among Hispanic males and females. Given that fries are often deep fried rather than baked, females who may be more concerned about managing their weight might have a tendency to monitor their consumption of high fat foods (Rolls et al. 1991). Children and young adults ate more fries than adults 30 and older (Figure 5.10). The current research suggests that the younger a consumer the greater the choice of fries over non-fried potato food products will be. A probable reason for the observed differences is the factor that older adults tend to be more concerned about their health, monitor their fat consumption, and as a result consume more non-fried potato products. However, given the prevalence of obesity among children and minority populations and associated risk for type 2 diabetes with fried potato consumption there is a need to decrease consumption of deep-fried fries (Halton et al. 2006; Lobstein et al. 2004; Flegal et al. 2002). French fries are convenient, affordable, accessible potato products (Lin et al 2004; Lin et al. 2001*b*) and it appears from this research that may impact consumption ratios differences.

African Americans and Whites consumed more mashed white potatoes than Hispanics (Table 5.6). Hispanic females tended to eat more of this food than their male counterparts. Overall, mashed potato consumption was similar across age groups. However, African Americans in the 30-49 age group consumption rates of mashed potatoes were lower than other age groupings within this racial/ethnic group.

African Americans and Whites reported eating more potato salad than Hispanics. This is a culturally American potato dish usually eaten during holiday type meals (Kittler

and Sucher 2007). Female and male consumption of potato salad were comparable except among Hispanics. More Hispanic women reported eating potato salad than Hispanic males. Potato salad increased as the age of individuals increased. The flavors and textures of potato salad maybe less appealing to children and, thus, may be a food preference that develops with age.

For this research, baked, roasted, boiled, and scalloped white potatoes were referred to as non-fried potato foods. More than twice the number of Whites (13%) consumed these non-fried potato items compared to both African Americans (6%) and Hispanics (5%) (Table 5.7). Hispanic and African American females consumed more non-fried potato products compared to their male counterparts. An increase in consumption of non-fried foods paralleled with an increase in age. The age variation of non-fried potato foods was a direct contrast to the consumption of French fries.

This research support previous findings that there are race/ethnic, age, and gender differences in potato consumption (Lin et al 2001; Lin and Blisard 2004).

### ***Pizza Consumption***

There were no significant differences for racial/ethnic consumption reports of the entire pizza category and pizza with meat/seafood ( $p < 0.05$ ). Interestingly, 20% of the respondents consumed some type of pizza on one of the two 24-hour recall days (Table 5.8). Pizza with meat or seafood had the greatest percentage of consumption reports across the racial/ethnic groups. The percentage of African Americans' and Whites' consuming cheese pizza was significantly higher than Hispanics. According to trends research, pizza consumption increased from the late seventies to late nineties and early twenty first century (Sebastian et al 2006; Nielsen et al. 2002). This consumption increase possibly can be attributed to the shift by Americans from eating at home to dining out and consuming more fast, "away-from-home" foods (Lin et al. 2007).

Because pizza is a major source of grains for all race/ethnic groups, the emphasis on using whole grains as a base for pizza crust could be emphasized by manufacturers who desire to make their product more healthful. This already has been done

successfully by pizza manufacturers to meet guidelines for inclusion of whole grain by many schools who participate in USDA's school lunch program.

## **Conclusions**

This research expands the knowledge base regarding dietary intake and trend analysis of grain and some starchy vegetables. Moreover, the current research investigation provides insights into the relationship of dietary patterns for specific grain/starchy vegetables items and race/ethnicity, age, and gender. This research illustrates there are socio-demographic differences in the consumption of grains such as whole grain foods, pastas, and white potato products.

Data from this research study can serve as baseline information for creating and further development of culturally relevant nutrition educational materials and diet healthy foods for populations having poor diet quality that make them at risk for some chronic diseases. For example, the current list of specific grain/starchy vegetable items could be used as marker foods on tools to assess diet such as food frequency questionnaires, which tend to be void of racial/ethnic specific food items (Jones-McLean et al. 2010). Furthermore, this research supports previous recommendations that nutrition knowledge and awareness must be relevant to a specific population in order for positive long term diet changes to take place (Barboukis 2007; James 2004). There is a need to increase whole grain consumption among Americans. With this understanding of grain consumption in diverse populations, nutrition and health professionals, food product developers, and policy makers can more effectively design culturally focused education programs and foods to overcome intake barriers and promote healthier grain consumption.

## **Research Implications**

The research study showed that a small proportion of people consume whole-grain products. Nutrition and health professionals can use the current research data to promote the incorporation of whole grains into the bread, cereal, pasta and rice products already being consumed by the different racial/ethnic and age groups. For example, educational materials targeted towards African Americans should emphasize the selection of grain options when consuming biscuits, rolls, and the eating brown or wild rice rather than white rice. This research shows that there are opportunities to promote the consumption of oatmeal and granola bars for sweetened ready-to-eat cereals, incorporation of whole grain pasta as substitute in macaroni and cheese and lasagna foods, especially among children. Therefore, increasing the whole-grain consumption and reducing some diet related health risks. The food industry can use this research information to identify areas to develop whole-grain options and target markets to make whole-grain product more visible, available, and affordable. Awareness of the positive health implications of consuming whole grains must be part of the focus of public policy and marketing strategies for consumers move toward selecting healthier foods.

This research supports the idea that white potato products are common food items in the American diet. Given that over consumption of potato products, especially French fries, have been shown to be related to obesity and increased risk of type-2 diabetes there is a need to promote healthier options for potato products. In order to do this, nutrition educators should provide consumers with resources on healthy preparation methods and the fast food industry should continue to offer alternatives to fried potatoes such as fruits and vegetables.

## **Limitations**

A limitation of this study is that the overall categories of grains and selected starchy vegetables were coded based on the USDA food nutrient database coding scheme, with dessert items excluded. If grain and selected starchy vegetable items were consumed but coded outside the grain or selected starchy vegetable categories by the USDA (e.g. meat with rice; potatoes in a stew), then those items were not included in the study.

The researchers recognize that race/ethnicity and food consumption is confounded with other socioeconomic, lifestyle, and agricultural variables: income, education, geographic residency, family structure, eating occasions, food consumption at home or away from home, availability, familiarity, and attitudes and perceptions regarding different grain and starchy vegetables foods. Even though it is possible to evaluate some of those variables using NHANES data, the key focus of the research was to assess consumption of specific fruit and vegetable products by major racial/ethnic groups. Hence it is plausible that race/ethnicity alone is not the driving reason for different consumption patterns.

It is important to note that the objective of this research was not to imply that different racial/ethnic groups are genetically pre-disposed or limited to eating specific fruits and vegetables. The purpose was to understand food consumption patterns using race/ethnicity as a differentiating factor, and gender and age as additional groupings.

## Tables and Figures

**Table 5.1 Demographic characteristics of sample by race/ethnicity, age and gender from 2003-2004, 2005-2006 NHANES data**

	African		
	American	Caucasian	Hispanic
<b>n</b>	4994	7525	5366
<b>Age</b>			
2-17y	2465	2027	2683
18-29y	864	1159	976
30-49y	780	1522	843
50-65y	512	1142	456
66+ y	373	1675	408
<b>Gender</b>			
Males	2477	3668	2586
Females	2517	3857	2780
Sample Total, N= 17885			

**Table 5.2 Grains and Selected Starchy Vegetables Consumption - Percent of respondents, 2 years or older, by race/ethnicity**

<b>Food Group/Item<sup>a</sup></b>	African American (non-Hispanic) n= 4994		White (non-Hispanic) n= 7525		Hispanic n= 5366		<b>p -value<sup>c</sup></b>
	%	± SE <sup>b</sup>	%	± SE	%	± SE	
Grains, Starches- all	79.3	± 0.6	83.6	± 0.4	81.9	± 0.5	<.0001
Cereal, all - cooked grains, RTE <sup>d</sup> cereal	41.5	± 0.7	43.6	± 0.6	40.0	± 0.7	0.0002
Crackers, all	18.1	± 0.5	26.5	± 0.5	15.0	± 0.5	<.0001
Pasta, all	28.6	± 0.6	28.5	± 0.5	17.2	± 0.5	<.0001
Rice, all	24.5	± 0.6	14.2	± 0.4	31.4	± 0.6	<.0001
Yeast, Quick breads-all	64.0	± 0.7	72.9	± 0.5	62.3	± 0.7	<.0001
Starchy roots/vegetables	55.7	± 0.7	54.7	± 0.6	46.9	± 0.7	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE= Standard Error

<sup>c</sup> P value for Pearson's chi-square test

<sup>d</sup> RTE= Ready-to-eat

**Table 5.3 Yeast/ Quick Bread Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

Food Group/Item <sup>a</sup>	African American (non-Hispanic) n= 4994		White (non-Hispanic) n= 7525		Hispanic n= 5366		p -value <sup>c</sup>
	%	± SE <sup>b</sup>	%	± SE	%	± SE	
Yeast/ Quick, <i>undefined flour</i> based	61.3	± 0.7	68.4	± 0.5	72.3	± 0.6	<.0001
Yeast/ Quick, <i>whole-grain</i> flour based	19.6	± 0.6	29.2	± 0.5	18.0	± 0.5	<.0001
Bagels	3.1	± 0.2	7.4	± 0.3	2.7	± 0.2	<.0001
Biscuits	8.9	± 0.4	6.9	± 0.3	3.7	± 0.3	<.0001
Bread <sup>d</sup>	44.7	± 0.7	48.9	± 0.6	38.2	± 0.7	<.0001
Cornbread	7.1	± 0.4	2.9	± 0.2	1.1	± 0.1	<.0001
Croissants	1.0	± 0.1	1.4	± 0.1	0.7	± 0.1	0.0007
English muffins	0.5	± 0.1	2.7	± 0.2	0.8	± 0.1	<.0001
French Toasts	1.9	± 0.2	2.4	± 0.2	1.5	± 0.2	0.0012
Garlic, onion breads	2.8	± 0.2	4.4	± 0.2	1.7	± 0.2	<.0001
Hushpuppies	0.5	± 0.1	0.8	± 0.1	0.1	± 0.0	<.0001
Muffins- excluding English muffins	2.2	± 0.2	4.0	± 0.2	1.9	± 0.2	<.0001
Pancakes	6.3	± 0.3	5.0	± 0.3	6.6	± 0.3	0.0002
Pumpernickel	0.1	± 0.0	0.6	± 0.1	0.1	± 0.0	<.0001
Rolls-excluding sweet rolls	27.0	± 0.6	30.1	± 0.5	23.1	± 0.6	<.0001
Rye	0.4	± 0.1	3.1	± 0.2	0.3	± 0.1	<.0001
Sourdough	0.3	± 0.1	2.2	± 0.2	0.9	± 0.1	<.0001
Specialty breads <sup>e</sup>	0.2	± 0.1	0.5	± 0.1	0.1	± 0.0	0.0009
Stuffing, dressing	1.9	± 0.2	1.6	± 0.1	0.8	± 0.1	<.0001
Tortillas + tortilla based foods <sup>f</sup>	8.5	± 0.4	14.7	± 0.4	56.1	± 0.7	<.0001
Waffles	3.6	± 0.3	4.1	± 0.2	2.9	± 0.2	0.0019

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

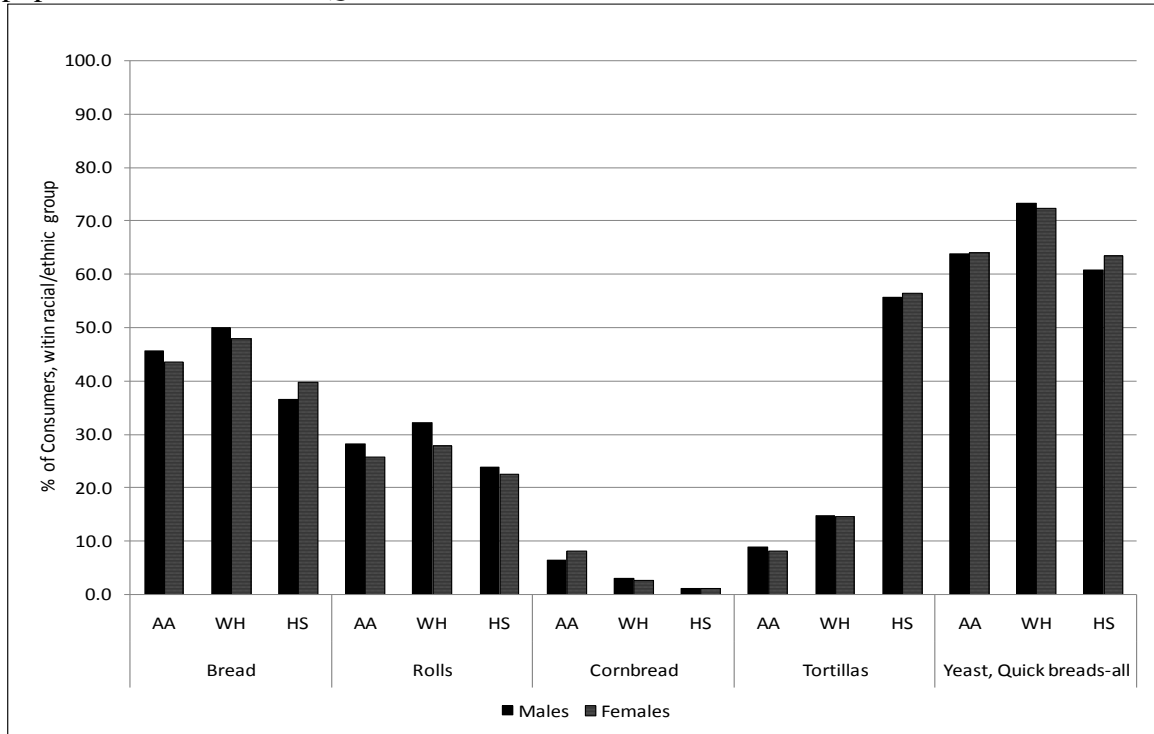
<sup>d</sup> Bread- any white, wheat, multigrain, and whole grain items listed as "bread" in USDA food coding scheme

<sup>e</sup> Specialty breads- i.e. focaccia, naan, Irish soda, soy, rice, potato, low gluten

<sup>f</sup> Tortilla based foods- i.e. burritos, tacos, enchiladas

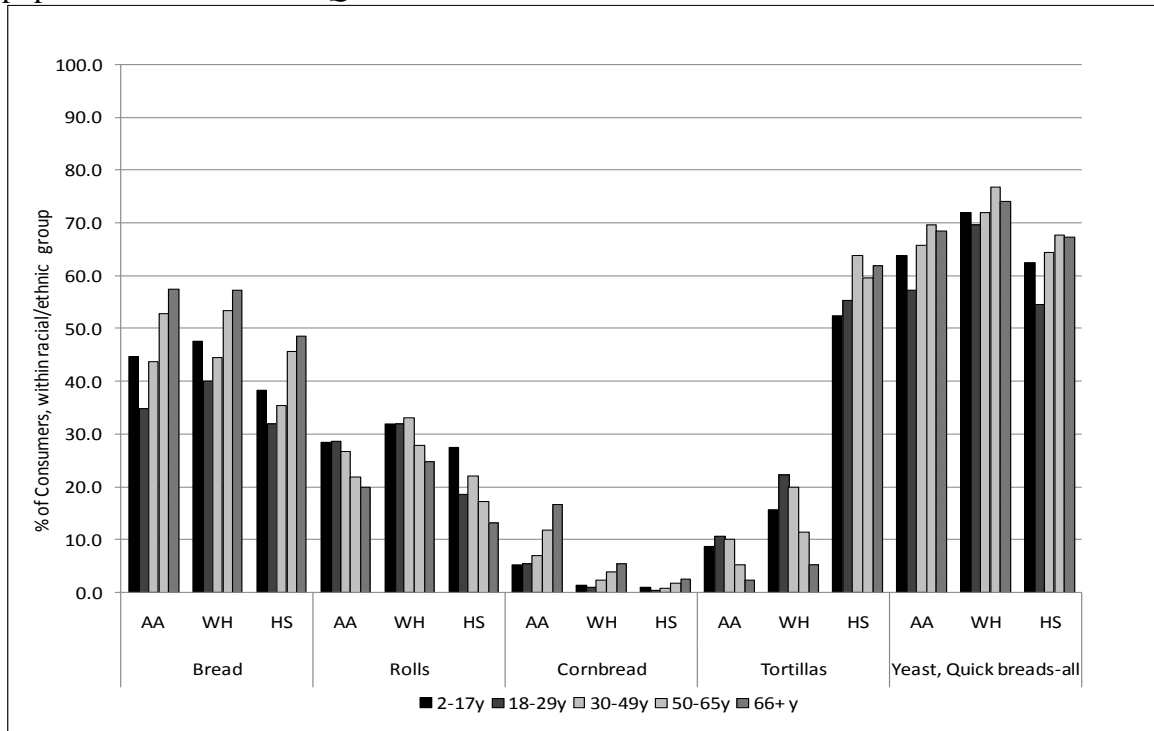


**Figure 5.1 Yeast/Quick Breads, Gender by Race/Ethnicity:** Consumption percentages of populations for All Yeast/Quick breads and selected items



AA= African American; WH= White; HS= Hispanic

**Figure 5.2 Yeast/Quick Breads, Age by Race/Ethnicity:** Consumption percentages of populations for All Yeast/Quick breads and selected items



AA= African American; CA= White; HS= Hispanic

**Table 5.4 Cereal Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Breakfast, granola bars	2.4	± 0.2	7.1	± 0.3	2.7	± 0.2	<.0001
Cream of Wheat	0.8	± 0.1	0.5	± 0.1	0.5	± 0.1	0.0295
Grits	6.8	± 0.4	0.8	± 0.1	0.1	± 0.0	<.0001
Oatmeal, cooked	6.1	± 0.3	8.1	± 0.3	5.3	± 0.3	<.0001
Ready-to-Eat cereal	32.1	± 0.7	37.1	± 0.6	36.5	± 0.7	<.0001
Sweetened, flavored cereal, RTE <sup>d</sup>	23.2	± 0.6	19.1	± 0.5	22.1	± 0.6	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

<sup>d</sup> RTE= Ready-to-eat

**Table 5.5 Pasta Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

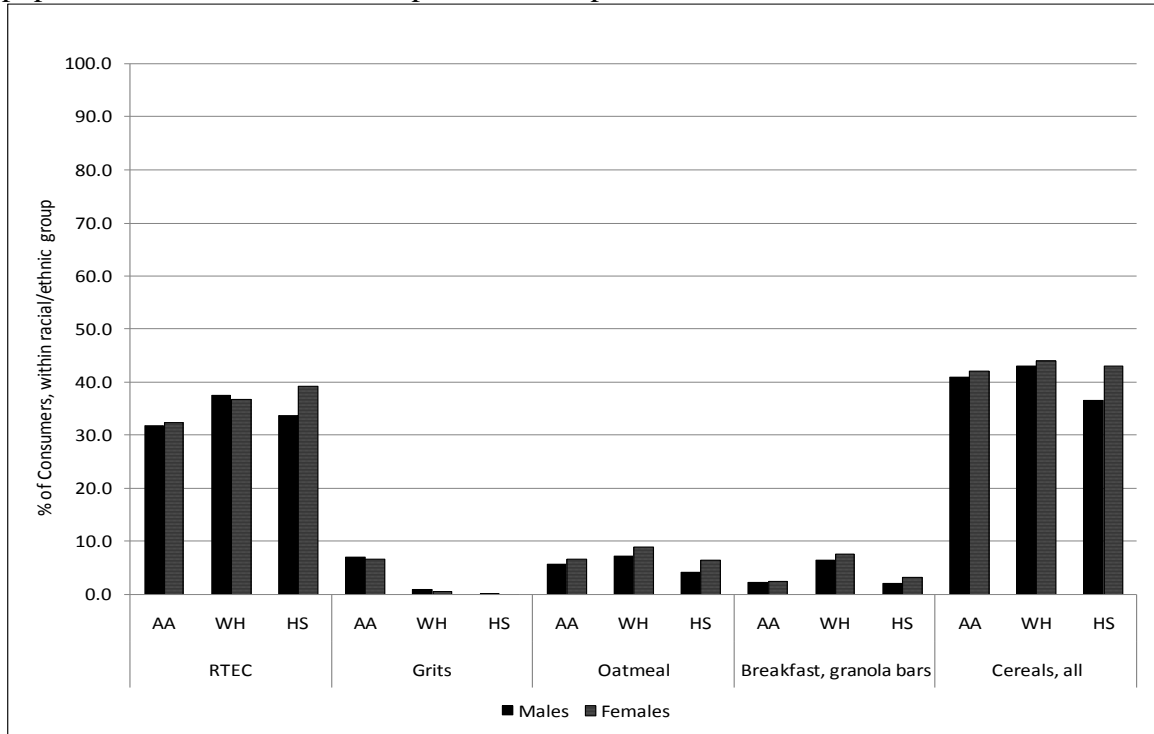
<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Couscous	0.1	± 0.0	0.2	± 0.1	0.0	± 0.0	0.0012
Lasagna	1.7	± 0.2	2.0	± 0.2	1.1	± 0.1	0.0004
Macaroni and cheese	14.1	± 0.5	9.7	± 0.3	4.6	± 0.3	<.0001
Noodles, all types	1.8	± 0.2	3.1	± 0.2	2.1	± 0.2	<.0001
Ravioli	1.3	± 0.2	1.6	± 0.1	0.7	± 0.1	<.0001
Spaghetti	9.9	± 0.4	9.5	± 0.3	7.9	± 0.4	0.0007
Spaghetti w/ tomato sauce	8.9	± 0.4	7.5	± 0.3	6.7	± 0.3	<.0001
Whole-wheat based	0.1	± 0.0	0.3	± 0.1	0.1	± 0.0	0.0107

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

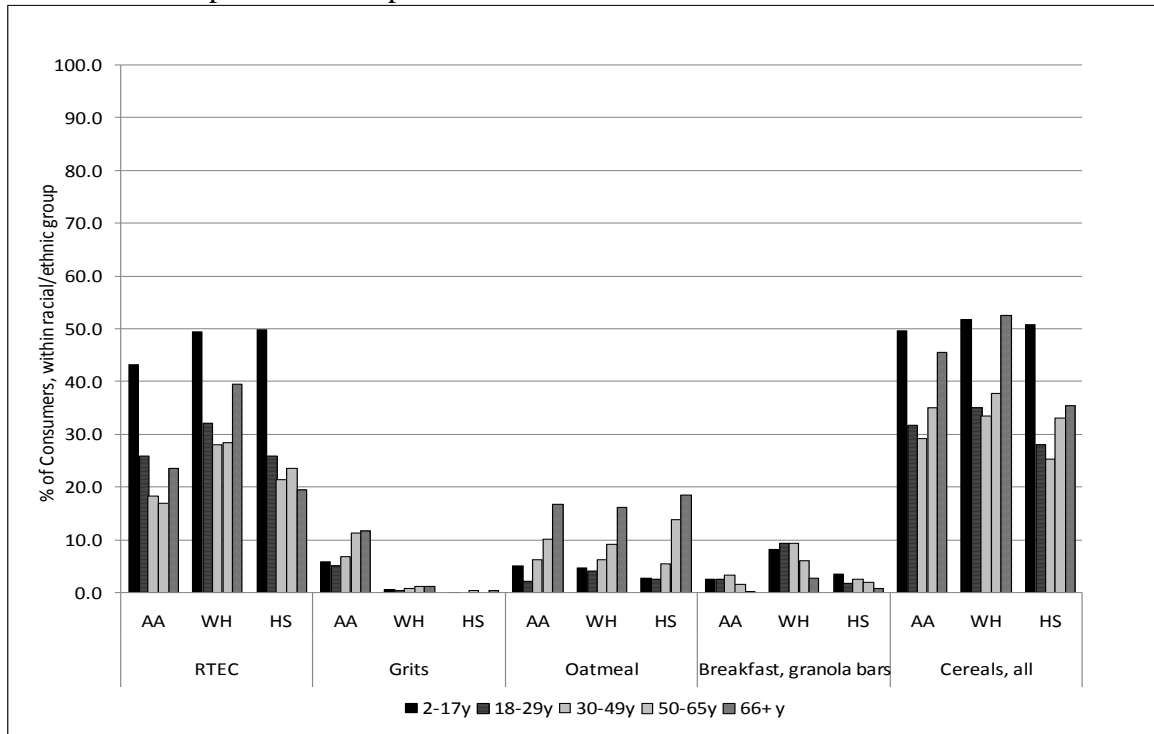
**Figure 5.3 Cereals, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Cereal* and specific cereal products



AA= African American; WH= White; HS= Hispanic

RTEC= Ready-to-eat cereal

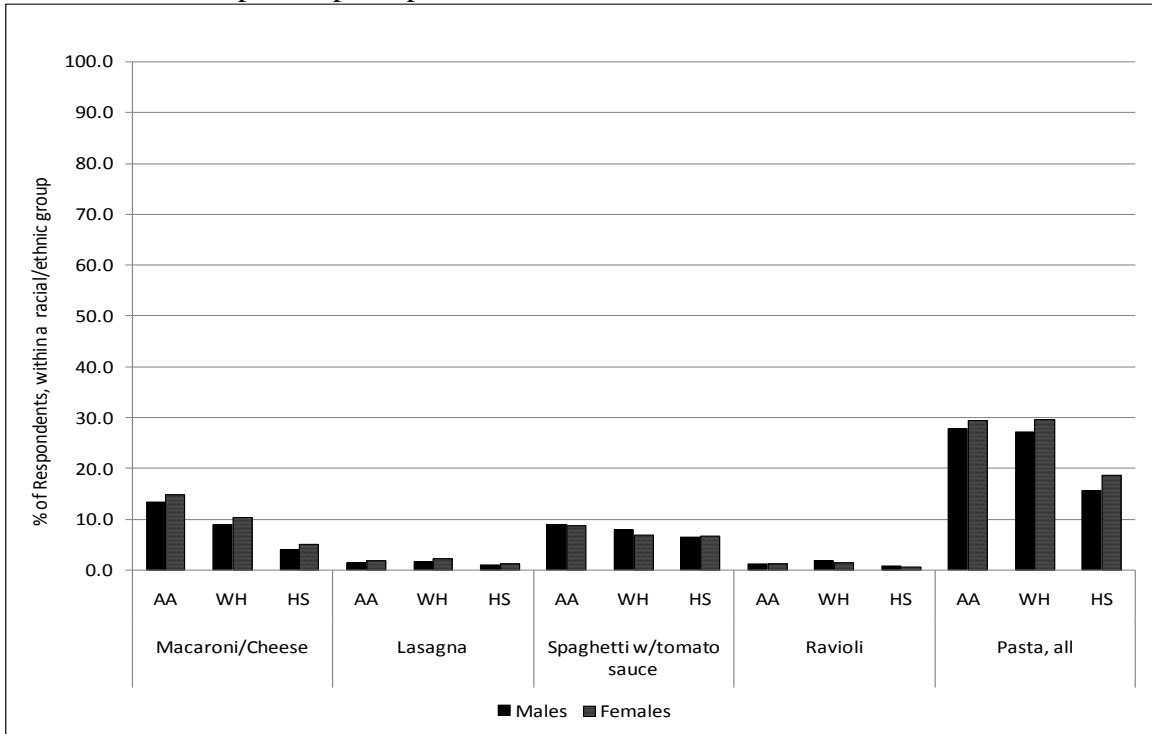
**Figure 5.4 Cereal, Age by Race/Ethnicity:** Consumption percentages of populations for *All Cereal* and specific cereal products



AA= African American; WH= White; HS= Hispanic

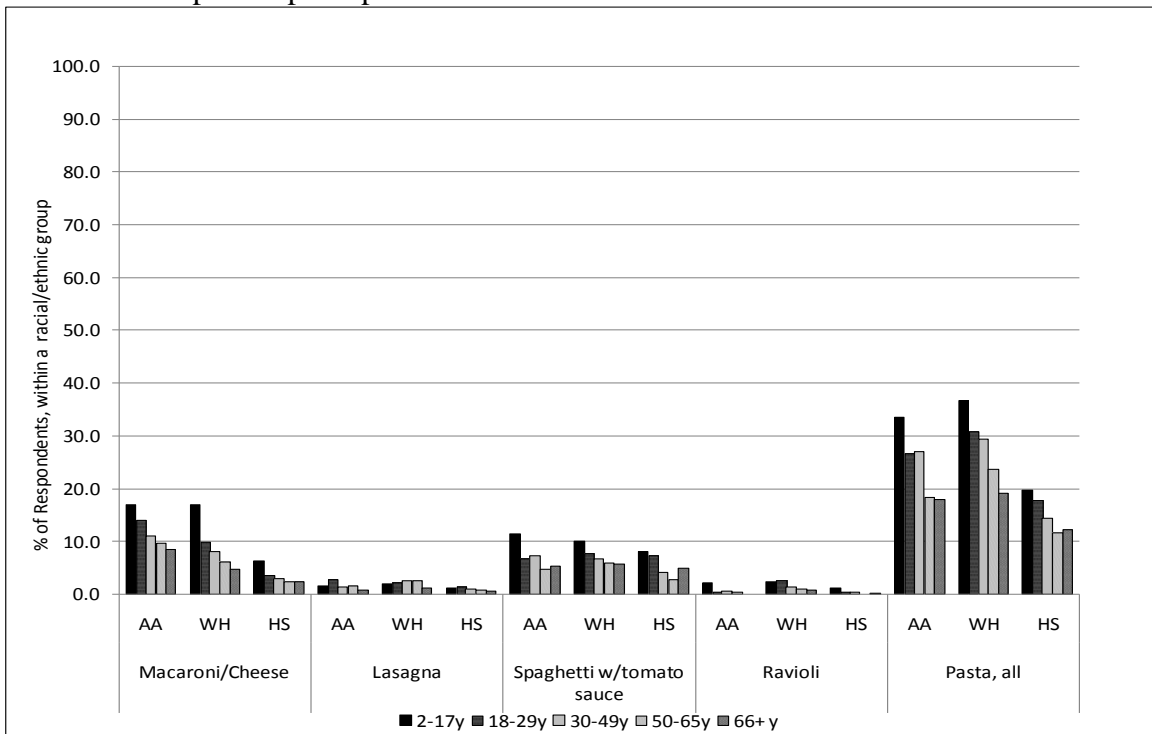
RTEC= Ready-to-eat cereal

**Figure 5.5 Pasta, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Pasta* and specific pasta products



AA= African American; WH= White; HS= Hispanic

**Figure 5.6 Pasta, Age by Race/Ethnicity:** Consumption percentages of populations for *All Pasta* and specific pasta products



AA= African American; WH= White; HS= Hispanic

**Table 5.6 Rice Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Brown, wild rice	1.7	± 0.2	1.1	± 0.1	1.6	± 0.2	0.0159
Fried rice	4.2	± 0.3	1.8	± 0.2	3.0	± 0.2	<.0001
White rice	11.7	± 0.5	4.4	± 0.2	11.2	± 0.4	<.0001
Rice w/ beans, peas, or other vegetables	2.6	± 0.2	1.0	± 0.1	3.5	± 0.3	<.0001
Spanish rice	0.7	± 0.1	1.5	± 0.1	8.0	± 0.4	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

**Table 5.7 Starchy vegetables/roots Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
All White Potato	55.2	± 0.7	54.6	± 0.6	46.2	± 0.7	<.0001
Fries	29.6	± 0.6	21.5	± 0.5	24.1	± 0.6	<.0001
Hash	3.1	± 0.2	3.2	± 0.2	2.7	± 0.2	0.273
Mashed	10.0	± 0.4	12.1	± 0.4	7.6	± 0.4	<.0001
Non Fried <sup>d</sup>	5.7	± 0.3	13.0	± 0.4	5.4	± 0.3	<.0001
Potato Salad	3.2	± 0.3	3.3	± 0.2	1.4	± 0.2	<.0001
Soup	0.2	± 0.1	1.0	± 0.1	0.3	± 0.1	<.0001
Plantains	0.6	± 0.1	0.1	± 0.0	1.1	± 0.1	<.0001
Taro, cassava, white sweet potato	0.3	± 0.1	0.1	± 0.0	0.2	± 0.1	0.0424

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

<sup>d</sup> Non-Fried= baked, roasted, boiled scalloped

**Table 5.8 Pizza Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

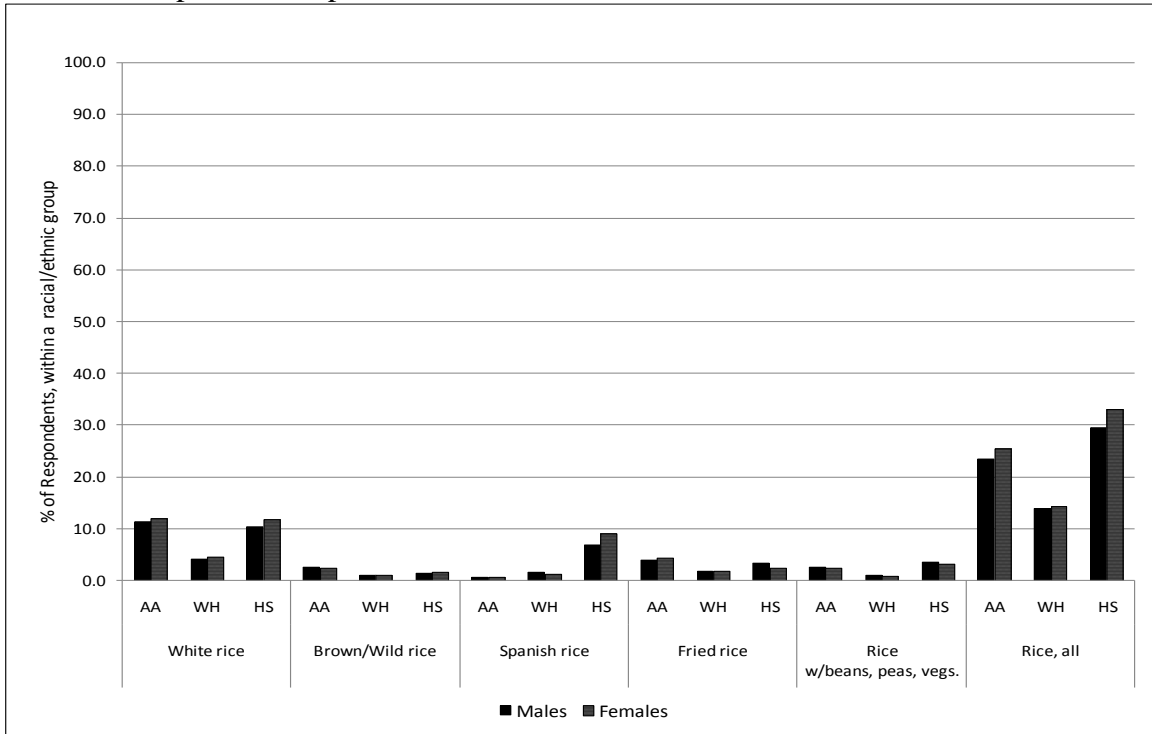
<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Pizza w/ cheese	6.8	± 0.4	6.9	± 0.3	4.8	± 0.3	<.0001
Pizza w/meat, seafood	14.1	± 0.5	13.7	± 0.4	15.4	± 0.5	0.023
Pizza rolls	0.4	± 0.1	0.5	± 0.1	0.3	± 0.1	0.1214

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

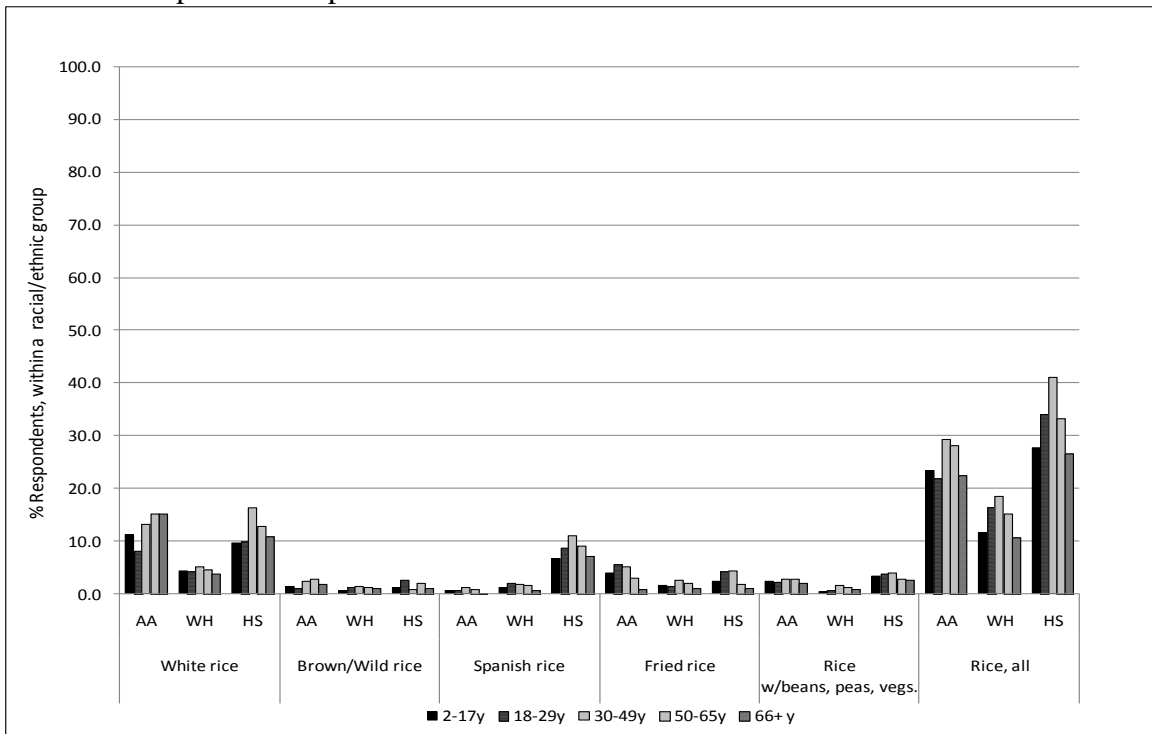
<sup>c</sup> P value for Pearson's chi-square test

**Figure 5.7 Rice, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Rice* and specific rice products



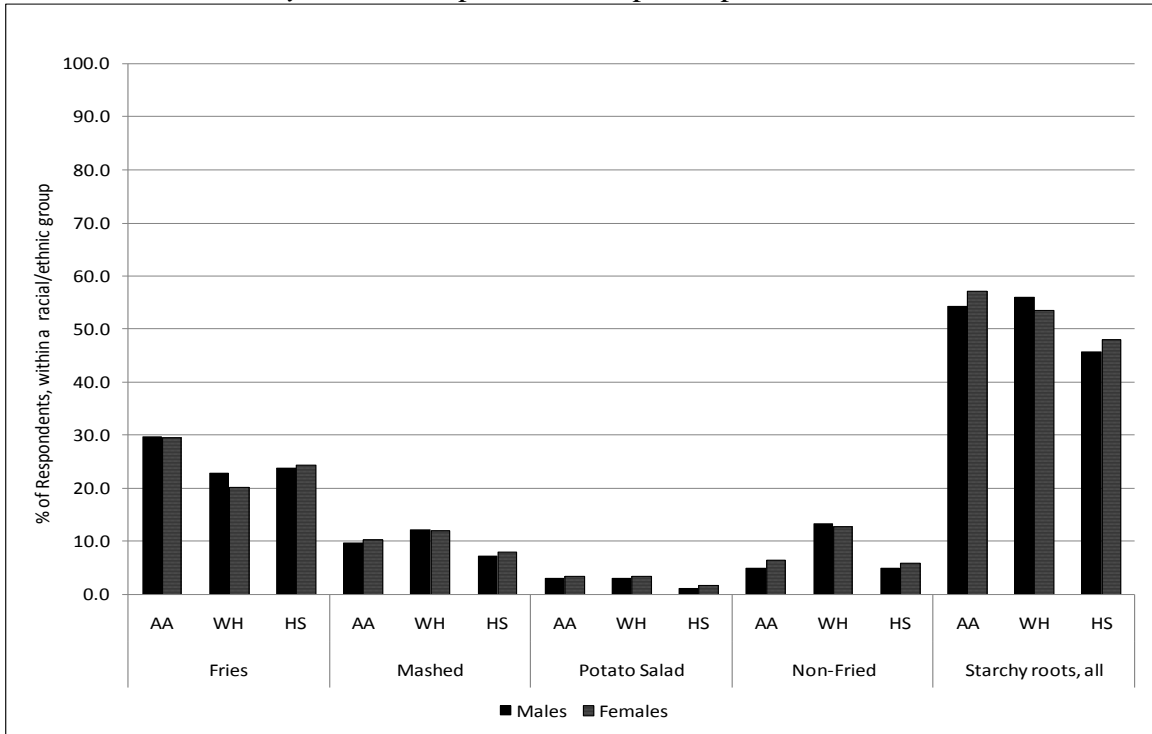
AA= African American; WH= White; HS= Hispanic

**Figure 5.8 Rice, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Rice* and specific rice products



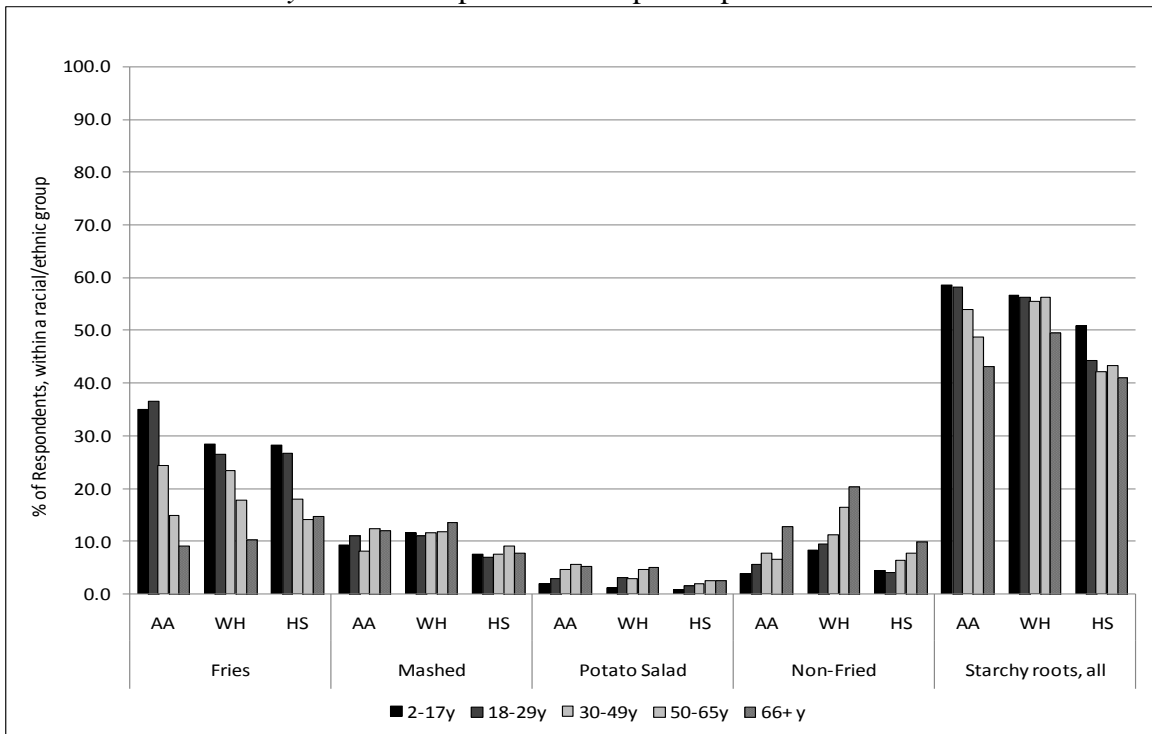
AA= African American; WH= White; HS= Hispanic

**Figure 5.9 Potato, Gender by Race/Ethnicity:** Consumption percentages of populations for All Selected Starchy Roots and specific white potato products



AA= African American; WH= White; HS= Hispanic Non-Fried= baked, roasted, boiled, scalloped

**Figure 5.10 Potato, Gender by Race/Ethnicity:** Consumption percentages of populations for All Selected Starchy Roots and specific white potato products



AA= African American; WH= White; HS= Hispanic Non-Fried= baked, roasted, boiled, scalloped

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# **CHAPTER 6 - Meat, Meat Products, and Legumes: Food Trends of African Americans compared to other racial/ethnic U.S. populations using NHANES 2003-2006 dietary survey data**

## **Introduction**

Meat (including poultry and fish) and meat based foods are an important part of the diets of many Americans and, in fact, form one of the key groups of the Food Guide Pyramid. Meat, fish, and legume foods provide a range of macronutrients, vitamins, and minerals including proteins, iron, zinc, fiber, omega -3 fatty acids needed for growth and healthy human development (Davis and Lin 2005; Rolfes et al. 1998).

Meats also contain some components that have been implicated in disease, such as saturated fat, cholesterol, and mercury that can result in heart disease, certain cancers, and (Gonzalez 2008; Luciano 2009; Booth and Zeller 2005). According to the 2005 Dietary Guidelines recommendations for the food guide pyramid, individuals are advised to consume 2-6 oz. of lean meat or other protein foods per day depending on age and gender (USDHHS 2005).

Meat consumption is a core part of Americans' diets and has been for a number of years (Gossard and York, 2003). Examination of data from the late 1800's, shows that both "white" and African American households consumed meat, but it often was not fresh meat (Dirks and Duran 2001). A study of food consumption across White, African-American, and Hispanic groups almost 100 years later (Patterson et al. 1995) showed wide spread use of meat and meat products including consumption by a greater percentage of people for fresh meat compared to processed or preserved meat. Diets high in red and processed meats have been associated with increased risk of coronary heart disease, hypertension, diabetes, and obesity (Steffen et al. 2005; Krauss et al. 2000; Lichtenstein et al. 1998). Conversely diets rich in lean meats, legumes, and nuts reduce the risk of some chronic diseases (Albert et al. 2002; Jiang et al. 2002 et al.; Bazzano et al. 2001). African American have high intakes of red and processed meat, low intake of

legumes and nuts thus partially explaining their high rates of hypertension and obesity (Wells and Buzby 2008; Hajjar and Kotchen 2003; Stevens 2000).

Several social, environmental, and individual factors such as income, education, gender, age, and race/ethnicity influence dietary consumption patterns (Deshmukh-Taskar et al. 2007; James 2004; Gossard & York 2003; Conner & Armitage 2002). Previous research has shown that meat and legume consumption differ by socioeconomic status, race/ethnicity, age and gender (Yen et al. 2008; Davis and Lin 2005; Putnam et al. 2002; Kristal et al. 1999). However, most studies have compared consumption in the context of nutrient intakes, energy intakes, and amounts (i.e grams, pounds) focusing on general categories of meat and legumes. A few studies have examined consumption patterns of specific types of meat and legumes (Nielsen et al. 2002; Patterson et al. 1995). This limited amount of published data on consumption patterns of specific meat and legumes for various racial/ethnic, age and gender warrants the need to further expand this area of research.

The purpose of this research was to examine consumption of selected types of meat and legumes consumed based on race and ethnicity, age and gender using 24-hour recall dietary data from survey years 2003-2006 of the National Health and Nutrition Examination Survey (NHANES).

## Materials and Methods

### *Data Source/Sample Population*

The 2003-2004, 2005-2006 NHANES 24-hour dietary recall data, known as *What We Eat In America* (WWEIA), were used for analysis of meat, poultry, fish, legumes, nuts, and seeds (here after referred to meat /legume group ) consumption. Two nonconsecutive days of 24-hr dietary recall and demographic information were analyzed to assess consumption patterns of participants who: 1) were at least two years of age, 2) had complete and satisfactory dietary recall data, and 3) were members of a selected racial/ethnic group. The total sample size for the surveys was 17, 885. The racial/ethnic, age, and gender characteristics of the survey samples are described in Table 1.

Individual Foods Files (IFF), containing foods coded for each individual, were accessed via the NHANES website to use for the meat /legume group food consumption comparison analysis. There were food files for each of the two recall days of each survey year, 2003-2004 and 2005-2006. Each food item in the IFF documents was assigned an 8-digit code. This code corresponded to codes and food descriptions in the USDA Food and Nutrient Database for Dietary Studies (FNDDS), which classifies food items by food groups and subgroups (USDA, FNDDS 2006, 2008). These food codes were used to identify the specific protein-rich food items used in the data analysis. A total of 2,055 food codes (1,729 codes- meat, poultry, eggs, fish/shellfish; 235 codes- legumes, nuts, seeds) from the FNDDS database were combined in this study to determine consumption overall or individually by food type.

For each food item, all consumption forms were combined to represent a food item. Because every possible meat/bean group product could not be evaluated, food items were selected if any of the following were true: commonly eaten, thought by the researchers to potentially show consumption differences or similarities, and listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007). Additional specific foods were added as data were compiled from the surveys based on frequency of consumption.



## *Data Analysis*

In view of the fact that the purpose of the research was to study foods consumed rather than nutrients consumed, the study utilized reports of population consumption frequency (i.e. meat or legume product or a particular given product consumed during either of the two recall reporting days constitutes "consumption" of the food category or that particular food for that individual) unlike most nutrition research, which focused on mean serving, nutrient, and energy intakes to understand consumption patterns of foods across race/ethnic groups and age and gender subgroups (Bachman et al. 2008; Beydoun et al. 2008; Cleveland et al. 2000). For the purpose of this research, consumption frequency refers to the proportion of a sample population who reported eating a food group or item.

Because every possible meat and legume product could not be evaluated, food items were selected if any of the following were true: commonly eaten, thought by the researchers to potentially show consumption differences or similarities, or listed in cultural food tables identifying common food items for a particular racial or ethnic group (Goody and Drago 2010; Kittler and Sucher 2007). All meat/bean group products, except gravies, in the FNDDS listing were included for total category counts. A total of six overall meat/bean subcategories were analyzed: beef, pork, poultry, fish/shellfish, mixed/processed meats, and legumes/nuts/seeds. To examine specific meat/bean foods, a total of 91 items comprised of multiple foods codes each were analyzed for consumption frequency by race/ethnicity.

To complete the statistical analysis, dietary recall and demographic data were pooled over the two non-conservative days and two survey years (2003-2004; 2005-2006). A Pearson's chi-square test was used to determine if there were significant differences between the proportions of "consumers" and "non-consumers" of identified food items for each racial/ethnic category, using the FREQ procedure in SAS® 9.2 (SAS Institute Inc., 2008). A significant difference was determined at 0.05 alpha level.

After evaluating the consumption rates across food items, foods with greatest percentages across racial/ethnic groups and those that appeared to have distinct race and ethnic differences were analyzed to further descriptively examine race by gender and race by age food intake patterns.

## **Results and Discussion**

### ***General***

A total of 78%, 81%, and 79% of African Americans, Whites and Hispanics respectively, consumed a meat, poultry, or fish product (Table 6.2) over the period of two days. The proportion of respondents consuming legumes ranged from 23% to 42%. This research contributes to the established notion that meat is a core part of Americans' diets (Gossard and York 2003; Davis and Lin 2005) and that legumes serve as a lesser, but important sources of protein.

There were significant differences ( $p < 0.05$ ) between racial/ethnic consumption reports for all food items except the total beef category, other poultry category (e.g. Cornish hen, pheasant, quail), canned tuna, shrimp, lamb, pecan, sunflower seed, and egg salad items. This research supports existing evidence that there are racial/ethnic differences in consumption of meats and legumes (Mitchell et al. 2009; Deshmukh-Taskar et al. 2007; Davis and Lin 2005; Kristal et al. 1999).

### ***Beef Consumption***

Beef was consumed by 46-48% of respondents in one of the three racial/ethnic groups (Table 6.2). Statistically, overall beef consumption was not significantly different for race/ethnicity. However, previous research has shown that African Americans were the largest consumers of beef among Whites and Hispanics (Davis and Lin 2005; Kristal et al. 1999). Although overall intake was similar among groups, consumption of specific beef items was different across the racial/ethnic groups.

Because of high levels of consumption, ground beef, steak, burgers, and beef with tomato based sauce food items were selected to further expand understanding of age and gender consumption trends by race/ethnicity. Some products were eaten by few people. For example, less than 1% of each racial/ethnic group reported eating corned beef and hash, brisket, sirloin, or oxtails (Table 6.3). African Americans and Whites tended to eat more corned beef and hash, whereas, Hispanics and Whites consumed more beef brisket or sirloin cuts compared to African Americans. Oxtails were primarily consumed by

African Americans. The consumption of organ or other atypical cuts of meat is a historic part of the African American diet (Weatherspoon et al. 2010; Opie 2008).

This research shows that across all ethnic groups, males tended to consume more beef than females (Figure 6.1). These results support previous findings for gender differences in beef consumption (Davis and Lin 2005; Gossard and York 2003). Specifically, Gossard and York (2003) reported that women on average consume fewer grams of beef per day (about 17 grams less) than men. Beef consumption tended to increase with age from ages 2- 49 years (Figure 6.2). Previous research has shown that beef consumption increased with age and young adults consume the most amounts of beef (Gossard and York 2003). Interestingly, as African Americans aged their beef consumption tended to decrease. This could be an indication that as African Americans age individuals shift from eating beef to other types of meat. This research highlights that gender and age impact beef consumption.

### **Race/Ethnicity by gender and age comparisons**

Ground beef (other than hamburgers) was consumed the most followed by hamburgers and steak products (Table 6.3). Based on 1994-1996 and 1998 continuing Survey of Food Intakes by Individuals (CSFII), ground beef was eaten the most compared to other fresh and processed beef products (Davis and Lin 2005). This research supports and updates previous ground beef consumption data based on nationally representative data.

Males tended to consume more ground beef compared to females. This further highlights previous mention of gender differences in beef consumption. Among African Americans and Hispanics ground beef consumption tended to decrease with age (Figure 6.3). This decline in consumption was not as apparent among Whites. Ground beef consumption was similar across the different White age groupings until age 66 years. This could indicate that as Americans age their beef consumption changes from ground beef to other cuts of beef such as steak. Findings in this research for steak consumption rates support this idea.

According to Figure 6.3, steak consumption tended to increase up until age 49 years. White and Hispanic males reported consuming more steak items than their female

counterparts (Figure 6.2). These racial/ethnic differences in the consumption of steak could be attributed to influences of social status on meat consumption. It has been thought that consumption of certain meats may serve as a “status marker” or status symbol (Gossard and York 2003). Less consumption of steak among African Americans could be a function of income and diet. African Americans tend to have lower household incomes compared to Whites (USDHHS Minority Report 2010).

African Americans consumed more hamburgers than Whites and Hispanics. Hamburgers, items that tend to be eaten away from home, are affordable and convenient foods (Nielsen et al. 2002; Lin et al. 1999*b*). More males than females reported eating a hamburger during the two survey period (Figure 6.1). Specifically, African American males ate more burgers than other participants. This finding is consistent with previous research showing African American males consuming more burgers than White and African American women (Deshmukh-Taskar et al. 2007). Furthermore, Davis and Lin (2005) reported that gender differences exist for beef consumption. Respondents ages 18-29 years consumed hamburgers more than any other age group (Figure 6.2). The consumption of hamburgers declined with an increase in age. This confirms published research showing age-related differences in the consumption of hamburgers. A reason for a greater proportion of 18-29 year olds consuming hamburgers could be that they tend to eat a large proportion of their meals at restaurants or fast food establishments and hamburgers are foods often eaten away-from-home (Nielsen et al. 2002; Lin et al. 1999*b*). This research suggests that males, children, and young adults may prefer hamburgers or have greater access to them than other demographic segments.

Beef in a tomato based sauce such as spaghetti or chili was consumed more by Whites than Hispanics and African Americans. Research has shown that Whites consume more vegetable products, such as tomato items, than African Americans and Hispanics (Guenther et al. 2006; Patterson et al. 1995). This shows how consumption of beef could promote the consumption of vegetables or vice versa thus impacting dietary quality. Consumption of beef with tomato type sauce such as spaghetti or chili was comparable among males and females. Beef in a sauce was comparable across the age cohorts for African American and Whites. Hispanics ages 30 and older consumed more

beef in a sauce items than their younger counterparts. These findings suggest that eating beef in a sauce is mitigated more by race/ethnicity and age than gender.

This research emphasizes the fact that different racial/ethnic groups consume beef in various ways. Such findings need to be considered in making dietary recommendations and when developing targeted nutrition education materials to promote or discourage consumption of certain types of beef.

### ***Pork Consumption***

Data analysis of pork products showed consumption differences among African Americans, Whites, and Hispanics (Tables 6.2 & 6.4). A total of 29-35% of the survey respondents indicated eating some type of pork. These data demonstrate one third of the diverse populations tend to eat this type of meat.

African Americans and Whites had a tendency to consume more pork products than Hispanics (Table 6.2). These results corroborate findings from national survey data demonstrating that pork consumption differs across various racial/ethnic populations (Davis and Lin 2005*b*; Patterson et al. 1995). This report of African Americans consuming less pork than Whites contrasts previous research demonstrating African Americans were the largest consumers of pork in 1994-1996, 1998 (Davis and Lin 2005*b*). The fact that the data in the current investigation is from 2003-2006 implies that there has been a shift in African Americans consumption of pork. White males reported consuming pork the most (Figure 6.3).

In this evident in this research, processed pork such as ham and bacon are consumed more than fresh pork items like pork chops. This is consistent with previous research (Davis and Lin 2005*b*). Pork chop consumption was lower than ham or bacon consumption (Table 6.4). Only about 4% of each racial/ethnic group reported eating this pork product. Fresh meat products tend to cost more than processed products, therefore offering a possible explanation for the lower consumption rate (Davis and Lin 2005*b*). Other reasons, such as the fact that ham reasonably is eaten at any meal while pork chops often are consumed only at the largest meal of the day may impact these findings as well.

Whites and Hispanics reported eating steak, cutlet or tenderloin cuts of pork more than African Americans although consumption in all groups was less than 1%. Pork roast was eaten more by Whites than African Americans and Hispanics. However, African Americans and Hispanics ate more pig extremity parts (i.e. feet, ears, skin) compared to Whites. Ham hocks, fat back, and chitterlings were consumed more by African Americans than Whites and Hispanics. These pork products are traditional food items in the African American diet eaten during holidays or as a seasoning meat (Weatherspoon et al. 2010). This research suggests that race/ethnicity correlates with the type of pork products consumed. These racial/ethnic differences could be based on cultural traditions, socio-economic status, and availability of various pork foods (Davis and Lin 2005*b*; Kittler and Sucher 2007).

Ham, bacon, and pork chops were consumed the most of the specific pork items. These items were selected for further analysis of racial/ethnic, age, and gender differences.

### **Race/Ethnicity by gender and age comparisons**

Pork consumption was comparable among African American males and females. The same was true among Hispanics. There have been mixed results on gender differences in the consumption of pork. Some research has shown that men consume more pork than women (Davis and Lin 2005*b*; Rolls et al. 1991) and found no differences by gender (Patterson et al. 1995). This research adds to contrast of information regarding male and female eating habits of pork.

From this investigation, there is a relationship of pork consumption and age. Adults 30 years and older tended to eat more pork than children and young adults (Figure 6.4). Davis and Lin (2005) found that pork consumption rates are age related. Therefore, it reasonable to consider that taste preference for pork may be age dependent.

Consumption of ham differed among the racial/ethnic sample populations. As shown in table 6.4, Whites (17.2%) consumed more ham items than African Americans (13.8%) and Hispanics (14.1%). White males reported the greatest consumption of ham. Hispanic male and female consumption of ham was similar (Figure 6.3). Children and young adults (18-29 years) reports of eating ham were comparable (Figure 6.4). Older

(66+) Whites had the highest report of ham consumption. Among Hispanics, the eating of ham tended to decrease with age. African Americans across the various age groups ate ham similarly, although slightly higher consumption was noted in 50-65 year olds.

Bacon was consumed more by African Americans and Whites than Hispanics (Table 6.4). Hispanic females tended to consume more bacon than their male counterparts (Figure 6.3). Conversely, White males ate more bacon than White females. Consumption of bacon was comparable among African American males and females. The eating of bacon had a tendency to increase with age from ages 2 to 65 years (Figure 6.4).

Pork chop consumption was comparable among males and females, but eating of pork chops varied across age groups (Figure 6.4). Small differences in pork chop consumption were noted with consumption in all race/ethnic groups higher for 50-65 year olds.

Most research on examining meat or pork consumption discussed the entire category of pork not specific pork products (Yen et al. 2008; Gossard and York 2003; Neilsen et al. 2002). However, this research expands information on pork describing consumption of various pork products as related to socio-demographic factors.

### ***Poultry Consumption***

Poultry and eggs were consumed by 47% to 58% of the survey participants across the three racial/ethnic groups (Table 6.2). Consumption of poultry has increased over the years with increasing emphasis on eating less saturated fat and cholesterol (Wells and Buzby 2008). African Americans tended to consume more poultry/egg products than Hispanics and Whites. This research supports previous studies documenting differences in racial/ethnic intake of poultry (Yen et al. 2008; Lin et al. 2003; Patterson et al. 1995).

Chicken was consumed more than turkey food items (Table 6.5). Females tended to consume more chicken and turkey than their male counterparts (Figures 6.5 & 6.7). Interestingly, this is the inverse of beef consumption previously discussed.

Eggs were consumed by 33% of Hispanics and 26% of African Americans and Whites (Table 6.5). Recommendations to reduce egg consumption because of perceived

negative health implications could explain the observed consumption rates of eggs (Krauss et al. 2000). A fried type egg product was the most commonly eaten egg items in this analysis (products where egg was a minor ingredient such as in mayonnaise or cakes were excluded). African American and White males consumed more eggs than their female counterparts (Figure 6.5). Egg consumption increased with age. Americans 30 and older ate more eggs than children and young adults (Figure 6.6). This research shows consumption differences of eggs depends on how an egg is prepared or eaten as well as race/ethnic, gender, and age characteristics.

Consumption of the specific turkey items (cooked, ground, turkey with dressing; turkey -pork meat alternatives) was low regardless of race/ethnicity (Table 6.5). However, consumption of turkey bacon, turkey ham, or turkey sausage (pork meat alternatives) was greater among African Americans than Whites and Hispanics. African Americans have been shown to have higher intakes of pork and, therefore, more saturated fat and cholesterol and lower diet qualities (Davis and Lin 2005*b*; Basiotis et al. 1998). Switching to turkey based products reminiscent of bacon or ham for health reasons may explain the consumption of these products by African Americans. Turkey consumption varied across age groups especially among Whites (Figure 6.6).

Chicken was the most consumed poultry item. There was low consumption of chicken salad, soups, and ground chicken. Fried, non-fried (e.g. baked, roasted, etc.), and processed chicken products (fillets, patties, nuggets) were further examine to identify trends of chicken consumption by race/ethnicity, age, and gender.

Interestingly, fried chicken was consumed more by Whites and Hispanics than African Americans. Conversely, Patterson et al. (1995) reported that more African Americans consumed fried chicken than Whites. Fried chicken has been considered a traditional food item of African American diets (Opie 2008; Bower 2007; Kittler and Sucher 2007).

### **Race/Ethnicity by gender and age comparisons**

Chicken fillet, patties and nuggets were consumed by approximately 12-15% of the survey populations. African Americans consumed more of these chicken products compared to Hispanics and Whites. For Hispanics and African Americans, males tended



to consume more of these items compared to their female counterparts (Figure 6.7). Consumption of chicken fillets, patties, and nuggets decreased with age (Figure 6.8). Fewer than 10% of Americans age 30 and older ate these types of chicken products. In general males, children, and adults 18-29 years tend to eat chicken fillets, patties, and nuggets. Research has shown that children and 18-29 year olds tend to eat restaurant and fast foods more than older persons (Lin et al. 1999). Therefore, the preference for fast foods may explain the age differences in consumption of chicken products such as nuggets.

Fried chicken consumption did vary by age more so than gender. Males and females had similar consumption of fried chicken (Figure 6.7). Adults 30-65 years tended to consume more fried chicken than children (2-17 years) and older adults (66+ years). This may be because children are substituting chicken nugget type products for fried chicken and older adults who are focused on health have reduced their consumption of fried products.

Baked, roasted, stewed, or broiled chicken was consumed more by African Americans and Hispanics than Whites (Table 6.5). Females tended to eat these non-fried chicken options more than males (Figure 6.7). This supports the idea that females tend to focus on weight management and monitor nutrient intakes, such as fat, by eating healthier (i.e. less fat) food options (Rolls et al. 1991). Consumption of these non-fried chicken foods tended to increase with age, except for Whites 66 years and older (Figure 6.8). As people age, dietary habits change and older people focus on developing healthy diets which includes the consumption of low fat foods (Lin et al. 2003).

These findings provide evidence that there are racial/ethnic, gender, and age differences in the consumption of processed chicken products.

### ***Fish& Other/Processed Meats Consumption***

#### **Fish/Shellfish**

Only 15-20% of the participants reported eating fish and shellfish (Table 6.2) in the two-day period. This supports findings in published studies that Americans eat more beef, pork, and poultry than fish (Lin et al. 2003; Putnam et al. 2002).

African Americans (20.1%) and Whites (19.5%) consumed more fish than Hispanics (15.4%) (Table 6.6). Hispanic and African American females consumed more fish than their male counterparts (Figure 6.9). However, Yen et al. (2008) reported men eating more fish than women. This can be seen among Whites in which more males reported consuming fish than females. The consumption of fish increased with age (Figure 6.10). The proportion of adults 30-66 years consuming fish was nearly twice the number of 2-29 year olds eating fish.

There were racial/ethnic differences in the consumption of specific fish products except for shrimp and tuna salad foods. African Americans consumed more catfish than Whites and Hispanics although consumption reports were 2% or less. Catfish is a traditional food item of the African American diet. The intake pattern of catfish demonstrates that consumption of certain foods is related to race/ethnicity.

Fish is a healthy meat alternative to red meats and chicken. Several fish products are high in omega-3 fatty acids which have been shown to be protective against the risk of some cancers and coronary heart disease (Hu et al. 2002; Fernandez et al. 1999). This research demonstrates that more Americans should consume fish therefore increasing their intake of unsaturated fats versus saturated adhering to the 2005 Dietary recommendations (USDHHS 2005).

### **Other/Processed Meats**

The category of other and processed meats include organ meats (liver, tripe), ribs, neckbones, lamb, veal, game, frankfurters, and luncheon meats. There were consumption differences by race/ethnicity of these products except for lamb (Table 6.6).

African Americans consumed more ribs, neckbones, and organ meats compared to Whites and Hispanics. African American females consumed more ribs compared to their male counterparts (Figure 6.9). The consumption of ribs tended to increase with age (Figure 6.10). Conversely, Hispanics consumed more tripe, a traditional food in some Latin American communities, than Whites and African Americans. These results demonstrate that there is a racial/ethnic use factor impacting the consumption patterns of certain meats. Furthermore, this research supports the idea that individuals tend to include foods in the diet that are traditional items in their cultures (Kittler and Sucher 2007).

Whites and African Americans consumed more hot dogs and luncheon meat than Hispanics (Table 6.6). This racial/ethnic difference in hot dog consumption is consistent with previous research findings (Patterson et al. 1995). More White males reported eating hot dogs than Whites females (Figure 6.9). Unsurprisingly, hot dog consumption decreased as age increased (Figure 6.10). Children tend to eat more hot dogs than adults. Nielsen et al. (2002) that energy intake from hot dogs decreased with age.

The consumption of luncheon meat was comparable among males and females for both African Americans and Hispanics (Figure 6.9). Fewer Whites females ate hot dogs than their male counterparts during the two-day survey period. Luncheon meat consumption was variable among the age cohorts. Within each racial/ethnic group for age, consumption fluctuated in non distinct patterns. According to previous research, consumption of luncheon meats tends to decrease with age (Nielsen et al. 2002). Processed meats like luncheon meats and hot dogs tend to be high fat meats and convenient to eat. Thus this may explain the consumption differences of these foods across various age groups.

Evidence in this research expands existing research showing that dietary patterns of certain meats are influenced by demographic factors of race/ethnicity, age, and gender.

### ***Legumes, Nuts, Seeds Consumption***

Consumption of legumes, nuts and seeds was less than 50% (Table 6.2). This is consistent with previous research (Mitchell et al. 2009; Lucier et al. 2000). Furthermore, this research demonstrated that there are racial/ethnic, age, and gender differences in the combined consumption of legumes, nut, and seeds. The consumption reports of all legumes/nuts/seeds were higher for Hispanics than for African Americans and Whites. In this research, further comparisons of specific legumes/nuts/seeds showed that dry bean consumption was responsible for the high consumption in this category among Hispanics. For the all legume/nuts/seeds item analysis, Hispanic females tended to consume more of these foods compared to their male counterparts (Figure 6.11). All legume/nut/seeds consumption increased as age increased, except for a decline from age group 2-17 years to 18-29 years among African Americans (Figure 6.12).

Analysis of specific legume/nut/seeds showed that there were low consumption reports across the different racial/ethnic groups (Table 6.7). However, racial/ethnic differences in consumption were apparent. For example, 17% of Hispanics reported eating pinto beans compared to the less than 2% of African Americans and Whites.

The all dry beans category, all nuts and seeds category, and peanut butter items were analyzed to further examine the relationships of consumption of race/ethnicity by gender and age.

### **Race/Ethnicity by gender and age comparisons**

In table 6.7, more than twice the proportion of Hispanics (31%) consumed dry beans compared to Whites (10%) and African Americans (7%). This supports previous research showing high consumption of dry beans and peas among Hispanics (Black et al. 2009; Mitchell et al. 2009; Lucier et al. 2000). Research by Black and colleagues (2009) demonstrated differences in dry bean consumption among Hispanics, African Americans, and Whites in a nutrition supplement program. Dry bean consumption was comparable among Hispanic males and females (Figure 6.11). Considering age comparisons, 30-65 year old participants consumed beans more than 2-29 year old respondents (Figure 6.12). Americans should consume more beans as a way to meet protein requirements and increase vegetable consumption (often eaten in conjunction with beans) which remains below recommended levels (Guenther et al. 2006).

Nuts and seeds were consumed more by Whites than African Americans and Hispanics. More specifically, Whites consumed more almonds, cashews, and walnuts than African Americans and Hispanics (Table 6.7). Nuts and seeds consumption was comparable among White males and females. However, Hispanic females and African American males consumed more nuts and seeds than their gender counterparts (Figure 6.11). Children (2-17 years) consumed more nuts and seeds than 18-29 year olds. After age 29, nuts and seeds consumption had a tendency to increase with age (Figure 6.12). Moderate consumption of nuts has been associated with reducing the risk of certain chronic diseases (Albert et al. 2002; Jiang et al. 2002). Eating nuts is part of a recommend strategy for consuming more unsaturated fats as part of a healthy diet (USDHHS 2005). Therefore, this could be the reason Whites, who tend to be aware of

nutrition and health benefits of foods (Blaylock et al. 1999), ate more nuts than their African American and Hispanic counterparts.

Peanut butter consumption was highest among Whites, about 15% (Table 6.7). Approximately, 7 % of African Americans and Hispanics reported that they ate peanut butter during the two day survey period. Hispanic females consumed more peanut butter than their male counterparts (Figure 6.11). There were distinct trends in the consumption of peanut butter by different age groups. Children ate more peanut butter than adults (Figure 6.12). Peanut butter, paired with other foods like jelly or bananas, often is given to children because it is rich in nutrients, has a sweet taste, and is convenient. Consumption of peanut butter has been associated with the reduced risk of type-2 diabetes (Jiang et al. 2002). Nuts and nut butters are sources of vitamins, minerals, and unsaturated fats that can reduce the risk of some chronic diseases and help improve overall diet quality consumption (Albert et al. 2002; Dreher et al. 1996). Therefore, adults could consume more peanut butter in an effort to practice healthy eating habits and reduce the risk of life threatening diseases such as coronary heart disease.

## **Conclusions**

This research demonstrates that dietary consumption trends of meat and protein based foods differ by race/ethnicity, age, and gender. African Americans' high intakes of meat and low intakes of fish and legumes are evident. In addition, higher intakes of hamburgers and organ meats among African Americans and higher intakes of fried chicken for example among Whites suggest some dietary patterns that may need to be changed. The results presented in this research can serve as reference points for future research exploring the relationships of meat and legume dietary intake and the demographic factors.

This investigation also provides consumption data on specific types of meat and legume foods. There is a need to understand dietary patterns as means to more effectively impact dietary habits across diverse populations (Barboukis 2007). It has been shown that dietary knowledge inversely impacts consumption of beef and pork (Yen et al. 2008), thus helping to reduce the risk of chronic disease and poor diet quality. This

information on the consumption of specific products by various groups provide suggestions for further development of culturally sensitive nutrition assessment tools, educational materials, intervention strategies, and new foods to maintain and improve diet quality through changes in meat and legume consumption.

### **Research Implications**

The current research emphasizes the ongoing need to reduce the consumption of high-fat and processed meats and increase the consumption of fish, shellfish, and legumes. There is a need to create strategic and innovative ways to promote the consumption of lean meats, beans, and nuts particularly within the context of gender differences and cultural traditions. For example, this research showed that there is an opportunity for nutrition educators to target males in terms of developing materials and techniques to reduce the consumption of beef. The consumption of various protein rich foods such as steak, pork chops, chicken, and beans is culturally related and highlight opportunities for future research to investigate the preparation and consumption of these foods for a better understanding of diet health issues within racial/ethnic groups with distinct health disparities. The data from this research can be used to identify foods in which lean protein rich alternatives can be emphasized to improve overall diet health such as promoting salmon, tilapia, black bean, and nut consumption.

## **Limitations**

A caveat to this research is that the overall categories of meats and legumes foods were coded based on the USDA food nutrient database coding scheme, excluding gravies from meat, poultry and fish. If meat or legume food items were consumed but coded outside the meat and legume categories by the USDA (e.g. vegetables as ingredients in a meat pie), then those items were not included in the study.

It also is important to acknowledge that race/ethnicity and food consumption is confounded with other socioeconomic, lifestyle, and agricultural variables: income, education, geographic residency, family structure, eating occasions, food consumption at home or away from home, food accessibility, availability, seasonality, and familiarity, and attitudes and perceptions regarding different fruit and vegetable foods. Although it is possible to evaluate some of those variables using NHANES data, the primary focus of the research was to assess consumption of specific meat, meat products and legume-based foods by major racial/ethnic groups. Thus it is probable that race/ethnicity alone is not the driving reason for different consumption patterns.

It is essential to note that the objective of this research was not to imply that different racial/ethnic groups are genetically pre-disposed or limited to eating specific meat and legume type products. The goal was to understand food intake patterns using race/ethnicity as a differentiating factor, and gender and age as additional groupings.

## Tables and Figures

**Table 6.1 Demographic characteristics of sample by race/ethnicity, age and gender from 2003-2004, 2005-2006 NHANES data**

	African		
	American	Caucasian	Hispanic
<b>n</b>	4994	7525	5366
<b>Age</b>			
2-17y	2465	2027	2683
18-29y	864	1159	976
30-49y	780	1522	843
50-65y	512	1142	456
66+ y	373	1675	408
<b>Gender</b>			
Males	2477	3668	2586
Females	2517	3857	2780
Sample Total, N= 17885			

**Table 6.2 All Meat, Poultry, Fish, Legumes Consumption - Percent of respondents, 2 years or older, by race/ethnicity**

<b>Food Group/Item<sup>a</sup></b>	African American (non-Hispanic) n= 4994		White (non-Hispanic) n= 7525		Hispanic n= 5366		<b>p -value<sup>c</sup></b>
	%	± SE <sup>b</sup>	%	± SE	%	± SE	
All Meat, Poultry, Fish	78.2	± 0.6	80.6	± 0.5	79.1	± 0.6	0.0027
Beef, All	46.1	± 0.7	47.2	± 0.6	48.4	± 0.7	0.0665
Fish & Shellfish, All	20.1	± 0.6	19.5	± 0.5	15.4	± 0.5	<.0001
Pork, All	34.3	± 0.7	35.2	± 0.6	29.0	± 0.6	<.0001
Poultry, All	65.0	± 0.7	58.8	± 0.6	64.0	± 0.7	<.0001
All Legumes, nuts, seeds	23.5	± 0.6	36.4	± 0.6	42.3	± 0.7	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test



**Table 6.3 Beef Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

Food Group/Item <sup>a</sup>	African American (non-Hispanic) n= 4994		White (non-Hispanic) n= 7525		Hispanic n= 5366		p -value <sup>c</sup>
	%	± SE <sup>b</sup>	%	± SE	%	± SE	
Beef brisket, sirloin	0.0	± 0.0	0.3	± 0.1	0.4	± 0.1	0.0016
Beef, roast + roast beef	2.5	± 0.2	4.6	± 0.2	2.0	± 0.2	<.0001
Beef stew	0.8	± 0.1	1.2	± 0.1	1.2	± 0.1	0.0298
Beef, tomato based sauce <sup>d</sup>	4.6	± 0.3	5.3	± 0.3	4.3	± 0.3	0.0218
Corned beef+ hash	0.8	± 0.1	0.8	± 0.1	0.3	± 0.1	0.0011
Ground beef	13.3	± 0.5	14.4	± 0.4	15.6	± 0.5	0.0045
Hamburger- plain, cheese	11.8	± 0.5	7.7	± 0.3	9.3	± 0.4	<.0001
Oxtails	0.4	± 0.1	0.0	± 0.0	0.0	± 0.0	<.0001
Steak	7.5	± 0.4	9.4	± 0.3	13.7	± 0.5	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

<sup>d</sup> Sauce- i.e. spaghetti meat sauce, chili con carne, sloppy joe

**Table 6.4 Pork Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

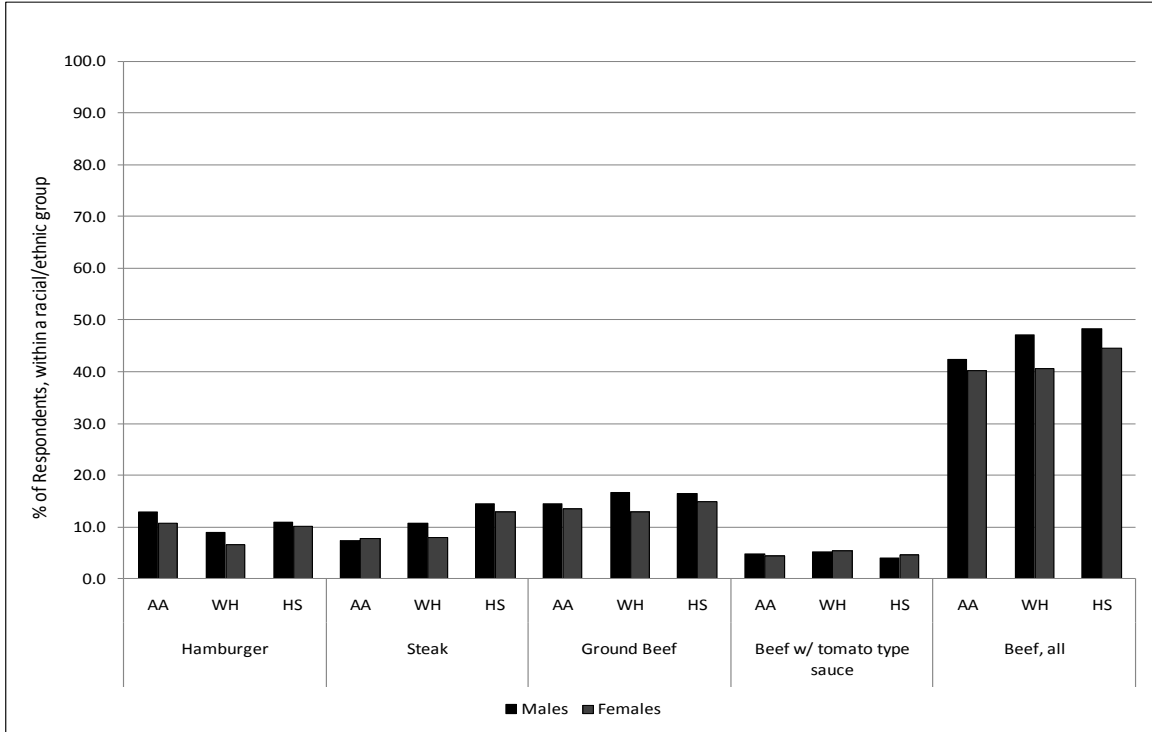
Food Group/Item <sup>a</sup>	African American (non-Hispanic) n= 4994		White (non-Hispanic) n= 7525		Hispanic n= 5366		p -value <sup>c</sup>
	%	± SE <sup>b</sup>	%	± SE	%	± SE	
Bacon	8.7	± 0.4	8.4	± 0.3	4.1	± 0.3	<.0001
Chitterlings, chitlins	0.2	± 0.1	0.0	± 0.0	0.0	± 0.0	<.0001
Ham, all	13.8	± 0.5	17.2	± 0.4	14.1	± 0.5	<.0001
Ham hocks, fat back	0.5	± 0.1	0.1	± 0.0	0.0	± 0.0	<.0001
Pig- feet, ears, skin	0.9	± 0.1	0.2	± 0.1	1.3	± 0.2	<.0001
Pork chop	4.8	± 0.3	4.4	± 0.2	3.6	± 0.3	0.0062
Pork roast	0.3	± 0.1	1.4	± 0.1	0.3	± 0.1	<.0001
Pork- steak, cutlet, tenderloin	0.4	± 0.1	0.9	± 0.1	0.9	± 0.1	0.0023

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

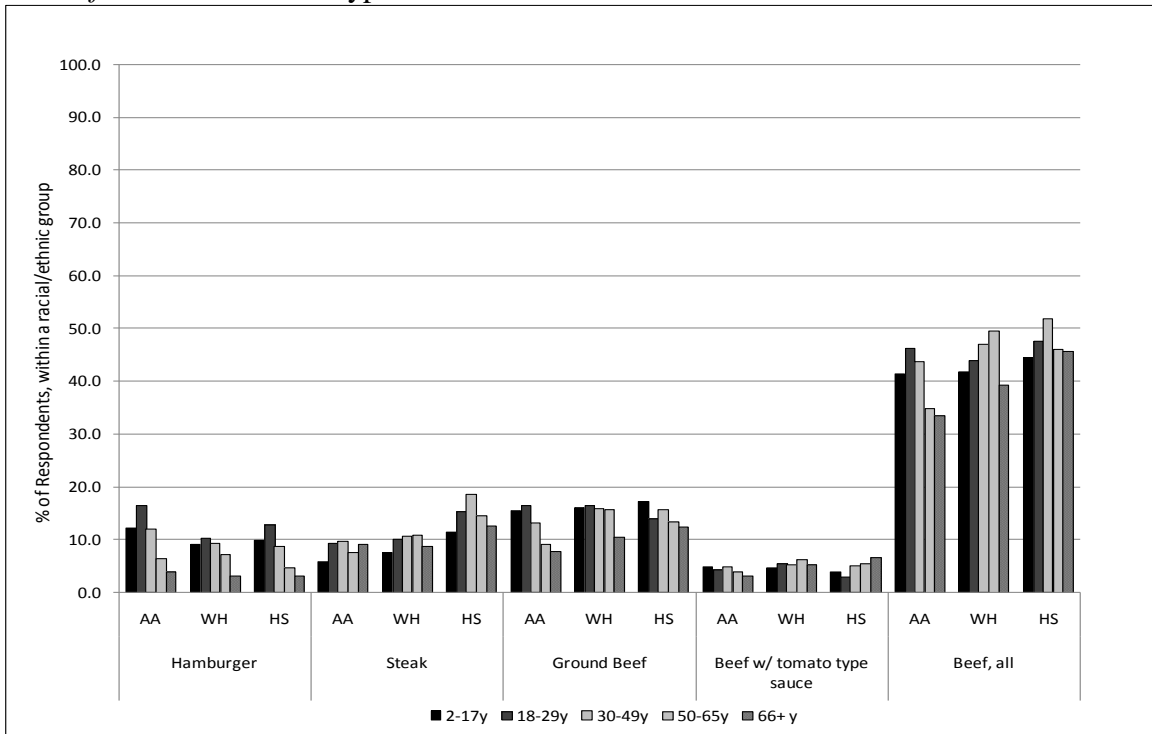
<sup>c</sup> P value for Pearson's chi-square test

**Figure 6.1 Beef, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Beef* and selected beef type items



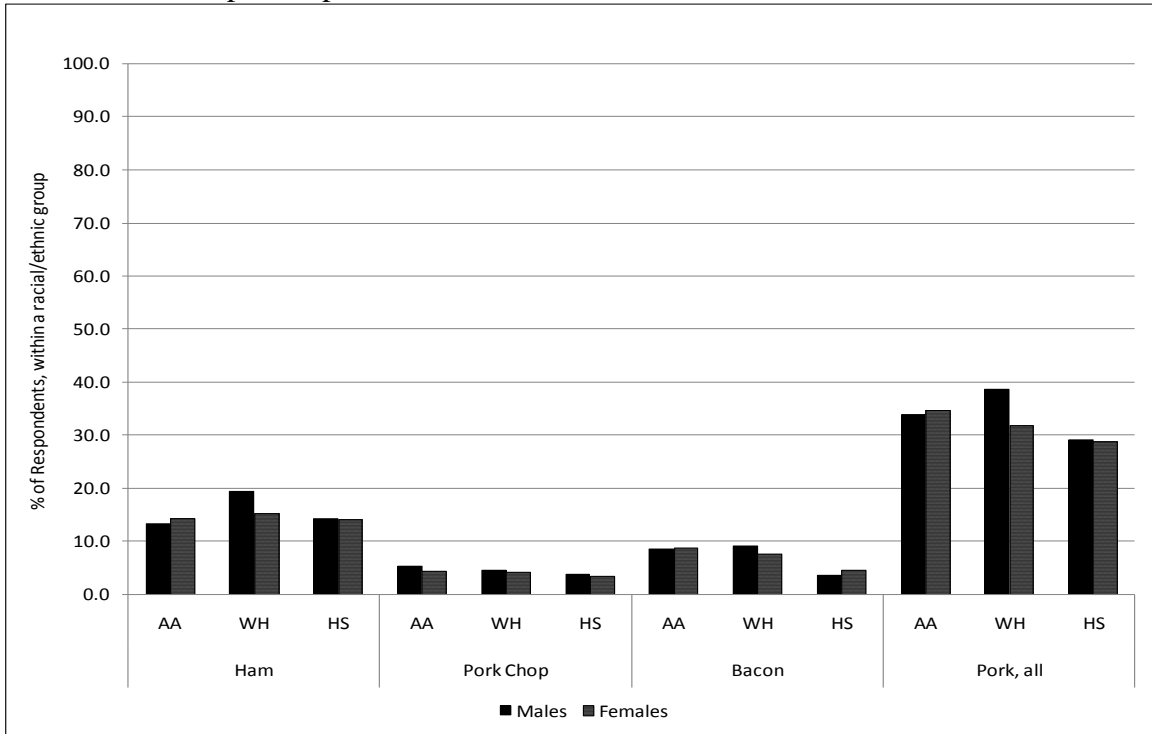
AA= African American; WH= White; HS= Hispanic

**Figure 6.2 Beef, Age by Race/Ethnicity:** Consumption percentages of populations for *All Beef* and selected beef type items



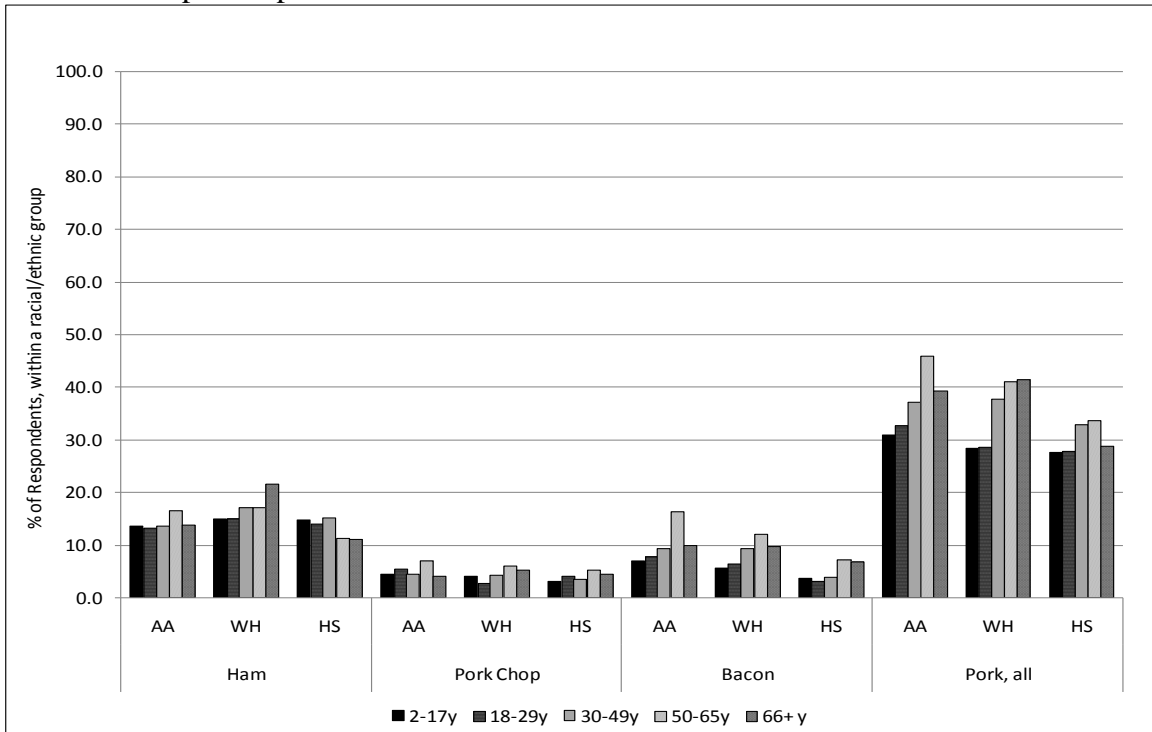
AA= African American; WH= White; HS= Hispanic

**Figure 6.3 Pork, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Pork* and specific pork items



AA= African American; WH= White; HS= Hispanic

**Figure 6.4 Pork, Age by Race/Ethnicity:** Consumption percentages of populations for *All Pork* and specific pork items



AA= African American; WH= White; HS= Hispanic

**Table 6.5 Poultry & Egg Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

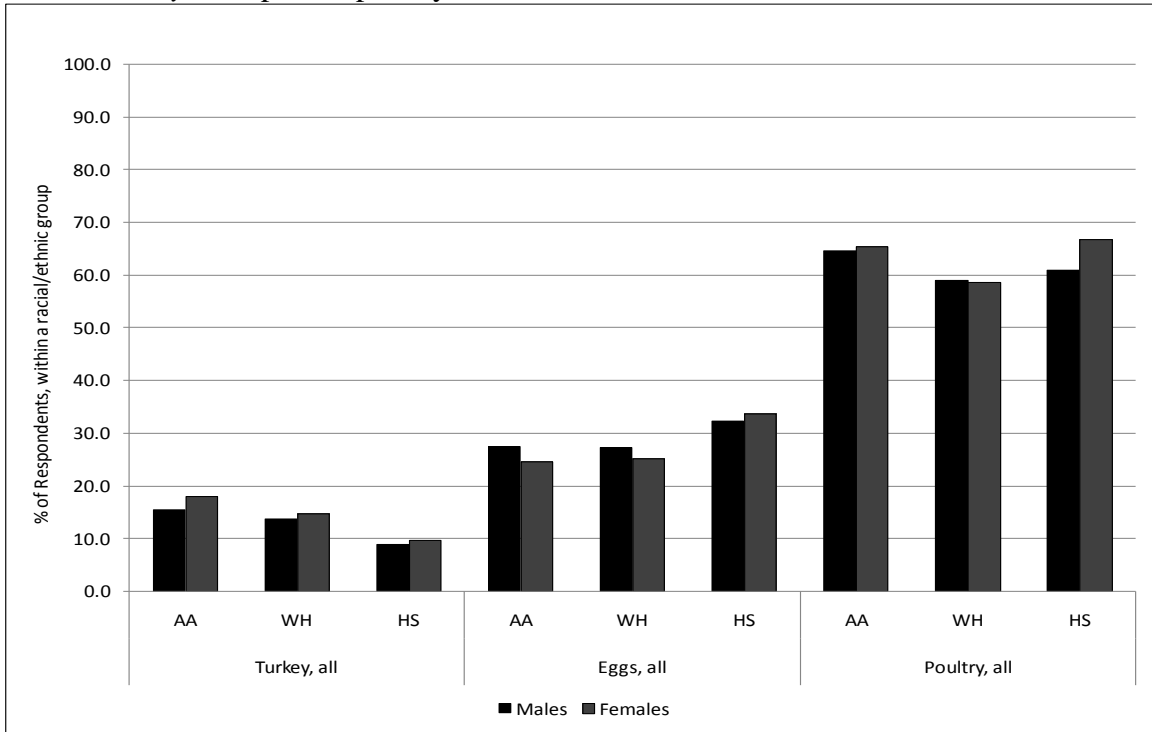
Food Group/Item <sup>a</sup>	African American (non-Hispanic) n= 4994		White (non-Hispanic) n= 7525		Hispanic n= 5366		p -value <sup>c</sup>
	%	± SE <sup>b</sup>	%	± SE	%	± SE	
Chicken, all	46.9	± 0.7	33.0	± 0.5	39.2	± 0.7	<.0001
Baked, roasted, broiled, stewed	13.0	± 0.5	9.8	± 0.3	11.6	± 0.4	<.0001
Chicken fillet, patty, nuggets	14.7	± 0.5	11.8	± 0.4	12.4	± 0.5	<.0001
Chicken salad	0.8	± 0.1	1.5	± 0.1	1.0	± 0.1	0.0006
Chicken soups, broths	1.0	± 0.1	1.6	± 0.1	5.9	± 0.3	<.0001
Ground chicken	0.2	± 0.1	0.2	± 0.0	0.6	± 0.1	<.0001
Fried chicken	10.1	± 0.4	11.0	± 0.4	11.7	± 0.4	0.0265
Duck, goose	0.0	± 0.0	0.3	± 0.1	0.1	± 0.0	0.0011
Cornish hen, pheasant, dove, quail	0.2	± 0.1	0.1	± 0.0	0.1	± 0.1	0.4005
Eggs all	26.0	± 0.6	26.2	± 0.5	33.1	± 0.6	<.0001
Boiled egg	3.4	± 0.3	3.3	± 0.2	2.0	± 0.2	<.0001
Fried, scrambled, omelet egg	20.5	± 0.6	20.0	± 0.5	28.9	± 0.6	<.0001
Poached egg	0.2	± 0.1	0.7	± 0.1	0.2	± 0.1	<.0001
Egg white only	0.9	± 0.1	0.7	± 0.1	1.0	± 0.1	0.2617
Egg salad, deviled	0.7	± 0.1	1.4	± 0.1	0.3	± 0.1	<.0001
Egg sandwiches	1.9	± 0.2	1.4	± 0.1	1.2	± 0.1	0.0037
Turkey, all	25.2	± 0.6	24.0	± 0.5	16.4	± 0.5	<.0001
Roasted, stewed, smoked, baked, fried	1.2	± 0.2	0.9	± 0.1	0.5	± 0.1	0.0018
Ground turkey	0.5	± 0.1	0.3	± 0.1	0.2	± 0.1	0.0152
Turkey bacon, ham, sausage	4.2	± 0.3	1.0	± 0.1	1.4	± 0.2	<.0001
Turkey w/ dressing, stuffing, gravy	0.1	± 0.0	0.2	± 0.1	0.0	± 0.0	0.0199

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup>SE=Standard Error

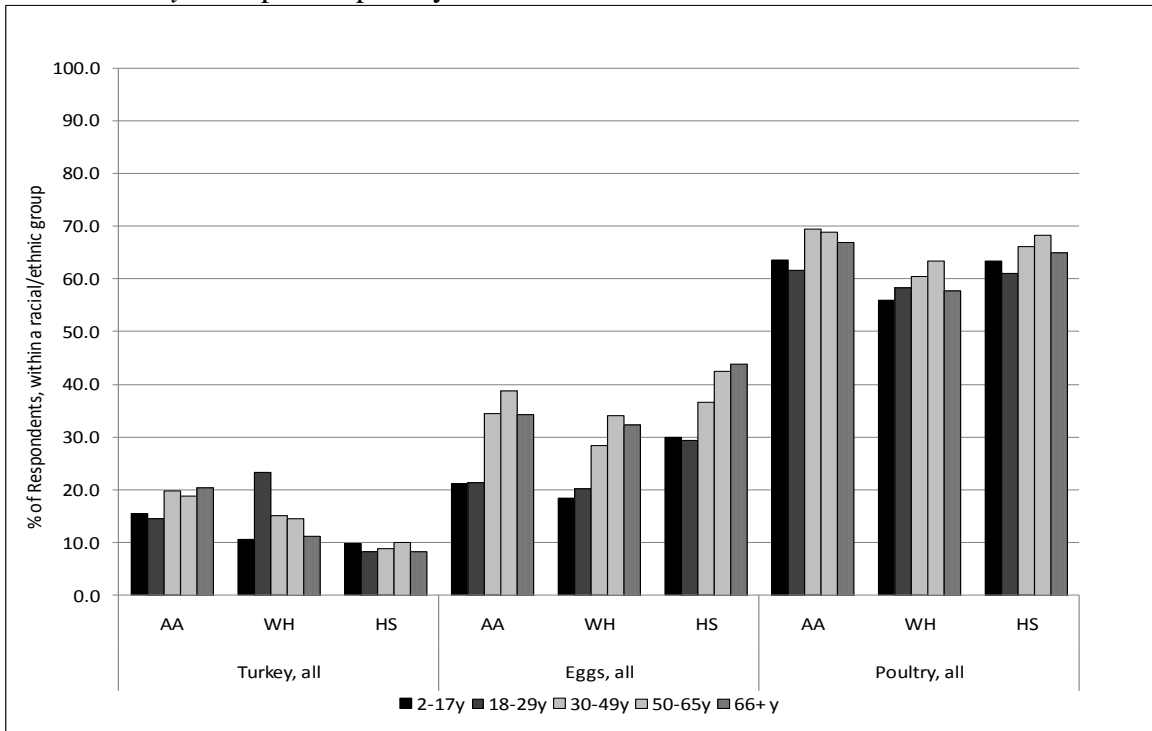
<sup>c</sup> P value for Pearson's chi-square test

**Figure 6.5 Poultry, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Poultry* and specific poultry items



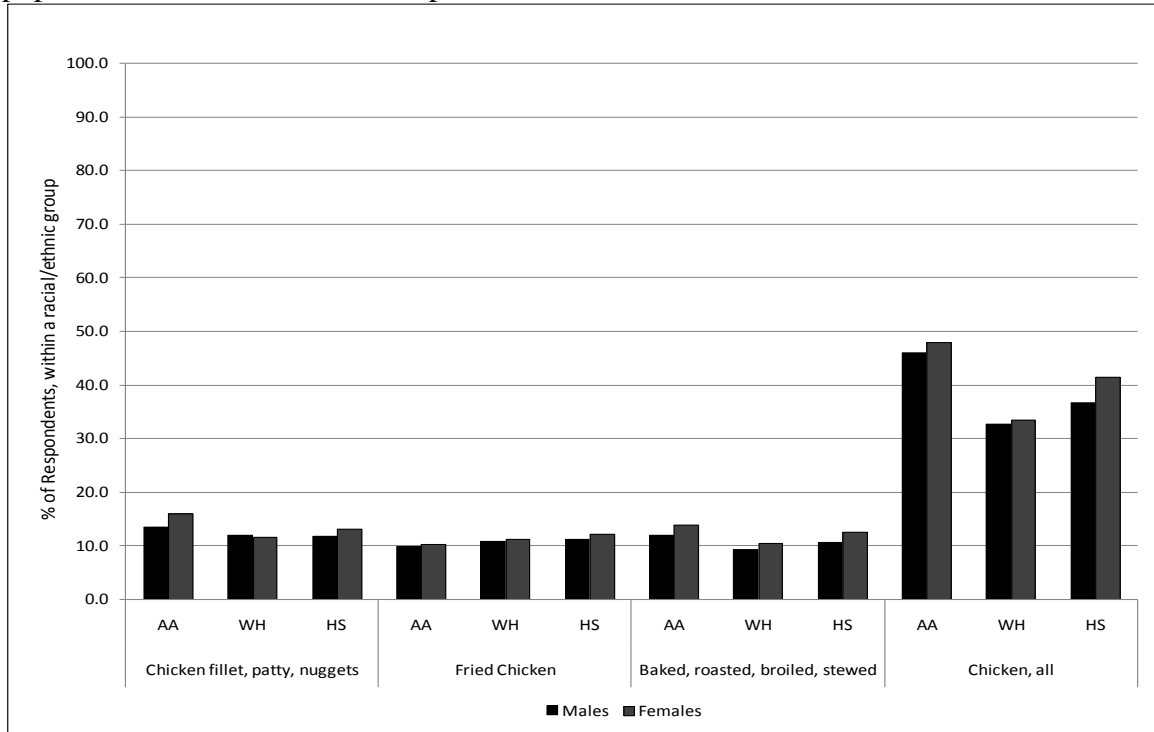
AA= African American; WH= White; HS= Hispanic

**Figure 6.6 Poultry, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Poultry* and specific poultry items



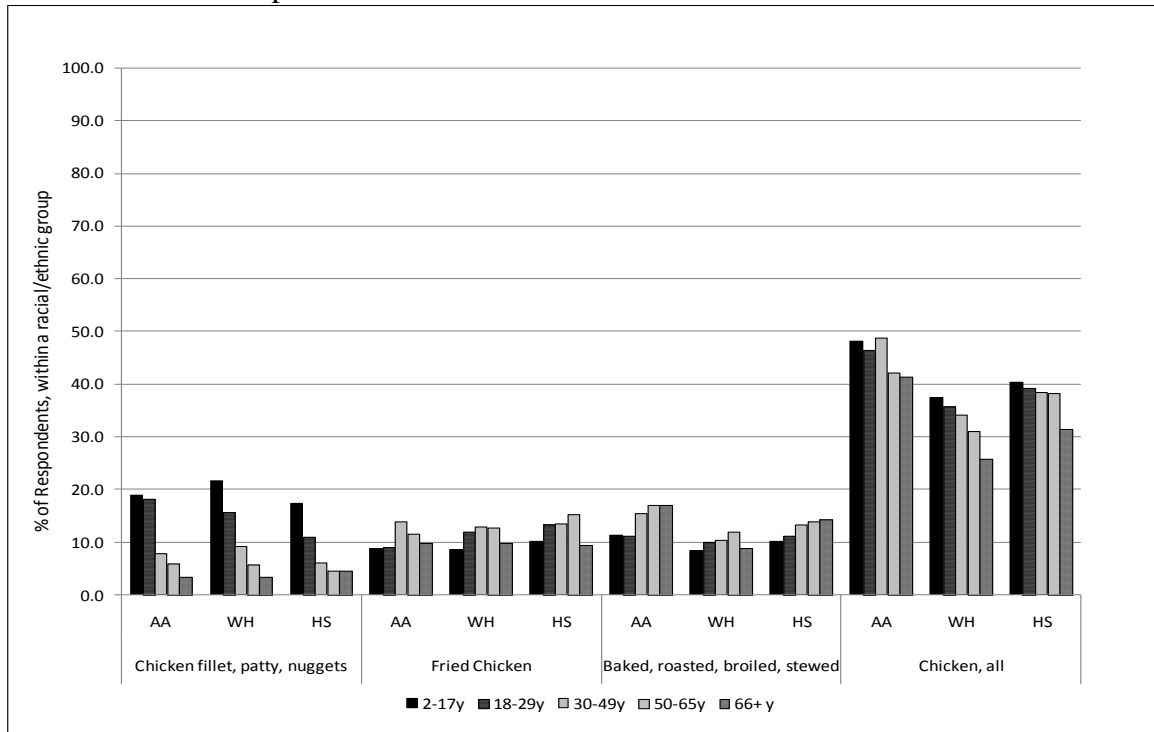
AA= African American; WH= White; HS= Hispanic

**Figure 6.7 Chicken, Gender by Race/Ethnicity:** Consumption percentages of populations for *All Chicken* and specific chicken items



AA= African American; WH= White; HS= Hispanic

**Figure 6.8 Chicken, Age by Race/Ethnicity:** Consumption percentages of populations for *All Chicken* and specific chicken items



AA= African American; WH= White; HS= Hispanic

**Table 6.6 Fish/Shellfish - Percent of respondents, 2 years or older, by race/ethnicity**

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Catfish	1.9	± 0.2	0.9	± 0.1	0.6	± 0.1	<.0001
Cod	0.4	± 0.1	0.6	± 0.1	0.3	± 0.1	0.0268
Lobster, crab, crayfish	1.4	± 0.2	1.0	± 0.1	0.4	± 0.1	<.0001
Oysters, clams, mussels, scallops	0.6	± 0.1	1.6	± 0.1	0.7	± 0.1	<.0001
Salmon	2.1	± 0.2	3.1	± 0.2	0.9	± 0.1	<.0001
Shrimp	4.1	± 0.3	3.6	± 0.2	4.1	± 0.3	0.1966
Tilapia, flounder	0.4	± 0.1	0.9	± 0.1	0.4	± 0.1	<.0001
Tuna casserole, pie	0.1	± 0.0	0.4	± 0.1	0.1	± 0.0	0.0002
Tuna salad	2.3	± 0.2	4.1	± 0.2	2.3	± 0.2	<.0001
Tuna, canned	1.0	± 0.1	1.3	± 0.1	1.2	± 0.1	0.3109
Whiting	1.1	± 0.2	0.1	± 0.0	0.0	± 0.0	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

**Table 6.7 Other/Processed Meats - Percent of respondents, 2 years or older, by race/ethnicity**

<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Bratwurst, Italian, Polish sausage	1.8	± 0.2	2.4	± 0.2	0.5	± 0.1	<.0001
Chorizo	0.0	± 0.0	0.0	± 0.0	2.0	± 0.2	<.0001
Frankfurters	12.8	± 0.5	10.5	± 0.4	9.4	± 0.4	<.0001
Game <sup>d</sup>	0.2	± 0.1	0.8	± 0.1	0.1	± 0.0	<.0001
Goat	0.2	± 0.1	0.0	± 0.0	0.2	± 0.1	0.0017
Lamb	0.6	± 0.1	0.6	± 0.1	0.4	± 0.1	0.3097
Liver- beef, chicken	0.5	± 0.1	0.5	± 0.1	0.2	± 0.1	0.0146
Luncheon, cold cut meat	21.3	± 0.6	24.6	± 0.5	19.1	± 0.5	<.0001
Bologna	5.3	± 0.3	4.3	± 0.2	3.0	± 0.2	<.0001
Ham luncheon meat	9.5	± 0.4	11.7	± 0.4	11.5	± 0.4	0.0003
Organ meats	0.9	± 0.1	0.4	± 0.1	0.6	± 0.1	0.0004
Neckbones- beef, pork	0.5	± 0.1	0.0	± 0.0	0.0	± 0.0	<.0001
Ribs- beef, pork	4.3	± 0.3	2.0	± 0.2	2.3	± 0.2	<.0001
Sausage-any meat	17.7	± 0.5	10.5	± 0.4	6.6	± 0.3	<.0001
Tripe	0.1	± 0.0	0.0	± 0.0	1.7	± 0.2	<.0001
Veal	0.1	± 0.0	0.4	± 0.1	0.1	± 0.0	<.0001

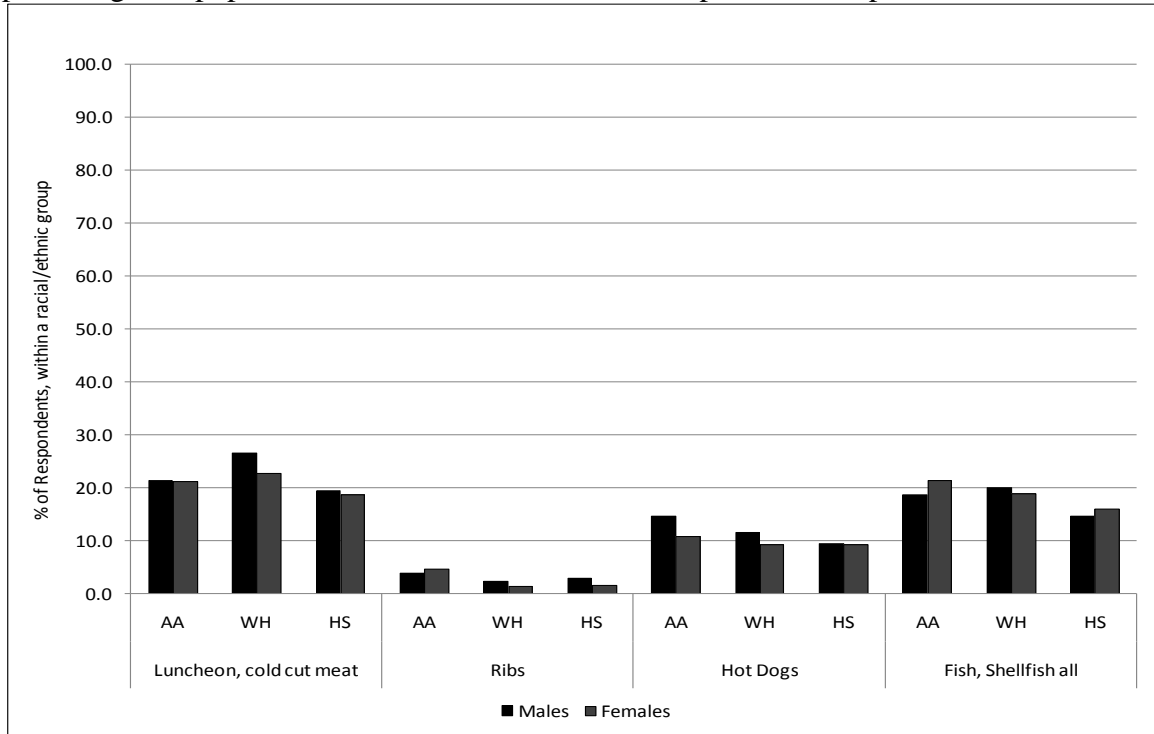
<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

<sup>c</sup> P value for Pearson's chi-square test

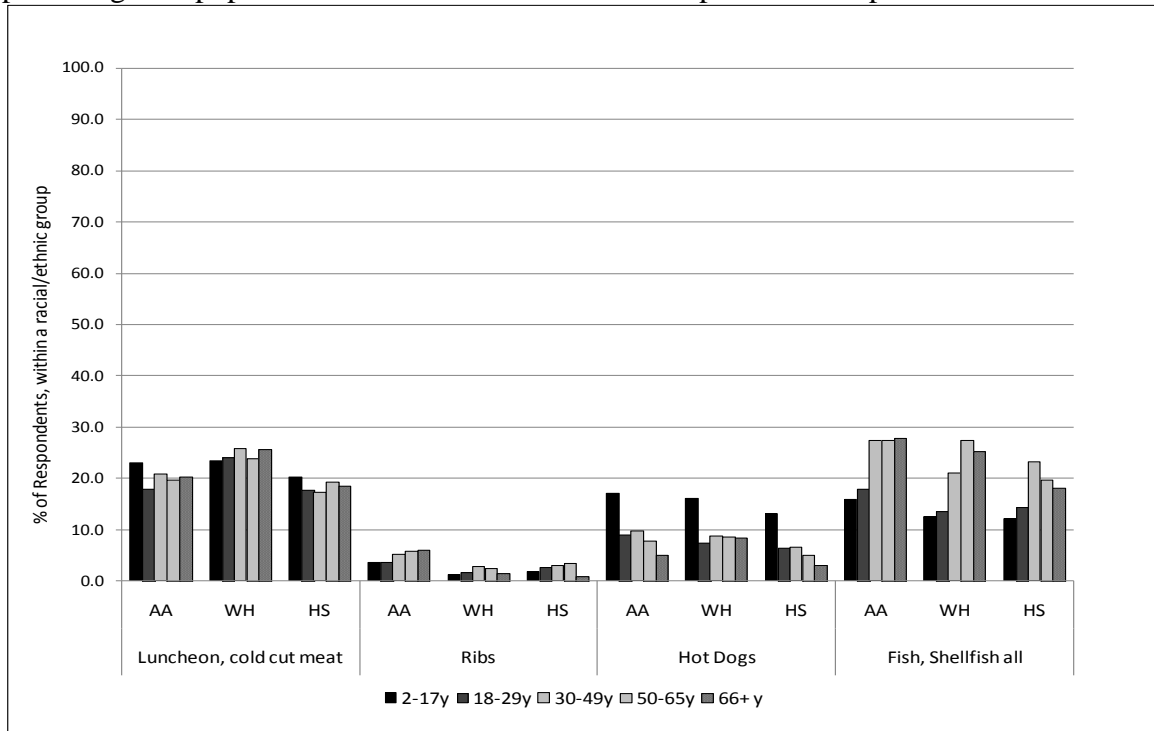
<sup>d</sup> Game- e.g. rabbit, deer, squirrel, ostrich

**Figure 6.9 Fish and Other/Processed Meat, Gender by Race/Ethnicity:** Consumption percentages of populations for All Fish/Shellfish and specific other/processed meat items



AA= African American; WH= White; HS= Hispanic

**Figure 6.10 Fish and Other/Processed Meat, Age by Race/Ethnicity:** Consumption percentages of populations for All Fish/Shellfish and specific other/processed meat items



AA= African American; WH= White; HS= Hispanic



**Table 7. Legume, nut and seed Consumption-** Percent of respondents, 2 years or older, by race/ethnicity

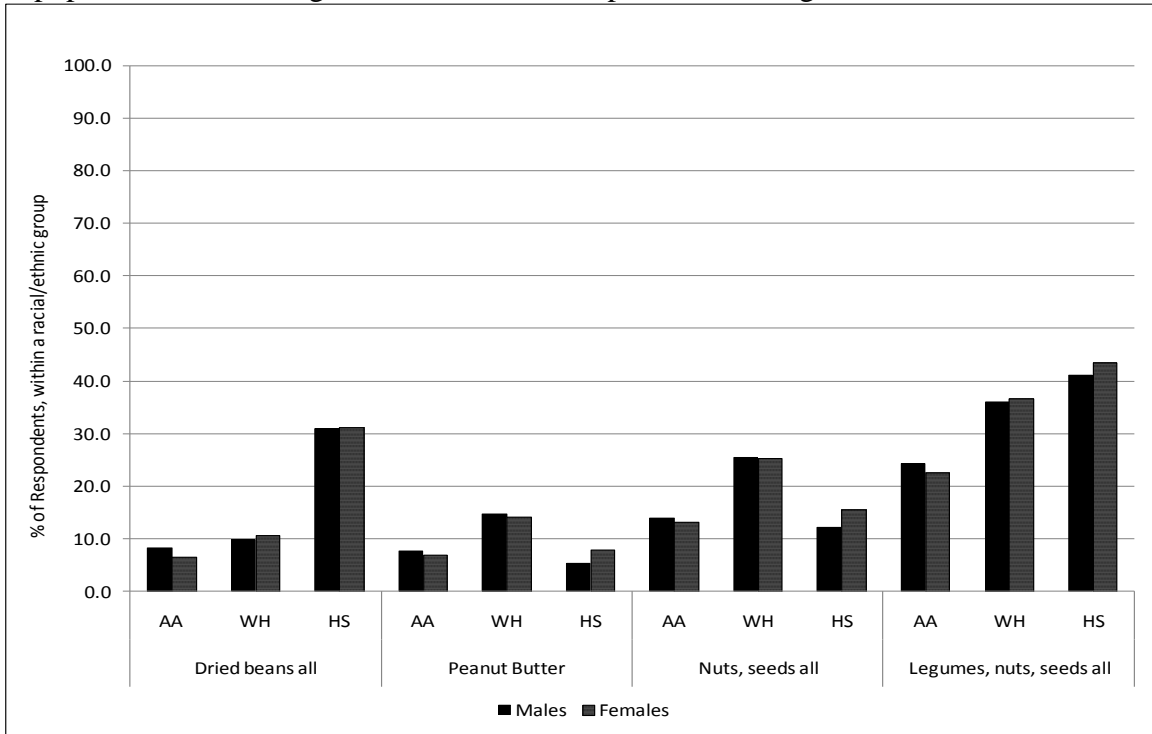
<b>Food Group/Item<sup>a</sup></b>	<b>African American (non-Hispanic) n= 4994</b>		<b>White (non-Hispanic) n= 7525</b>		<b>Hispanic n= 5366</b>		<b>p -value<sup>c</sup></b>
	<b>%</b>	<b>± SE<sup>b</sup></b>	<b>%</b>	<b>± SE</b>	<b>%</b>	<b>± SE</b>	
Dried Beans, all	7.4	± 0.4	10.4	± 0.4	31.1	± 0.6	<.0001
Beans w/meat , sauce, baked-chili	1.7	± 0.2	2.6	± 0.2	0.8	± 0.1	<.0001
Black beans	0.3	± 0.1	0.9	± 0.1	2.8	± 0.2	<.0001
Black-eyed pea, cowpeas	0.6	± 0.1	0.1	± 0.0	0.0	± 0.0	<.0001
Butter, lima dry	0.6	± 0.1	0.4	± 0.1	0.1	± 0.0	<.0001
Garbanzo, chickpeas	0.2	± 0.1	1.3	± 0.1	0.5	± 0.1	<.0001
Kidney, red	0.7	± 0.1	0.4	± 0.1	1.3	± 0.2	<.0001
Lentil	0.0	± 0.0	0.3	± 0.1	1.0	± 0.1	<.0001
Pinto, calico, red Mexican	1.4	± 0.2	1.7	± 0.1	17.3	± 0.5	<.0001
Refried	0.7	± 0.1	2.1	± 0.2	11.1	± 0.4	<.0001
Soybean (including curd, soups)	0.1	± 0.0	0.9	± 0.1	0.2	± 0.1	<.0001
Nuts & seeds, all	13.6	± 0.5	25.4	± 0.5	13.9	± 0.5	<.0001
Almond, all	0.4	± 0.1	2.1	± 0.2	1.0	± 0.1	<.0001
Cashew, all	1.0	± 0.1	1.4	± 0.1	0.4	± 0.1	<.0001
Peanuts, all	9.4	± 0.4	18.1	± 0.4	9.0	± 0.4	<.0001
Peanut butter	7.4	± 0.4	14.5	± 0.4	6.7	± 0.3	<.0001
Pecan	0.3	± 0.1	0.5	± 0.1	0.5	± 0.1	0.2673
Pumpkin, squash seeds	0.0	± 0.0	0.1	± 0.0	0.4	± 0.1	0.0002
Sunflower seeds	1.5	± 0.2	1.5	± 0.1	1.3	± 0.2	0.4269
Walnut	0.4	± 0.1	1.2	± 0.1	0.4	± 0.1	<.0001

<sup>a</sup> Repeated counts of consumption could occur across food groups or items

<sup>b</sup> SE=Standard Error

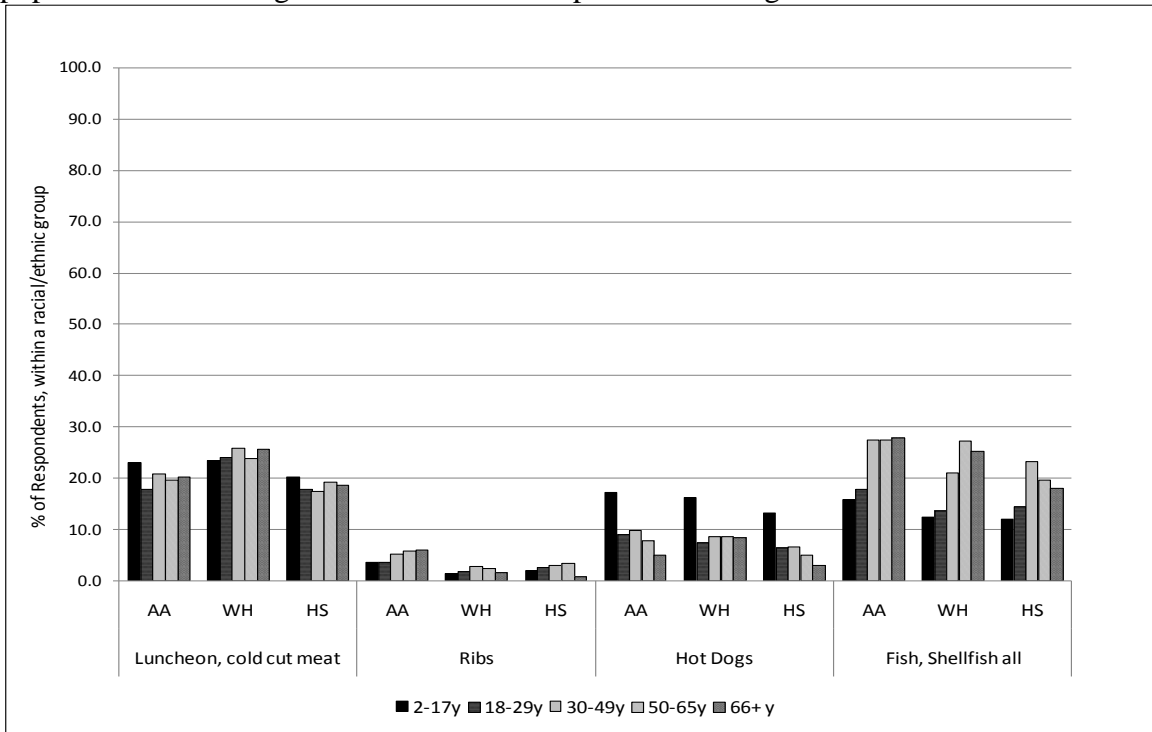
<sup>c</sup> P value for Pearson's chi-square test

**Figure 6.11 Legumes/nuts/ seeds, Gender by Race/Ethnicity:** Consumption percentages of populations for All legumes/nuts/seeds and specific other legume/nut/seed items



AA= African American; WH= White; HS= Hispanic

**Figure 6.12 Legumes/nuts/ seeds, Age by Race/Ethnicity:** Consumption percentages of populations for All legumes/nuts/seeds and specific other legume/nut/seed items



AA= African American; WH= White; HS= Hispanic

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# Appendix A - Food Code Combinations and Descriptions for SAS- examples

## Food Combinations examples

### Apple

(62101100<= food <=62101300) or (63101000<= food <=63101500)  
or (63401010<= food <=63401060) or (64101010<= food <=64104010)

### Greens- collards, turnips, mustard, and NS type

(72107100<= food <=72107223) or (72118200<= food <=72118223) or  
(72122100<= food <=72122223) or (72128200<= food <=72128520)

### Cheddar, American

(14010100<= food <=14010100) or (14104010<= food <=14104020) or  
(14110010<= food <=14110030)

### All breads

(51000100<= food <=52101000)

### Bacon

(22600200<= food <=22605010) or (27520110<= food <=27520170) or  
(28321130<= food <=28321130)

## Food Description examples

62101100	=	"Apple, dried, uncooked"
72107100	=	"Collards, raw"
14104010	=	"Cheese, natural, Cheddar or American type"
51133010	=	"Bread, sour dough"
22601000	=	"Pork bacon, smoked or cured, cooked"



## Appendix B - Consumption Analysis SAS Code example

```
/*dm 'log;clear;output;clear;';          */
/*ods rtf; */
options linesize=78 nofmterr nodate nonumber;
title 'Starch,Grain = Both Days Dietary Data Analysis 2003-2006 CAH';

libname NH "G:\NHANES\DATA";
proc format;
  value GenderF
    1= 'Male'
    2= 'Female';

  value RaceF
    1= 'Hispanic'
    2= 'Hispanic'
    3= 'White'
    4= 'African American'
    5= 'Multi-racial';

  value FoodCodeF
51000100 = "Bread, NS as to major flour"
56201750 = "Cornstarch, dry"
56201800 = "Cornstarch, hydrolyzed powder"
;
run;

/*
title2 'Review of data using PROC CONTENTS';
proc contents data=NH.drxfcd_c varnum;
proc contents data=NH.drxfcd_d varnum;
proc contents data=NH.dr1liff_c varnum;
proc contents data=NH.dr1liff_d varnum;
proc contents data=NH.dr2liff_c varnum;
proc contents data=NH.dr2liff_d varnum;
proc contents data=NH.demo_c varnum;
proc contents data=NH.demo_d varnum;
run; */

data DEMO_4yr (keep=SEQN RIDAGEYR RIDRETH1 RIAGENDR);
  set NH.demo_c
      NH.demo_d;
run;

proc sort data=DEMO_4yr;
  by SEQN;
run;

data DEMO_4yrN;
  set DEMO_4yr;
  group= .;
  if ((RIDAGEYR >= 2) and (RIDRETH1= 1 OR RIDRETH1=2 OR RIDRETH1=
3 OR RIDRETH1= 4)) then group=1;
  ELSE group=0;
```

```

run;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.demo_4yrN;
set demo_4yrN;
run;*/

data demo_4yrAN;
set demo_4yrN;
if group= 0 then delete;

    label RIAGENDR= 'Gender of Subject';
    format RIAGENDR GenderF.;

    label RIDRETH1= 'Race of Subject';
    format RIDRETH1 RACEF.;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.demo_4yrAN;
set demo_4yrAN;
run; */

libname NH "G:\NHANES\DATA";
data IFF_0304(keep= SEQN WTDR2D DR1IFDCD DR2IFDCD DR1DRSTZ DR2DRSTZ);
    set NH.dr1iff_c
        NH.dr2iff_c;
run;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.IFF_0304;
set IFF_0304;
run;*/

libname NH "G:\NHANES\DATA";
data IFF_0506(keep=SEQN WTDR2D DR1IFDCD DR2IFDCD DR1DRSTZ DR2DRSTZ);
    set nh.dr1iff_d
        nh.dr2iff_d;
run; */

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.IFF_0506;
set IFF_0506;
run;*/

data IFF_Total(keep=SEQN WTDR2D DR1IFDCD DR2IFDCD DR1DRSTZ DR2DRSTZ);
    set iff_0304
        iff_0506;
run;
title2 ' All 4 yrs- Days 1 & 2 Recall Data';
proc sort data=IFF_Total;
    by SEQN;
run;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.IFF_Total;

```

```

set IFF_Total;
run; */

data iff_4yrEdt;
set IFF_Total;
if WTDR2D = . then delete;
run;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.IFF_4yrEdt;
set IFF_4yrEdt;
run; */

/*Renaming Code*/
data IFF_4yrEdt1;
set IFF_4yrEdt;
rename DR1IFDCD= food;
if DR1IFDCD = . then DR1IFDCD= DR2IFDCD;
rename DR1DRSTZ= RCstatus;
if DR1DRSTZ = . then DR1DRSTZ= DR2DRSTZ;
run;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.IFF_4yrEdt1;
set IFF_4yrEdt1;
run;*/

data iff_4yrFin;
set IFF_4yrEdt1;
drop DR2IFDCD DR2DRSTZ;
run;

/*libname NH "G:\NHANES\DATA\DemoFood";
data nh.IFF_4yrFin;
set IFF_4yrFin;
run;*/

/* Section to enter food codes
data FOODFreq;
merge IFF_4yrFin (IN=i keep= SEQN WTDR2D Food RCstatus
where= ((51000100<= food <=52101000)or (53540000<= food
<=53544450)
))
demo_4yrAN (keep=SEQN group RIDAGEYR RIDRETH1 RIAGENDR);
by SEQN;
if i;
run;
title2 ' Merge- Demographics and Dietary Recall For Food Codes';

/**This library contents will change with each run of the program**/;

/*libname NH "G:\NHANES\DATA\Milk";
data nh.FOODFreq;
set FOODFreq;
run; */

data FDFreq2;

```

```

set FOODFreq;
incoh= .;
    if ((RCstatus=1) and (group=1) /*and (RIDRETH1= 1 OR RIDRETH1= 2
OR RIDRETH1= 3 OR RIDRETH1= 4)*/)
    then INCOH=1;
    ELSE INCOH=0;
run;
proc sort data=FDFreq2;
by incoh;
/*proc freq data=FDFreq2;
tables incoh / list missing;
run; */

/*libname NH "G:\NHANES\DATA\Milk";
data nh.FDFreq2;
set FDFreq2;
run; */

data FDFreq3;
set FDFreq2;
if incoh= 0 then delete;

    label RIAGENDR= 'Gender of Subject';
    format RIAGENDR GenderF.;

    label RIDRETH1= 'Race of Subject';
    format RIDRETH1 RACEF.;

    label food = 'Food Name';
    format food FoodCodeF.;

    if (2 <= RIDAGEYR <= 17) then AGEGRP='2-17';
    else if (18 <= RIDAGEYR <= 29) then AGEGRP='1829';
    else if (30 <= RIDAGEYR <= 49) then AGEGRP='3049';
    else if (50 <= RIDAGEYR <= 65) then AGEGRP='5065';
    else if (RIDAGEYR >= 66) then AGEGRP='66+';
    label AGEGRP='Age Group';
run;

proc sort data=FDFreq3;
by seqn;
run;

data count (keep= seqn count food RIDRETH1 RIAGENDR AGEGRP);
set FDFreq3;
by seqn;
/*retain count RIDRETH1;*/
count+1;
if first.seqn then count= 1;
if last.seqn then output;
run;

proc sort data=count;
by RIDRETH1;
run;

/***/To Calculate all freq by seqn, food, race, gender, age***/

```

```

/*proc freq data=count;
by RIDRETH1;
run; */

/**To calculate gender/age/ food by race***/
ods rtf;
title2 'Grain, starch, potato, other roots';
proc freq data=count;
tables RIAGENDR*RIDRETH1/ nopercnt norow;
run;

proc freq data=count;
tables RIDRETH1*AGEGRP/ nopercnt norow;
run;

proc freq data=count;
tables food*RIDRETH1/ nopercnt norow;
run;
ods rtf close;

```

## Appendix C - Pearson's Chi-Square SAS Code example

```
ods rtf;
data three;
  input foodcat $ race $ eat $ count;
cards;
BreadRollsA AA Y 3196
BreadRollsA AA N 1798
BreadRollsA CA Y 5483
BreadRollsA CA N 2042
BreadRollsA HS Y 3341
BreadRollsA HS N 2025

Rye AA Y 22
Rye AA N 4972
Rye CA Y 236
Rye CA N 7289
Rye HS Y 17
Rye HS N 5349

Sourdough AA Y 16
Sourdough AA N 4978
Sourdough CA Y 164
Sourdough CA N 7361
Sourdough HS Y 46
Sourdough HS N 5320

  by foodcat;
proc freq data=three;
  by foodcat;
  weight count;
  tables race*eat/chisq cellchi2 expected norow nocol;
run;
ods rtf close;
/*quit;*/
```