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Dietary Risk Factors by Race/Ethnicity, Age-group, and Gender in a Representative Sample of US Older Adults

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Abstract

Objective: To explore the relationships among ethnicity/race, gender, demographics, age-group and dietary health in a nationally representative sample of older adults. **Design:** Cross-sectional study **Setting:** Data for this study were collected by interview in the mobile examination centers from the National Health and Nutrition Examination Surveys, 2011 - 2012. **Participants:** U.S. representative sample of adults aged 55 years and older (N = 1860) from five ethnic/racial groups. All participants read, understood, and signed informed consent forms under data collection procedures by trained individuals. **Measurements**: Sociodemographics were collected by trained interviewers using a general questionnaire. Food groups were determined by 24-hour recall using the validated USDA Automated Multiple-Pass Method. Data were presented by cross-tabulation and logistic regression to investigate relationships among race/ethnicity, gender, and age groups**. Results:** Over 70% of older adults failed to consume 2.75 cups of combined fruits and vegetables. Other Hispanics (Hispanics excluding Mexican Americans) had higher Odds of sugar-containing food consumption compared to non-Hispanic Whites (adjusted model). Being older and female were protective factors for over-consumption of sugar. **Conclusion:** Older Americans are not meeting dietary guidelines and there are differences by gender and ethnicity. Since diet has been associated with quality of life and medical costs, public health interventions can benefit by knowing age-, gender- and racial/ethnic- specific dietary behaviors.

Keywords: Age-group, race/ethnicity, gender, foods with added sugar, fat intake

Introduction

Older adults are the fastest growing population and have the highest medical costs of all age groups in the United States (1). The burden of high medical costs to society can be reduced when older Americans follow dietary guidelines, a key indicator of health (2). Poor diet and physical inactivity are predicted to surpass tobacco use in the leading cause of death and accounted for over 16% of deaths in the U.S. (3). Unlike most sociodemographic risk factors, dietary behavior has the potential to be modified (4).

Healthy aging includes following dietary guidelines. According to the Institutes of Medicine (5), total fat intake should not exceed 35 percent of calories and saturated fat not more than 6 percent of calories for adults. The dietary guidelines for Americans recommend increasing fruit and vegetable intake while decreasing added sugar and solid fat consumption (6). Certain dietary factors: low intake of sugar (7) and low saturated fat (8-9), and high consumption of fruits and vegetables have been associated with healthy aging and less adverse health events (10-12). Yang et al (7) observed added sugar consumption was associated with mortality from cardiovascular disease in a representative US adult population. Replacement of saturated fats with polyunsaturated fats reduced coronary risk by 13% in European and American cohorts (13). Each 1-serving/d increase in intake of fruits or vegetables was associated with a 4% lower risk for coronary heart disease in a large cohort of health professionals (10). Higher consumption of fruits and vegetables were protective of all-cause mortality and cardiovascular mortality in a meta-analysis of pooled cohort studies (12).

Limited data is available for dietary trends of older adults by age-group, gender, and race/ethnicity. Dietary trends of US adults have been presented with older adults as a single group, ages 65 years and older in previous studies. Dietary factors may vary by race/ethnicity, gender and sociodemographics for different age-groups of older adults and this has not been examined to date. The aim of the present study was to examine dietary trends that are associated with healthy aging for older adults by age-group and race/ethnicity.

Methods

Participants

This study extracted data from the 2011 – 2012 National Health and Nutrition Examination Survey (NHANES) that are available for public use (National Health and Nutrition Examination Survey, (NHANES) (14). Each survey period applies a complex, stratified, multistage probability cluster sampling design to obtain a nationally representative sample of the U.S. civilian, noninstitutionalized population. NHANES operates under the auspices of the National Center for Health Statistics (NCHS), Division of Health and Nutrition Examination Survey (DHNES), a part of the Centers for Disease Control and Prevention (CDC). For this study, inclusion criteria were as follows: adults ≥ 55 years of age with complete first-day dietary data and who reported belonging to one of five racial/ethnic categories. The final sample included N = 1860 participants: 125 Mexican Americans (MA); 202 Other Hispanics (OH) (belonging to a Hispanic group other than MA); 204; other race/mixed race (MX); 529 non-Hispanic Blacks (NHB); and 799 non-Hispanic Whites (NHW). The data were weighted using the coded strata and units variables with the appropriate sample weight. The sample weight chosen was the first-day dietary recall in-person interview. This dietary sample weight was chosen to account for unequal probabilities of selection, account for nonresponse, and to conform to a known population distribution.

Ethical Considerations

The data used for this study were publically available. Prior to public release, the study protocol #2011-17 was approved by the National Center for Health Statistics Research Ethics Review Board (NCHS-ERB) (15). All participants read, understood, and signed informed consent forms under data collection procedures by NHANES trained individuals. Detailed information concerning the data collection procedure for this survey can be found at the NHANES website (14).

Sociodemographic variables

In order to assess dietary changes by stage of life, variables were formed for two age categories (55-74 and 75 and over yrs.) and four age-groups (55-64.9; 65-74.9; 75-79.9; and ≥ 80 yrs.). NHANES assigns an age of 80 for anyone 80 years or older to protect their identity. Race/ethnicity included five categories (stated above under participants) and was re-coded with non-Hispanic White as the comparison group. A binary variable was created for marital status: living with partner or married/other (single, never married, divorced, widowed, separated). Binary variables were created for living without any person in the household and living without family. Participants were considered living alone if the total living in the household was one. Living without family was considered if the total number of people in the family was less than two. A binary variable for poverty/above poverty was created based on the *income to poverty index* (16). Income-to-poverty ratios represent the ratio of household income to the appropriate poverty threshold. Ratios below 1.00 indicate that the income is below the official definition of poverty, while a ratio of 1.00 or greater indicates income above the poverty level. Education was collapsed from five to four categories: less than 9th grade and some high school were combined to a single group: less than a high school diploma or GED; high school diploma or GED; some college; and college or above.

Dietary Variables

Dietary intake was assessed in the Mobile Examination Center using an automated 24 hour recall USDA's Automated Multiple-Pass Method (AMPM). This method was validated in normal weight, premenopausal women using doubly labeled water total energy expenditure and 14-day estimated food record absolute nutrient intake (17). Trained interviewers helped survey participants recall the amount of food consumed with the help of portion images, measuring cups and rulers. Survey participants were requested to report all foods and beverages consumed during the past 24 hours from midnight to midnight. Food groups were provided and those indicating dietary risk: added sugars, solid fat, and total fruit and vegetable intake (excluding fruit juices and white potato) were chosen for this analysis. Cut offs for high risk were based on clinical judgement and the population distribution. The highest quartile for total fruits and vegetables was 2.75 cups, so values under the upper quartile were considered dietary risk. Dietary risk for total fat was >35 % of total calories and solid fat was considered >6% of total calories based on the IOM dietary reference intake (5). Total fat included oils and solid fats. Solid fats are fats that are solid at room temperature and can be described as shortening or hydrogenated oils (18). Solid fats primarily come from animal sources or from vegetable oils that have been hydrogenated and examples include butter, beef tallow, stick margarines, and shortenings (18). Variables for high fat and high solid fat were constructed using the participant's grams of fat type multiplied by 9 grams per calorie and divided by their total energy (Kcal/day) and multiplied by 100. The resulting percent was converted to a binary variables based on the cutoffs. Since there is no set amount for added sugar, dietary risk was considered 20 teaspoons, which corresponded to the highest quartile. Added sugars included all sugars used as ingredients in processed and prepared foods such as breads, cakes, soft drinks, jams, chocolates, and ice cream, and sugars eaten separately or added to foods at the table. Examples of added sugars include white sugar, brown sugar, raw sugar, corn syrup, corn syrup solids, high fructose corn syrup, malt syrup, maple syrup, pancake syrup, fructose sweetener, liquid fructose, honey, molasses, anhydrous dextrose, crystal dextrose, and dextrin (18).

Statistical Methods

All data were analyzed applying the first dietary 2-year sample weights using the Statistical Package for Social Sciences (SPSS, version 22) with the module for complex design analysis. All analysis took into account differential probabilities of selection for the complex sample design with SPSS, using Taylor series linearization. A p value of less than .05 (two-sided) was considered statistically significant. Participants' characteristics were presented by percent and 95% confidence intervals by cross-tabulation for race/ethnicity, gender, and age group. Separate logistic regression complex sample analyses were performed using all the above sociodemographics for Odds of each of the following dietary-risks: high percent of foods with added sugar; high total fat; high solid fat; and low fruit and vegetable consumption. Ethnicity and gender were tested by as main and interactive parameters and the best model was presented. Models for dietary factors were conducted with all sociodemographic factors (fully adjusted). Of the three dietary models run, only those that achieved model fit (overall significance of the model) were presented in this article.

Results

Descriptive information about the study population is shown in **Table 1**. Hispanics had a higher percent with less than a high school diploma or GED as compared to other groups. Non-Hispanic Blacks had the lowest percent married or partnered as compared to other racial/ethnic groups. White non-Hispanics were more likely to be living alone as compared to other groups. Living below the poverty level and meeting dietary guidelines for sugar, fat, and fruit and vegetable intake were not significantly different by race/ethnicity without adjustments. Over 70% older adults failed to consume 2.75 cups of combined fruits and vegetables. A minimum of 5 servings (approximately 2.5 cups) is recommended by the World Health Organization to prevent chronic disease (19). High fruit and vegetable consumption has been observed to reduce age-related oxidative stress, inflammation, and sarcopenia (20).

Table 1

Characteristics of the sample by race/ethnicity

Variable	**MA**	**OH**	**MR**	**NHB**	**NHW**	***P***
< HS diploma or GED	63.1[a]	53.4[a]	21.7[b]	18.5[b]	21.2[b]	<.001
	(47.7, 76.2)	(43.0, 63.5)	(9.9, 41.1)	(11.6,28.2)	(14.2, 30.4)	
Married /living with partner	66.3[a]	50.8[a]	69.7[a]	39.1[b]	56.9[a]	<.001
	(52.3, 77.9)	(36.3, 65.2)	(56.4, 80.3)	(31.0, 47.9)	(48.8, 64.7)	
Living alone	3.6[a]	7.1[a]	3.8[a]	8.3[a]	13.9[b]	.006
	(1.0, 11.7)	(2.9, 16.2)	(1.7, 8.1)	(5.1, 13.2)	(9.6, 19.6)	
Living without family (but with a Medical Assistant)	6.2[a]	9.8[a,b]	12.8[a b]	14.9[a,b]	20.9[b]	.016
	(2.9,12.8)	4.4,20.3)	8.4, 18.9)	(9.7, 22.2)	(15.6, 27.5)	
Poverty level (<1.00 poverty index)	14.0	13.9	10.7	13.1	11.0	.734
	(7.4, 24.9)	(9.1, 20.7)	(6.5, 17.1)	(9.3, 18.1)	(7.8, 15.4)	
Low fruit and vegetable intake (≤ 2.75 cups)*	72.6	79.3	76.5	69.8	70.1	.316
	(64.0, 79.8)	(68.4, 87.2)	(65.8, 84.6)	(62.8, 76.0)	(60.0, 785)	

High solid fat intake (>6% calories)	85.1 (76.8, 90.8)	93.0 (86.6, 96.5)	86.6 (80.2, 91.2)	82.0 (72.9, 88.5)	82.6 (79.2, 85.6)	.146
High total fat intake (>35 % calories	9.6 (4.4, 19.7)	14.3 (9.6, 20.7)	12.4 (8.5, 17.9)	12.1 (8.3, 17.4)	13.3 (9.5, 18.2)	.717
High Sugar = foods with added sugar intake (≥ 20 tsp)	26.0 (17.9, 36.1)	34.8 (22.7, 49.20	20.3 (13.3, 29.7)	26.1 (19.9, 33.4)	24.3 (19.5, 29.8)	.292

Abbreviations: MA =Mexican American; OH=Other Hispanic; MR = Mixed race or other race; NHB = non-Hispanic Black; NHW = non-Hispanic White.

Notes: * total intake of fruits and vegetables minus white potato and juices. Data are in percent (95 % CI). Columns with the same letter are not significantly different.

Table 2 presents logistic regression model of high sugar intake with sociodemographic predictors. Models for other dietary factors could not be fit using the same sociodemographic predictors. The model for high sugar intake showed Other Hispanics had higher Odds of consuming 20 teaspoons per day of sugar (from sugar-containing foods) as compared to non-Hispanic Whites. Being older and female were protective factors for over-consumption of sugar.

Table 2

Logistic regression model of sociodemographics with high sugar intake

High sugar (≥ 20 teaspoons/day)				
Variable/parameters	**OR**	**95% CI**	**SE**	***P***
Race	-	-	-	.001
Mexican American	0.72	0.20, 2.57	0.60	.596
Other Hispanic	2.51	1.50, 4.20	0.24	.002
Mixed race or other race	0.81	0.36, 1.85	0.39	.605
Non-Hispanic Black	0.97	0.49, 1.94	0.33	.937
Non-Hispanic White (reference)	1.00	-	-	-
Married or living with partner	0.63	0.36, 1.09	0.26	.092

Other: single, widowed, divorced, separated (reference)	1.00	-	-	-
Gender (male)	2.05	1.29, 3.24	0.21	.004
Female (reference)	1.00	-	-	-
Income poverty ratio (<1.00 –below poverty)		0.50, 2.28	0.36	.859
≥ 1.00 –above poverty (reference)	1.00	-	-	-
Age (years)	0.97	0.94, 0.99	0.01	.013

Table 3 shows dietary and sociodemographic factors by age. Adults 75 years and older had a higher percent of low fruit and vegetable intake as compared to adults 55-74 years. Conversely, adults 55-74 years had a higher percent of foods with added sugar as compared to adults 75 years and older. There were no significant differences in fat intake, living status, or education by age. Dietary and sociodemographic factors are compared by gender in **Table 4**. Fruit and vegetable intake did not vary by gender. High sugar, total fat and solid fat intakes were present in a greater percent of males as compared to females. Living situation, poverty and education did not vary by gender.

Table 3

Age groups with dietary factors and sociodemographics

Variable	**55-74 years**	**75 and older**	***P* value**
Low fruit + vegetables* ≤ 2.75 cups	70.4 (64.0, 76.1)	80.1 (74.4, 84.9)	.002
High sugar (≥20 tsp)	27.4 (23.9, 31.2)	18.6 (14.3, 23.9)	.002
High total fat (> 35 % of calories)	12.9 (9.6, 17.1)	10.8 (7.6, 15.1)	.422
High solid fat (> 6% of calories)	83.6 (80.3, 86.4)	88.5 (83.0, 92.3)	.100
Living alone	8.6 (5.9, 12.4)	8.5 (6.1, 11.8)	.934
Living without family	14.6 (11.3, 18.8)	15.4 (12.1, 19.4)	.692
Married/partnered	53.5 (46.0, 60.8)	58.0 (51.2, 64.5)	.328
Poverty level (<1.00 poverty index)	11.7 (9.0, 15.0)	14.6 (10.4, 20.2)	.168

< high school diploma	26.9 (22.0, 32.4)	30.3 (25.2, 36.0)	.149

Notes: Significance is based on the adjusted *F* and its degrees of freedom. The adjusted *F* is a variant of the second-order Rao-Scott adjusted Chi-square statistic. Values are given as percent (95^{th} confidence interval) *vegetables minus white potato and fruit minus fruit juice.

Table 4

Dietary factors and sociodemographics by gender

Variable	Male	Female	*P*
Low fruit + vegetables* ≤ 2.75 cups	72.3 (66.3, 78.7)	71.9 (65.3, 77.7)	.724
High sugar (≥20 tsp)	62.1 (54.8, 68.8)	37.9 (31.2, 45.2)	<.001
High total fat (> 35% of calories)	11.5 (8.9, 14.7)	13.3 (9.4, 18.6)	.434
High solid fat (> 6% of calories)	85.7 (81.0, 89.4)	83.6 (77.3, 88.4)	.611
Living alone	51.5 (37.6, 65.1)	48.5 (34.9, 62.4)	.491
Living without family	54.6 (45.2, 63.7)	45.4 (36.3, 54.8)	.091
Married/partnered	45.5 (39.9, 51.2)	54.5 (48.8, 60.1)	.220
Poverty level (<1.00 poverty index)	41.3 (35.2, 47.8)	58.7 (52.2, 64.8)	.079
< high school diploma	57.6 (43.7, 70.3)	42.4 (29.7, 56.3)	.096

Notes: Significance is based on the adjusted *F* and its degrees of freedom. The adjusted *F* is a variant of the second-order Rao-Scott adjusted Chi-square statistic. Values are given as percent (95th confidence interval) *vegetables minus white potato and fruit minus fruit juice.

Additional analysis of dietary factors across four age-groups (55-64.9; 65-74.9; 75-79.9; and ≥ 80 yrs.) was performed (data not shown). Approximately 70-80% of older adults consumed less than 2.75 cups (5.25 servings) of combined fruit and vegetables. The youngest old (55 – 64.9 years) consumed significantly more total fruit and vegetables than the oldest old (≥ 80 years) ($p = .028$). High sugar consumption (≥20 tsp) was present in over 15% of older adults with the youngest old consuming significantly more than the other groups (*p* <.001). There were no significant differences in solid fat and total fat consumption.

Discussion

The aim of the present study was to examine the relationships among dietary health indicators, age-groups, and race/ethnicity in a representative sample of US older adults. This study found older adults ≥75 years consumed less total fruits and vegetables as compared to the youngest old (55-74 years) independent of race and gender. These results were in contrast to a review finding that older men, African Americans, and adults living in homes and communities lacking socioeconomic resources eat fewer fruits and vegetables (11). Moreover, Peltzer and Phaswana-Mafuya (21) measured a mean intake of 4 servings for fruit and vegetable and no significant differences among South African older adults by age categories. The investigators reported < 30% met the recommendation of 5 servings which is in close agreement with our study (21). A slightly higher percent of men (77.6) and women (78.4) failed to meet the 5 serving recommendation for fruits and vegetables averaged over 52 countries, primarily of low and middle income based on the World Health Survey 2002-2003 (22). Based on their survey, lower fruit and vegetable intake was associated with older age and lower income (22). Nutrition knowledge negated the association of fruit and vegetable consumption being higher in woman in a U.K. population of older adults (23). In contrast, sociodemographics were not associated with fruit and vegetable intake for this study.

Sugar was the only apparent gender difference in the assessed dietary health indicators for older adults. Males consumed a higher percent of foods with added sugar as compared to females. These results are in agreement with those from Canadian population groups (24). The investigators reported significantly higher sugar consumption in men 51-70 years and 71and over as compared to females in those respective groups (24). Fruit juices/drinks were a major source of added sugar across all ethnic-gender groups in a large cross-sectional study of older adults (45-75 years) from five ethnicities: African-Americans, Native Hawaiians, Japanese-Americans, and Caucasians; however, regular sodas were the highest contributor of added sugar consumption for Japanese American women (17.5%) and Latino-

Mexican men (35.2%) (25). In this current study, percent of added sugars in food was higher for the younger old (55-74 years) as compared to the older old (75 and over). This trend agrees with a National Center of Health Statistics data brief for sugar by age group; however, the study compared adults as 20-39; 40-59; and 60 years and over (26).

In the present study, there were no differences in solid fat intake neither by ethnicity, nor by age-group. The solid fats category combined food sources with saturated and trans-fats. While it is evident that trans-fat intake is associated with cardiovascular disease risk and outcomes, saturated fat intake and cardiovascular risk has become a controversial area. O'Sullivan, Hafekost, Mitrou, and Lawrence (27) reported differences for the interactions of race/ethnicity, food source, and saturated fat with mortality in a meta-analysis. The authors concluded that saturated fat in meat was protective of cardiovascular disease in Asian populations; whereas, it was associated with mortality in non-Asian populations. Huth, Fulgioni III, and Larson (8) confirmed that replacing fats and oils high in saturated fatty acids or trans fatty acids with polyunsaturated fatty acid oils was favorable to lipid profile and reduced coronary heart disease risks in a systematic review; however, ethnic differences were not assessed.

Several limitations of this study are hereby noted. The relationships among dietary factors with key components of healthy aging, such as inflammation and cognitive function were not examined. Dietary factors in older adults account for inflammation and cognitive function (28). Handling et al (28) reported that high plasma homocysteine (inflammatory marker) was associated with a lower measure of cognition; while, high serum vitamin D was associated with a better score on cognitive function in a U.S. representative sample of older adults. The types of dietary factors in the current study were limited to the consumption of fruit/vegetables, added sugars, and solid fats. Pohlhausen and colleagues (29) found lower than optimal calorie intake among a German community of older adults who were receiving homecare. In the current study there was no distinction made between homecare and non-homecare recipients. Having a lower than optimal calorie intake, due to physiological, psychological, and neurological barriers could account for inadequate intake of fruits and vegetables among older adults; albeit, this association was not assessed. Lastly, weight reduction for older adults who are obese and physical activity for all adults were components of healthy aging that were not considered in the current study. Miller and Robinson (30) recommended that strength and aerobic training be incorporated into a weight-loss program for older adults to maintain muscle strength, based on their results of a six-month intervention.

The strength of the study was using a U.S. representative sample of older adults and considering age differences among them. The main limitation of this study was that the data are cross-sectional and only contributes to associations between dietary behavior among age-groups and race/ethnicity. The results indicate a current time-period and do not represent a trend in dietary changes across time for older adults. Dietary intake was by self-report; albeit, a validated multi-pass method with trained interviewers was utilized, minimizing bias of under- and over- reporting. Another limitation was that solid fat was not distinguished between trans-fats and saturated fats in the data set. The present study showed age and racial/ethnic differences in dietary factors that are risk factors for chronic diseases among older adults. These findings encourage other researchers to explore modifiable, dietary health markers by age, gender and ethnicity with consideration of life-stages within older populations. Future studies should include changes in dietary risk factors for older adults. Trends in dietary behavior can be applied to public health interventions, targeting specific issues by age-group, race/ethnicity and gender.

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Statement of author's contributions to manuscript:

Both authors, Joan Vaccaro and Fatma Huffman, were responsible for design, writing, statistical analysis, and final content of this manuscript. Both authors have read and approved the final manuscript.

Ethical standards:

This experiment complies with current laws of the country in which they were performed.

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