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ABSTRACT

MARY D. HILL

Recalled fruit and vegetable intake while growing up and its association with adult fruit and vegetable intake among U.S. adults – analysis of the food attitudes and behaviors survey

(Under the direction of DR. KYMBERLE STERLING)

High dietary intake of fruits and vegetables (FVs) is associated with a lower risk for chronic disease including certain cancers, optimal child growth, and weight management. More than 72 million U.S. adults are obese; therefore, fruit and vegetable intake is important in weight management. Using data from the Food Attitude and Behavior survey, this study will address the following questions: is there a correlation between recalled fruit and vegetable intake during childhood and adult fruit and vegetable intake among U.S. adults? Secondly, is reported fruit and vegetable consumption associated with sociodemographic variables and other health-related behaviors? Results indicated there is a positive correlation between recalled FV intake and reported FV intake in adults. Therefore, public health practitioners should develop initiatives to increase the amount of FV intake in children so that these FV consumption habits may continue in adulthood.

INDEX WORDS: fruit intake, vegetable intake, obesity, weight management, sociodemographics, health-related behaviors

RECALLED FRUIT AND VEGETABLE INTAKE WHILE GROWING UP AND ITS ASSOCIATIONS WITH ADULT FRUIT AND VEGETABLE INTAKE AMONG U.S. ADULTS. ANALYSIS OF THE FOOD ATTITUDES AND BEHAVIORS SURVEY

BY

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B.B.A, COLUMBUS STATE UNIVERSITY

A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of the Requirements for the Degree

MASTERS OF PUBLIC HEALTH

ATLANTA, GEORIGA

2011

RECALLED FRUIT AND VEGETABLE INTAKE WHILE GROWING UP AND ITS ASSOCIATION WITH ADULT FRUIT AND VEGETABLE INTAKE AMONG U.S. ADULTS – ANALYSIS OF THE FOOD ATTITUDES AND BEHAVIORS SURVEY

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EXPERIENCE

Mary D. Hill is a Public Health Analyst in the Guidelines, Development, and Recommendations Team, Obesity Prevention and Control Branch, Division of Nutrition, Physical Activity, and Obesity (DNPAO), National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), Centers for Disease Control and Prevention (CDC). She has held this position from July 2004 to present. Ms. Hill provides technical assistance regarding the translation, dissemination, and evaluation of obesity-related programs and activities through project management, partnership development and communication strategies. Ms. Hill's primary focus has been the Lean Works! Website project for employers and addressing childhood obesity in the child care setting.

Prior to her employment in DNPAO, she served as a Management and Program Analyst in the Office on Smoking and Health (OSH), CDC, from September 2000 to July 2004. In this capacity, she managed the fiscal and administrative operations for the division. She provided oversight of an $87M budget, approximately 75% of which was extramural funding. Ms. Hill developed, executed, and monitored contracts and cooperative agreements with various agencies and vendors. She authorized the approval of all human resource management actions for approximately 100 full-time equivalent positions and 70 contracted positions in the division.

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Chapter I – Introduction

Purpose of Study

High dietary intake of fruits and vegetables (FVs) is associated with a lower risk for chronic disease including certain cancers, optimal child growth, and weight management. (He, Nowson, Lucas, & MacGregor, 2007; U. S. Department of Health and Human Services & U. S. Department of Agriculture, 2005; U.S. Department of Health and Human Services, 2000). Research on the impact of fruit and vegetable intake on obesity prevention and control is important, since more than one third of United States (U.S.) adults, over 72 million people, are obese (Centers for Disease Control and Prevention, 2010a). From 1980 through 2008, the rate of obesity (often defined as Body Mass Index greater than 30) has doubled in adults. Furthermore, the obesity rates have increased markedly for all groups in society regardless of age, sex, race, ethnicity, socioeconomic status, education level, or geographic region (Centers for Disease Control and Prevention, 2010a). In addition, there are racial disparities associated with obesity. According to the 2009 Behavioral Risk Factor Surveillance System report that examined data from 2006-2008 blacks were 51% more likely and Hispanics were 21% more likely than non-Hispanic whites to be obese (Centers for Disease Control and Prevention, 2010a).

Obesity is associated with a variety of diseases, and it is a financial burden to Americans. In 2008, medical costs related to obesity were estimated to be as high as $147 billion. In 2006, $1,400 more was spent on obese people than on people at a normal weight (Ogden, Lamb, Carroll, & Flegal, 2010a; Ogden, Lamb, Carroll, & Flegal 2010b).

Obesity in childhood is a predictor of obesity in adulthood. Data from the National Longitudinal Study of Adolescent Health (Add Health) was examined to determine the incidence and risk of severe obesity, defined as BMI ≥ 40, in adulthood as predicted by weight in adolescence. The and colleagues (n=8834, individuals aged 12 to 21) found that adolescents who were obese had a substantially higher risk of developing severe obesity as an adult than did normal or overweight adolescents (The, Suchindran, North, Popkin, & Gordon Larsen, 2010). Results from this study also indicated that:

- Among individuals who were obese as adolescents, incident severe obesity was 37.1% in men and 51.3% in women.
- The incidence of severe obesity was highest among black women at 52.4%
- Less than 5% of individuals who were considered normal weight in adolescence developed severe obesity in adulthood. This trend was present among all sex and racial/ethnic groups.

These findings suggest that interventions designed to prevent adult onset severe obesity would be best implemented among obese adolescents, particularly among black girls (The, et al., 2010).

The causes of obesity in the United States are complex and numerous including social, economic, environmental, and individual aspects. The U.S. Centers for Disease Control and Prevention (CDC) indicates that to effectively fight obesity, policy and environmental approaches must make healthy choices “available, affordable, and easy”, and should be implemented in multiple settings such as communities, schools, work sites,

and health care facilities (Centers for Disease Control and Prevention, 2010a). CDC has recommended six target behaviors to address obesity prevention and control. These include:

- Increasing intake of fruits and vegetables
- Increasing moderate and/or vigorous physical activity
- Increasing the initiation and duration of breast feeding
- Decreasing the amount of TV/screen time
- Decreasing the amount of energy dense foods consumed
- Decreasing the consumption of sugar sweetened beverages (Centers for Disease Control and Prevention & Division of Nutrition, 2010b)

Fruit and vegetable intake is important in weight management. In conference proceedings of the Nutrition Society, Rolls (2010a) indicated that portion size and food energy density have robust effects on energy intake and obesity prevention (Rolls, 2010a). Energy density can be reduced by increasing the amount of water-rich foods consumed such as fruits and vegetables (Rolls, Roe, & Meengs, 2010b). Rolls and colleagues conducted two experiments: the addition study and substitution study. In the addition study (n=52), more vegetables were added to the meal while keeping meat and grain portions constant. In the substitution study (n=48), more vegetables were substituted for meat and grain meal components. The study results indicated that increases in vegetable portion size resulted in a greater consumption of vegetables in both study arms (mean +/- SE: 60 +/- 5 g; P<0.0001). Adding more vegetables to the meal did not significantly affect total meal energy intake; however, vegetable substitution for the grain or meat decreased meal energy intake (40+/- 10 kcal; P<.0001) (Rolls, et al.,

2010b). Findings from this study suggest that serving more vegetables, either by adding more to a meal or substituting them for other foods, is an effective strategy to increase vegetable intake at meals.

However, fruit and vegetable (FV) intake may be different among racial sub-groups. A systematic review of the literature by Casagrande and colleagues (2009) indicated that African Americans are less likely to meet the Dietary Guidelines for Americans in fruit and vegetable consumption and saturated fats intake. While the majority of U.S. adults (89%) did not meet daily recommendations of fruit and vegetable servings (5 or more daily), African Americans were 38% less likely to meet fruit and vegetable recommendations when compared to white Americans (Casagrande, Whitt Glover, Lancaster, Odoms Young, & Gary, 2009).

Research Question

There is large body of epidemiological research that suggests fruit and vegetable intake helps promote health and prevents chronic disease. Rasmussen and colleagues (2006) conducted an extensive literature review (98 papers) on the determinants of fruit and vegetables intake among children and adolescents. Rasmussen found that socio-economic position, preferences, parental intake, and home availability/accessibility are all consistently positively associated with fruit and vegetable intake (Rasmussen, et al., 2006). How do these determinants of childhood fruit and vegetable intake relate to adult intake? Though studies have examined the relationship between child food preferences and adult fruit and vegetable intake (Birch 1999, Devine et al, 1999), there is a limited amount of research on the relationship between FV intake when growing up and FV

intake in adulthood, and how this relationship informs obesity prevention and control. Therefore, this research will address the following question: is there a correlation between recalled fruit and vegetable intake during childhood and its association with adult fruit and vegetable intake among U.S. adults. Secondly, is reported fruit and vegetable consumption associated with sociodemographic variables and other health-related behaviors?

This research extends current research in this area by addressing a question that is not yet fully answered. Findings from this study will likely inform obesity prevention intervention development.

Chapter II - Review of Literature

Fruit and Vegetable Intake When Growing Up

Research suggests that learned food preference patterns in early childhood may influence dietary intake in the long term (Birch, 1999; Liem & Mennella, 2002). Some food preferences may be developed in the prenatal or postnatal stage. Beauchamp et al. (2009) reported that if mothers consume FVs, their breast-fed infants will learn about these dietary choices as they experience the flavors in the mother's milk, thus emphasizing the importance of a varied diet in pregnant and lactating women (Beauchamp & Mennella, 2009).

The preschool years are a pivotal period for children to develop healthy eating habits. Using data from the Feeding Infants and Toddlers Study (FITS) (n=3,273), to describe the food consumption patterns of US children aged 2 to 3 years, Fox and colleagues (2010) found that about 70% of 2- to 3-year-olds consumed a portion of vegetables at least once a day; thus, more than a quarter of the children in this age range did not consume a portion of vegetables at least once per day. Regarding fruit and 100% juice intake, approximately 87% of 2- to 3- year olds consumed at least one distinct portion of fruit or 100% juice in a day. Nearly 85% of the children consumed a type of sweetened beverage, dessert, sweet, or salty snack in a day. This research suggests that, parents and caregivers should be encouraged to expose young children to a wide variety of fruits and vegetables and other nutritious foods and limit consumption of low-nutrients (Fox, Condon, Briefel, Reidy, & Deming, 2010). Skinner and colleagues reported that

the number of foods that children preferred did not change significantly between the ages 2 and 3 years to age 8 years (Skinner, Carruth, Wendy, & Ziegler, 2002).

Fruit and Vegetable Intake as an Adult

The newly released 2010 Dietary Guidelines for Americans (DGA) recommends that Americans eat more fruits and vegetables. Three reasons support the recommendation for Americans to eat more vegetables and fruits:

- First, most vegetables and fruits are major contributors of a number of nutrients that are underconsumed in the United States, including folate, magnesium, potassium, dietary fiber, and vitamins A, C, and K. Several of these are of public health concern for the general public (e.g., dietary fiber and potassium) or for a specific group (e.g., folic acid for women who are capable of becoming pregnant) (U. S. Department of Health and Human Services & U.S. Department of Agriculture, 2011).

- Second, consumption of vegetables and fruits is associated with reduced risk of many chronic diseases. Specifically, moderate evidence (studies of strong design with minor methodological concerns) indicates that intake of at least 2 1/2 cups of vegetables and fruits per day is associated with a reduced risk of cardiovascular disease, including heart attack and stroke. Some vegetables and fruits may be protective against certain types of cancer (U. S. Department of Health and Human Services & U.S. Department of Agriculture, 2011).
- Third, most vegetables and fruits, when prepared without added fats or sugars, are relatively low in calories. Eating them instead of higher calorie foods can

help adults and children achieve and maintain a healthy weight (U. S. Department of Health and Human Services & U.S. Department of Agriculture, 2011).

The national Healthy People 2020 fruit objective and vegetable objective are to increase the mean daily intake of fruit from 0.5 cup to 0.9 cup per 1000 calories and to increase the mean daily intake of vegetables from 0.8 cup to 1.1 cups per 1000 calories for the proportion of Americans aged at least 2 years (U. S. Department of Health and Human Services, 2010). According to CDC, in 2009 approximately 32.5% of U.S. adults consumed fruit two or more times per day. The highest percentage was consumed by District of Columbia residents (40.2%), and the lowest consumption was among Oklahoma residents (18.1%). The frequency of adults who consumed vegetables three or more times per day was 26.3%. Tennessee had the highest consumption rate of 33.0% and South Dakota had the lowest rate of 19.6%. No state met the Healthy People 2010 objectives related to fruit and vegetable consumption (Centers for Disease Control and Prevention, 2010).

Findings from a recent CDC's Behavioral Risk Factor Surveillance System (BRFSS, 2009) study indicate that non-Hispanics Blacks, ages 18 years and older differed from non-Hispanic whites in their daily consumption of fruits and vegetables. Over a third (33.7%, 95% CI: 32.6-34.9) of Non-Hispanic Blacks reported consuming fruits two or more times per day compared to non-Hispanics Whites (31.1%, 95% CI: 30.8-31.4). Regarding vegetable consumption, 21.9% (95% CI: 20.9-22.9) of Black respondents consumed vegetables three or more times per day compared to 27.7% (95% CI: 27.4-28.0) of Whites (Centers for Disease Control and Prevention, 2010).

Relationship between Fruit and Vegetable Intake When Growing Up and in Adulthood

There is a dearth of research examining the relationship between fruit and vegetable intake in childhood and adult dietary behaviors. The majority of the research refers to the development of child food preferences in affluent populations (Birch, 1999). However, research should be conducted that compares food development and preference across different food environments (Birch, 1999). Haire-Joshu et al. (2004) conducted an exploratory study (n= 1227) on how one's fruit and vegetable intake in childhood relates to three current dietary behaviors among African American women: intake of fruits and vegetables, exposure to and preference for fruits and vegetables, and preference for trying new foods. Study participants ranged in age from 18 to 65 years; mean years of education was 12.3. Results of the study showed that one's vegetable intake as a child was significantly related to exposure and preference for both fruits and vegetables, for trying new foods, and intake of vegetables as adults ($p < .0001$). Eating fruit as a child was not significantly associated with adult fruit and vegetable intake ($p = .19$) (Haire Joshu, Kreuter, Holt, & Steger May, 2004). Devine and colleagues (1999) examined life-course experiences and events associated with current fruit and vegetable consumption. Study participants were of low to moderate income living in a northeastern U.S. city. Three ethnic groups, black (n=201), Hispanic (n=191), and white (n=200) participated in the study. Results found that among Hispanic respondents, life-course events such as liking fruit and vegetable in youth, making dietary changes for health purposes, and food skills were all positively associated with fruit ($R^2 = .25$) and vegetable ($R^2 = .35$) consumption. Though there was no relationship between youth fruit and

vegetable intake and adult intake, Blacks (81%) and Hispanics (73%) were significantly more likely than whites (59%) to have grown up eating fresh fruits and vegetables from a garden or farm. Among the White respondents, such sociodemographic characteristics as being married with young children or single with no children and having a garden in adulthood were positively associated with the consumption of fruits ($R^2 = .20$) and vegetables ($R^2 = .22$) The association between life-course events and experiences and current fruit and vegetable intake differed among the three ethnic groups (Devine, Wolfe, Frongillo, & Bisogni, 1999).

Results from the literature review differ regarding the association of fruit and vegetable intake in childhood and consumption in adults. In Blacks, Haire-Joshu (2004) reported a significant association between vegetable intake as a child and as an adult, but not a significant association between fruit intake as a child compared to intake as an adult. Devine (1999) found that the liking of fruit and vegetables in Black children was not significantly associated with an affinity for fruit and vegetables in adults. Based on these results, further research of these different associations of fruit and vegetable intake when growing up, and reported fruit and vegetable intake as an adult is needed.

Chapter III - Methods and Procedures

Overview of FAB Survey Design, Participant Recruitment, and Survey Procedures

Data utilized in this study were obtained from the Food, Attitudes, and Behaviors (FAB) Survey. Developed by the National Cancer Institute in 2005, the FAB survey contains 65 questions, has 8 sections, and measures participants:

> Attitudes and opinions, health, shopping, fruit and vegetable consumption, eating behaviors, physical activity, food preferences, and demographic data. The conventional constructs include self-efficacy, barriers, social support, and knowledge of recommendations related to fruit and vegetable (FV) consumption, novel constructs include shopping patterns, taste preferences, views on vegetarianism, intrinsic/extrinsic motivation, and environmental influences. The FAB survey was conducted in fall 2007.

Participants in the study were drawn using Synovate's Consumer Opinion Panel, and included 3,397 adults, with an oversampling of non-Hispanic Blacks(28%). Final response rate for the survey was 59%.

Current Study Design

The current study used a cross-sectional study design to address the research question. A cross sectional design was appropriate because there was one wave of survey data collected from participants.

Measures used for the current study

The table below presents the main constructs/concepts that were examined in the study, along with corresponding item and response options. Also noted is whether the variable is an independent or dependent variable.

Construct/Concept	Item	Response options	Independent or dependent variable
Recalled fruit intake while growing up	When you were growing up, which BEST describes how often you ate fruit?	Rarely Few times per month Once per week More than once per week Once per day More than once per day	Independent
Recalled vegetable intake while growing up	When you were growing up, which BEST describes how often you ate vegetables?	Rarely Few times per month Once per week More than once per week Once per day More than once per day	Independent
Race	Which of the following would you say is your race?	White Black Asian American Indian or Alaskan Native Native Hawaiian or other Pacific Islander	Independent
Gender	Please indicate your gender	Male Female	Independent
Age	Please indicate your age	18-34 years 35-54 years 55 or older	Independent
Body mass index	What is your	<25	Independent

(BMI)	height and weight without shoes? (BMI calculated and categorized)	25-29.9 ≥30	
Geographical region	What region of the country do you live?	Northeast Midwest South West	Independent
Income	What is your annual household Income?	<20K 20-45K 45-75K >75K	Independent
Education	Please indicate the highest level of education you have received	Some high school High school degree Some college College degree	Independent
Smoking status	Have you smoked at least 100 cigarettes in your entire life?	Current Former Never	Independent
Physical activity	Describe your level of physical activity	Inactive 0-150 min/week >150 min/week	Independent
Reported adult fruit intake	About how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day?	None ½ cup or less ½ to 1 cup 1-2 cups 2-3 cups 3-4 cups 4 cups or more	Dependent
Reported adult vegetable intake	About how many cups of vegetable (including 100% vegetable juice) do you eat or drink each day?	None ½ cup or less ½ to 1 cup 1-2 cups 2-3 cups 3-4 cups 4 cups or more	Dependent

To ensure validity of the assessment tool, an evaluation study (n=516) was conducted of three short FV screeners, the 2-item CUPS FV screener to record the number of cups of fruit and vegetables ate or drank each day, a 2-item FV screener described number of servings of fruit and vegetables ate or drank per day, and a 16-item item FV screener which consists of 8 frequency and 8 portion size questions that ask about FV consumption over the past month. Multiple 24-hour dietary recalls were used as the gold standard comparison method. Results indicated that the 16-item screener used in the FAB study was approximately the same when compared to the 24 hour values (Yaroch, et al., 2011).

Statistical Analysis

Data analysis was conducted using Statistical Analysis System (SAS) version 9.2, SAS Institute, Cary NC. The variables, reported adult fruit intake and reported adult vegetables intake, measured by cups per day, were combined for analysis. Explanatory Variables included body mass index (BMI) calculated from self-reported height and weight data (kg/m^2), region, annual household income, education, smoking status, and physical activity.

Frequency analysis of the missing data was performed; 61 persons were excluded who did not respond to the questions on adult fruit and vegetable intake (table 0a, Appendix B). A sample size of 3336 was included for data analysis. Further analysis showed that 39 persons (Table 0b, Appendix B) did not respond to the question on fruit intake when growing up, and 29 persons (Table 0c, Appendix B) did not respond to the question regarding vegetable intake when growing up. Frequency procedures were used

to determine the number and percent of persons missing sociodemographic characteristics (Table 0d, Appendix B) such as age, gender, race, education level, income, region; and health-related data (Table 0e, Appendix B) including BMI, smoking status, and physical activity. A t-test (.58) was conducted to determine if there was a statistically significant difference in fruit and vegetable intake between the persons included and not included in the sample (Table 0f, Appendix B). There was no statistically significant difference between the two groups. Mean, standard error, and 95% confidence interval were also calculated for adult fruit and vegetable intake using a unit of cups per day.

Procedures were run to provide descriptive information on recalled fruit and vegetable intake when growing up (Table 1). Data on fruit and vegetable intake were then categorized into four categories: less than once per week, more than once a week, once a day, and more than once a day. Chi-square tests were conducted to determine if there was a significant difference in recalled fruit and vegetable intake when growing up among persons with different sociodemographic characteristics (Tables 3-4). Table 4 describes the frequency of adult fruit and vegetable intake. Chi-square tests were also used to evaluate the significance of adult fruit and vegetable intake sub-categorized by recalled child fruit or vegetable intake (Table 5). Table 6 depicts the correlations between recalled fruit and vegetable intake when growing up and adult fruit and vegetable intake stratified by race.

Chapter IV - Results

When all significant missing variables were excluded, a sample of N=3181 were included for analysis. Among the study participants, the highest percent of recalled vegetable intake while growing up was in the once per day category, and the highest percent of fruit intake was also in the once per day category (Table 1).

Reviewing the data across each category for fruit intake when growing up, age and BMI were not significant indicators of fruit intake when growing up. Gender, race, education, income, smoking status, region, and physical activity are significant indicators of fruit intake when growing up (Table 2). For the category of once per day, females, whites, those with a college degree, those with income greater than $75K, those who never smoked, those in the northeastern region of the country, and those who were active greater than 150 minutes per week, had the highest frequency of consuming fruit when growing up (Table 2).

When reviewing the data across categories, BMI and smoking status were not significant indicators of vegetable intake when growing up. Age, gender, race, education, income, region, and physical activity were significant indicators of vegetable intake when growing up (Table 3). For the category of one per day, age greater than 55 years, females, whites, those with college degrees, income greater than $75K, those living in the northeast, and those who were physically active more than 150 minutes per week, had the highest frequency of vegetable consumption when growing up (Table 3).

For adult fruit and vegetable intake, BMI and region were not significant indicators. Age, gender, race, education, income, smoking status, and physical activity

were significant indicators for adult fruit and vegetable intake. Of those who consumed the most fruits and vegetables per day (>4.5 cups/day), individuals who were >55 years, females, those with some college, highest income, and former smokers had the highest percentage. When comparing to adult FV intake, in the greater than 4.5 cups per day, Black adults were more likely to consume the recommended amount of fruit and vegetables than Whites. Individuals categorized as "Others" had the highest percentage of greater than 4.5 cups of fruit and vegetable intake as adults (Table 4).

The calculated mean of adult fruit and vegetable intake was 2.83 cups per day (95% confidence level of 2.72-2.93) and a standard error of 0.05. The measure of cups per day was based on a DGA recommendation of 4.5 cups fruits and vegetables per day for a person consuming 2000 calories. Table 5 provides the frequency and chi-square of fruit and vegetable intake when growing up in relation to fruit and vegetable intake as adults. The p-value (<.0001) for the chi-square results for fruit intake when growing up and adult fruit and vegetable intake indicated a significant association between these two variables. The p-value (<.0001) for the chi-square results of vegetable intake when growing up and adult fruit and vegetable intake indicated a significant association between these two variables.

When stratified by race, the correlation between recalled fruit intake when growing up and fruit and vegetable intake as adults was higher for "other", followed by Whites and Blacks. For recalled vegetable intake when growing up and fruit and vegetable intake as adults, the correlation for Blacks and others was higher than that of Whites. All p-values were <.0001 (Table 6).

The correlation for fruit intake when growing up and vegetable intake when growing up was r=.56 with a p-value <.0001. This result indicates a strong positive correlation of fruit intake when growing up and vegetable intake when growing up. In summary as fruit and vegetable intake while growing up increases, there is a positive increase in adult fruit and vegetable consumption.

Chapter V - Discussion and Conclusion

As previously stated, the objective of this research was to focus on whether there is a correlation between recalled fruit and vegetable intake during childhood and reported adult fruit and vegetable intake among U.S. adults. Secondly, is reported fruit and vegetable consumption associated with sociodemographic variables and other health-related behaviors?

Results from this study indicate there is a positive correlation between recalled fruit and vegetable intake when growing up and reported fruit and vegetable intake in adults. It is important to examine how participants' sociodemographic and health-related characteristics affect this relationship.

In examining recalled fruit intake when growing up, regarding race, it is interesting to note that Blacks (28.33%) are more likely to eat fruit more than once a day than Whites (18.04%). This was an interesting finding considering the reported consumption rates for these two populations. In comparing income data, persons in the less than $20K category (28.20%) were more likely to consume fruit more than once a day than persons in higher income categories, i.e. greater than $75K (18.90%).

The results were also significant when comparing the fruit intake when growing up and adult FV intake. It is interesting to note that participants who reported consuming fruit more than once per day when growing up were also more likely to consume more than 4.5 cups of fruits and vegetables per day as an adult (37.76%) compared to respondents who consumed less than one cup per day (11.29%). Results were similar for recalled vegetable intake when growing up and reported adult FV intake. Again,

participants who recalled consuming vegetables more than once a day when growing up were more likely to consume more than 4.5 cups of fruits and vegetables per day as an adult (30.94%) compared to participants who consumed less than one cup per day (13.43%).

Regarding the three study variables, recalled fruit intake when growing up, recalled vegetable intake when growing up, and reported adult FV intake, BMI was not a significant indicator. Because FV and vegetable intake is a significant factor in obesity prevention and control, this finding requires further research.

Previous research has shown that food preferences learned in childhood predict food preferences in adulthood. In the current research, when stratified by race, results showed a positive correlation of recalled FV intake when growing up and FV intake as an adult across all race groups. Haire-Joshu (2004) reported a significant relationship between one's vegetable intake as a child and vegetable intake in Black female adults. These results correspond with the current study results. However, Haire-Joshu's reported that eating fruit as a child was not significantly associated with adult fruit and vegetable intake. This finding differs with results of the current research study. Devine (1999) reported a positive association of liking fruit and vegetables in youth to fruit and vegetable intake in Hispanic adults. These results are similar to the current research study results. Additional research is needed in other study populations to fully understand these findings.

This study has the following limitations. Because the data was collected via a cross sectional survey and contains self-reported data, it does not allow for behavior

change prediction. Additional longitudinal research studies are needed to show whether FV intake when growing up predicts FV intake in adults. Adults were required to recall fruit and vegetable intake when growing up, which may lead to a recall error among participants. For some, this may have been a year or two ago (aged 18 years) whereas for others it may represent a longer period (aged 50 years). Also, growing up did not have a defined time period. The reported adult FV intake variables were combined for analysis; therefore it was not possible to report adult fruit and vegetable intake separately. Although African Americans were oversampled for the survey, the sample was not sufficient to do analyses on other racial/ethnic groups.

In conclusion, there is a positive correlation between recalled FV intake and reported FV intake in adults. Specifically, some sociodemographic factors, such as gender, race, education and income were consistently associated with recalled fruit and vegetable intake while growing up and reported intake as an adult. As noted previously, adult BMI was not associated with recalled fruit and vegetable intake or current fruit and vegetable intake. Though our data precluded an analysis of fruit and vegetable intake and weight management, prior research does suggest a positive association between fruit and vegetable intake and weight management. Though additional research is needed in more diverse samples, the findings from this study imply that public health practitioners should develop initiatives to increase the amount of fruit and vegetable intake in children so that these fruit and vegetable consumption habits may be carried into adulthood.

Tables

Table 1:

Recalled frequency of fruit and vegetable intake when growing up

	Fruit intake (N=3181) (%)	Vegetable intake(N=3181) (%)
Rarely	3.60	1.64
Few times per month	7.80	2.88
Once per week	7.91	2.83
More than once a week	23.31	17.18
Once per day	31.22	43.57
More than once a day	21.20	31.89

Table 2.

Characteristics and frequency of fruits intake when growing up

Characteristics	N (%)	Less than once per week	More than once a week	Once a day	More than once a day	χ^2
Total						
Age						
18-34 years		165(18.79)	264(29.68)	260(28.00)	219(23.53)	.1564
35-54 years		233(18.90)	332(26.98)	421(33.27)	281(20.86)	
>55 years		201(20.15)	273(28.48)	318(32.00)	214(19.37)	
Gender						
Male		233(19.42)	386(31.01)	387(30.37)	241(19.20)	.0123
Female		366(19.14)	483(25.88)	612(31.98)	473(22.99)	
Race						
White		393(19.58)	615(29.84)	711(32.54)	394(18.04)	<.0001
Black		158(20.35)	199(25.84)	208(25.48)	225(28.33)	
Other		48(15.82)	55(19.70)	80(27.70)	95(36.79)	
BMI						
<25		154(16.33)	278(30.18)	306(30.59)	224(22.90)	.0858
25-29.9		183(18.70)	293(29.66)	330(31.83)	211(19.81)	
≥30		227(21.79)	267(26.52)	319(31.13)	237(20.54)	
Highest Education Level						
Some high school		106(29.09)	102(26.17)	81(21.81)	92(22.94)	<.0001
High school degree		226(23.92)	267(28.40)	271(28.58)	199(19.11)	
Some college		159(16.58)	253(27.48)	299(30.93)	251(25.01)	
College degree		108(11.64)	247(30.26)	348(39.63)	172(18.46)	
Income						
<20K		142(23.36)	148(25.49)	135(22.95)	175(28.20)	<.0001
20-45K		171(20.88)	243(28.92)	262(30.57)	191(19.63)	
45-75K		154(20.07)	212(29.46)	233(30.75)	157(19.72)	
>75K		132(13.51)	266(28.78)	369(38.81)	191(18.90)	
Cigarette Smoking Status						
Current		142(19.02)	215(28.82)	199(27.02)	189(24.14)	.0061
Former		154(22.09)	186(26.28)	247(34.03)	131(17.60)	
Never		281(17.52)	447(28.74)	532(32.36)	371(21.38)	
Region of country						
Northeast		110(17.74)	162(27.38)	216(35.28)	131(19.60)	<.0001
Midwest		129(20.10)	194(29.11)	223(32.14)	138(18.64)	
South		273(21.73)	375(30.49)	357(27.94)	282(19.83)	
West		87(15.21)	138(24.24)	203(32.56)	163(27.98)	
Physical Activity last month						
Inactive		265(28.63)	256(27.14)	261(28.80)	169(15.43)	<.0001
0-150 min/week		123(19.02)	181(28.22)	237(34.20)	126(18.56)	
>150 min/week		193(13.58)	394(28.94)	458(31.07)	391(26.41)	

Table 3.

Characteristics and frequency of vegetable intake when growing up

Characteristics	N (%)	Less than once per week	More than once a week	Once a day	More than once a day	χ^2
Total						
Age						
18-34 years		94(10.05)	193(21.64)	363(40.57)	258(27.74)	<.0001
35-54 years		92(7.21)	220(16.91)	538(43.98)	417(31.89)	
>55 years		49(4.96)	139(13.27)	455(45.97)	363(35.80)	
Gender						
Male		104(8.19)	249(19.54)	534(43.41)	360(28.86)	.0008
Female		131(6.60)	303(15.07)	822(43.72)	678(34.61)	
Race						
White		134(6.79)	326(16.24)	984(45.88)	669(31.10)	<.0001
Black		75(10.24)	175(22.87)	266(32.57)	274(34.31)	
Other		26(8.45)	51(18.01)	106(38.49)	95(35.05)	
BMI						
<25		61(6.33)	142(14.58)	446(47.57)	313(31.51)	.1329
25-29.9		77(7.34)	178(18.49)	434(42.76)	328(31.41)	
≥30		83(8.02)	205(18.37)	423(41.95)	339(31.66)	
Highest Education Level						
Some high school		42(11.16)	80(20.81)	136(36.50)	123(31.53)	.0011
High school degree		80(8.41)	172(16.60)	414(44.44)	297(30.55)	
Some college		71(7.14)	168(17.22)	400(42.57)	323(33.06)	
College degree		42(4.33)	132(15.94)	406(47.38)	295(32.34)	
Income						
<20K		64(9.17)	132(20.51)	201(35.90)	203(34.42)	<.0001
20-45K		68(8.3)	129(14.50)	373(43.73)	297(33.46)	
45-75K		54(7.27)	144(19.35)	322(44.17)	236(29.20)	
>75K		49(4.88)	147(15.95)	460(48.81)	302(30.35)	
Cigarette Smoking Status						
Current		66(8.31)	141(18.80)	305(45.50)	233(30.39)	.1109
Former		44(6.12)	103(13.69)	331(46.30)	240(33.88)	
Never		117(7.32)	288(17.89)	690(43.11)	536(31.69)	
Region of country						
Northeast		39(6.12)	106(17.39)	314(51.34)	160(25.14)	.0006
Midwest		48(7.40)	132(19.19)	302(43.41)	202(30.00)	
South		108(8.18)	235(17.65)	479(39.32)	465(34.85)	
West		40(6.92)	79(13.95)	261(44.50)	211(34.64)	
Physical Activity last month						
Inactive		106(10.82)	180(18.02)	392(43.07)	273(28.10)	.0001
0-150 min/week		42(6.56)	115(18.11)	299(45.06)	211(30.27)	
>150 min/week		76(5.43)	239(16.76)	616(43.16)	505(34.65)	

Table 4.

Characteristics and frequency of adult fruits and vegetable intake

Characteristics	N(%)	<1 cup/day	1-4.5 cups/day	>4.5 cups/day	χ^2
Total					
Age					
18-34 years		239(27.72)	508(55.05)	161(17.23)	.0048
35-54 years		310(25.04)	712(57.08)	245(17.88)	
>55 years		188(19.81)	606(60.96)	212(19.24)	
Gender					
Male		327(26.61)	708(56.98)	212(16.41)	.0073
Female		410(21.95)	1118(58.39)	406(19.66)	
Race					
White		485(24.29)	1280(59.89)	348(15.82)	<.0001
Black		191(25.55)	404(49.79)	195(24.65)	
Other		61(21.63)	142(50.36)	75(28.02)	
BMI					
<25		229(25.59)	544(55.95)	189(18.46)	.2283
25-29.9		214(21.77)	596(59.20)	207(19.04)	
≥30		260(25.23)	600(58.27)	190(16.50)	
Highest Education Level					
Some high school		116(30.99)	197(51.92)	68(17.09)	<.0001
High school degree		263(28.38)	516(53.72)	184(17.90)	
Some college		200(21.08)	568(59.97)	194(18.95)	
College degree		158(19.01)	545(63.00)	172(17.99)	
Income					
<20K		166(28.02)	291(49.81)	143(22.17)	.0006
20-45K		212(24.40)	497(58.75)	158(16.85)	
45-75K		178(24.97)	451(59.28)	127(15.75)	
>75K		181(20.17)	587(61.30)	190(18.53)	
Cigarette Smoking Status					
Current		220(31.12)	394(51.73)	131(17.15)	<.0001
Former		144(20.74)	422(59.38)	152(19.88)	
Never		348(21.93)	963(60.14)	320(17.93)	
Region of country					
Northeast		125(20.83)	374(60.70)	120(18.47)	.4266
Midwest		164(24.94)	391(57.34)	129(17.72)	
South		321(26.08)	716(56.12)	250(17.79)	
West		127(22.78)	345(58.38)	119(18.84)	
Physical Activity last month					
Inactive		316(34.28)	517(54.53)	118(11.19)	<.0001
0-150 min/week		149(24.25)	409(60.66)	109(15.08)	
>150 min/week		242(17.35)	830(58.74)	364(23.91)	

Table 5.

Frequency of Adult F&V intake and Fruit and vegetable intake recall when growing up

	Adult Fruit/Vegetable Intake	N(%)		
	<1 cup/day	1-4.5 cups/day	>4.5 cups/day	χ^2
Child Fruit				<.0001
Less than once per week	229(40.07)	309(50.72)	61(9.21)	
More than once a week	249(29.31)	518(60.21)	102(10.57)	
Once a day	175(18.38)	639(64.48)	185(17.14)	
More than once a day	84(11.29)	360(50.94)	270(37.76)	
Child Vegetable				<.0001
Less than once per week	106(43.55)	110(46.38)	19(10.07)	
More than once a week	204(38.24)	291(53.43)	57(8.33)	
Once a day	297(23.17)	849(62.86)	210(13.97)	
More than once a day	130(13.43)	576(55.63)	332(30.94)	

Table 6.

Correlations between recalled fruit and vegetable intake when growing up and adult fruit and vegetable intake by race

Group	Correlation	p-value
Overall		
Child fruit	.29	<..0001
Child vegetable	.29	<.0001
Non-Hispanic White		
Child fruit	.28	<.0001
Child vegetable	.26	<.0001
Non-Hispanic Black		
Child fruit	.26	<.0001
Child vegetable	.33	<.0001
Other		
Child fruit	.43	<.0001
Child vegetable	.33	<.0001

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Appendices

Appendix A: Food Attitude and Behavior Survey

FAB Main
2007-09-26(SYN)g_le

Appendix B: Tables of Missing Data

Table 0a.

Characteristics of persons missing versus not missing F&V Intake data

Characteristics	Included	Not Included
Total	3336	61
Age		
18-34 years	924(28.33)	25(47.17)
35-54 years	1297(39.77)	15(28.30)
>55 years	1040(31.89)	13(24.53)
Sex		
Male	1275(39.22)	25(43.10)
Female	1976(60.78)	33(56.90)
Race		
White	2157(66.29)	30(51.72)
Black	813(24.98)	21(36.21)
Other	284(8.73)	7(12.07)
BMI		
<25	1010(31.88)	21(38.18)
25-29.9	1075(33.93)	19(34.55)
≥30	1083(34.19)	15(27.27)
Highest Education Level		
Some high school	393(12.07)	15(27.27)
High school degree	991(30.45)	17(30.91)
Some college	982(30.17)	11(20.00)
College degree	889(27.31)	12(21.82)
Income		
<20K	643(19.27)	27(44.26)
20-45K	913(27.37)	12(19.67)
45-75K	783(23.47)	9(14.75)
>75K	997(29.89)	13(21.31)
Cigarette Smoking Status		
Current	784(24.21)	9(16.36)
Former	762(23.53)	9(16.36)
Never	1692(52.25)	37(67.27)
Region of country		
Northeast	653(19.57)	12(19.67)
Midwest	719(21.55)	14(22.95)
South	1348(40.41)	24(39.34)
West	616(18.47)	11(18.03)
Physical Activity		
Inactive	946(49.04)	23(63.89)
0-150 min/week	704(36.50)	6(16.67)
>150 min/week	279(14.46)	7(19.44)

Table 0b.

Characteristics of persons missing versus not missing fruit intake when growing up data

Characteristics	Included	Not Included
Total	3358	39
Age		
18-34 years	942(28.75)	7(18.42)
35-54 years	1298(39.62)	14(36.84)
>55 years	1036(31.62)	17(44.74)
Sex		
Male	1286(39.32)	14(36.84)
Female	1985(60.68)	24(63.16)
Race		
White	2163(66.05)	24(64.86)
Black	824(25.16)	10(27.03)
Other	288(8.79)	3(8.11)
BMI		
<25	1018(31.93)	13(37.14)
25-29.9	1079(33.85)	15(42.86)
≥30	1091(34.22)	7(20.00)
Highest Education Level		
Some high school	402(12.28)	6(16.22)
High school degree	994(30.37)	14(37.84)
Some college	984(30.06)	9(24.32)
College degree	893(27.28)	8(21.62)
Income		
<20K	663(19.74)	7(17.95)
20-45K	913(27.19)	12(30.77)
45-75K	782(23.29)	10(25.64)
>75K	1000(29.78)	10(25.64)
Cigarette Smoking Status		
Current	788(24.20)	5(13.51)
Former	757(23.25)	14(37.84)
Never	1711(52.55)	18(48.65)
Region of country		
Northeast	654(19.48)	11(28.21)
Midwest	726(21.62)	7(17.95)
South	1356(40.38)	16(41.03)
West	622(18.52)	5(12.82)
Physical Activity		
Inactive	963(49.61)	6(25.00)
0-150 min/week	699(36.01)	11(45.83)
>150 min/week	279(14.37)	7(29.17)

Table 0c.

Characteristics of persons missing versus not missing vegetable intake when growing up data

Characteristics	Included	Not Included
Total	3368	29
Age		
18-34 years	946(28.78)	3(11.11)
35-54 years	1301(39.58)	11(40.74)
>55 years	1040(31.64)	13(48.15)
Sex		
Male	1290(39.31)	10(37.04)
Female	1992(60.69)	17(62.96)
Race		
White	2168(65.98)	19(73.08)
Black	828(25.20)	6(23.08)
Other	290(8.83)	1(3.85)
BMI		
<25	1022(31.97)	9(34.62)
25-29.9	1085(33.94)	9(34.62)
≥30	1090(34.09)	8(30.77)
Highest Education Level		
Some high school	405(12.33)	3(11.54)
High school degree	996(30.33)	12(46.15)
Some college	986(30.02)	7(26.92)
College degree	897(27.31)	4(15.38)
Income		
<20K	664(19.71)	6(20.69)
20-45K	917(27.23)	8(27.59)
45-75K	785(23.31)	7(24.14)
>75K	1002(29.75)	8(27.59)
Cigarette Smoking Status		
Current	789(24.16)	4(14.81)
Former	761(23.30)	10(37.04)
Never	1716(52.54)	13(48.15)
Region of country		
Northeast	660(19.60)	5(17.24)
Midwest	726(21.56)	7(24.14)
South	1358(40.32)	14(48.28)
West	624(18.53)	3(10.34)
Physical Activity		
Inactive	963(49.54)	6(28.57)
0-150 min/week	701(36.06)	9(42.86)
>150 min/week	280(14.40	6(28.57)

Table 0d.

Frequency and percent of persons missing sociodemographic characteristics

Characteristic	N%
Total	113(3.4%)
Age	
18-34 years	8(20.51)
35-54 years	16(41.03)
>55 years	15(38.46)
Sex	
Male	13(44.83)
Female	16(55.17)
Race	
White	18(54.55)
Black	12(36.35)
Other	3(9.09)
Highest Education Level	
Some high school	6(17.65)
High school degree	12(35.29)
Some college	11(32.35)
College degree	5(14.71)
Income	
<20K	36(31.86)
20-45K	34(30.09)
45-75K	16(14.16)
>75K	27(23.89)
Region of country	
Northeast	23(20.35)
Midwest	26(23.01)
South	44(38.94)
West	20(17.70)

Table 0e.

Frequency and percent of persons missing health-related data

Characteristic	N%
BMI	
<25	34(33.66)
25-29.9	41(40.59
≥30	26(25.74)
Cigarette Smoking Status	
Current	33(31.73)
Former	30(28.85)
Never	41(39.42)
Physical Activity	
Inactive	31(27.93)
0-150 min/week	25(22.52)
>150 min/week	55(49.55)

Table 0f.

F&V child/Adult Intake among people who are missing sociodemographic characteristics

	Missing	Not Missing	t-test
	Mean	Mean	
Adult F&V	3.09	2.94	0.58
	N%	N%	
Child Fruit			
More than once per day	24(21.24)	714(22.45)	
Once per day	37(32.74)	999(31.41)	
More than once per week	33(29.20)	869(27.32)	
Once per week	10(8.85)	240(7.54)	
Few times per month	6(5.31)	248(7.80)	
Rarely	3(2.65)	111(3.49)	
Child Vegetable			
More than once per day	27(23.89)	1038(32.63)	
Once per day	58(51.33)	1356(42.63)	
More than once per week	20(17.70)	552(17.35)	
Once per week	2(1.77)	94(2.96)	
Few times per month	5(4.42)	90(2.83)	
Rarely	1(0.88)	51(1.60)	