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The effect of race and predictors of socioeconomic status on diet quality in the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study sample

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Abstract

Purpose—To examine effects of race and predictors of socioeconomic status (SES) on nutrient-based diet quality and their contribution to health disparities in an urban population of low SES.

Design—Data were analyzed from a sample of the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) Study participants examining effects of age, sex, race, income, poverty income ratio (PIR), education, employment, and smoking status on nutrient-based diet quality as measured by a micronutrient composite index of nutrient adequacy ratios (NAR) and a mean adequacy ratio (MAR). Regression models were used to examine associations and t-tests were used to look at racial differences.

Subjects—African American and white adults ages 30-64 residing in 12 predefined census tracts in Baltimore City, Maryland.

Results—Sex, age, education, PIR, and income were statistically significant predictors of diet quality for African Americans, while sex, education, and smoking status were statistically significant for whites. African Americans had lower MAR scores than whites (76.4 vs. 79.1). Whites had significantly higher NAR scores for thiamin, riboflavin, folate, B12, vitamins A and E, magnesium, copper, zinc, and calcium, while African Americans had higher vitamin C scores.

Conclusion—Education significantly impacted diet quality in the HANDLS sample, but race cannot be discounted. Whether the racial differences in diet quality are indicative of cultural

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differences in food preferences, selection, preparation, and availability or disparities in socioeconomic status remains unclear.

Keywords

Race; Socioeconomic Status; Education; Diet Quality

Introduction

Health disparities are an unfortunate consequence of discrepancies in the levels of access to adequate health care among subpopulations in a given culture. Factors such as race, sex, health insurance, physical disability, sexual orientation, and educational attainment all affect treatment in the health care system.[1] These factors combined with different behaviors such as diet and physical activity lead to varying health outcomes among groups of Americans. Eliminating health disparities is at the forefront of the United States' (US) health care policy, being a focus of both the Healthy People 2010 goals and the Public Health Priorities from the Office of the Surgeon General.[2,3] Another risk factor that plays a role in health disparities is diet quality. Diet quality has been shown to vary considerably across race and indictors of socioeconomic status (SES). [4-10]

There are two primary measures of diet quality, food-based and nutrient-based measures.[11] Jenkins and Guthrie demonstrated that key nutrients can be used as a measure of overall nutritional adequacy of a diet. [12] Nutrients are a strong predictor of health outcomes,[13] and higher-quality diets are associated with decreased risk of many chronic conditions. [13-17] For example, frequent intake of micronutrient-rich fruits and vegetables are associated with a protective effect against coronary heart disease (CHD), as are potassium and folate[14] Diets rich in fruits and vegetables are abundant with such key nutrients as folate, vitamins C, D, E, calcium, and zinc. These nutrients appear to have a protective effect against certain types of cancer.[16]

Although research has addressed the association between race, SES, and diet quality, there are inconsistent findings with respect to the influence of race and predictors of SES. In several nationally representative samples, food and nutrient-based diet quality scores increased with increasing level of education[4,5,7] and higher poverty income ratio (PIR) or income.[4,5,9] Whites had higher diet quality scores than African Americans.[4] However, the variable that contributed most to the variance differed among the studies. Less is known about these relationships in low-income populations. One study reported poorer diet quality in a lower income population in the Lower Mississippi Delta compared to a nationally representative sample.[6] In addition to race and SES, food security and smoking status influence diet quality. Cigarette smoking is significantly and inversely associated with Healthy Eating Index (HEI) scores.[18] Food insecurity has been associated with lower quality diets as measured by the HEI.[19]

A new prospective study, the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study, was designed by the National Institute on Aging to explore health disparities, specifically the roles of race and SES on risk for cardiovascular and cerebrovascular diseases, and cognitive function. The HANDLS study was initiated in 2004. The baseline sample consists of African American and white men and women, 30-64 years of age living in Baltimore City[20]. The purpose of this study is to examine the effects of race and predictors of SES including education, income, PIR, and employment on nutrient-based diet quality in the HANDLS sample, the present data from which was composed primarily of individuals of low SES. To account for additional variance in diet quality, the effects of age, sex, smoking status, and food security were also examined.

Methods

Description of the HANDLS study

The HANDLS study is a prospective longitudinal study of approximately 3,724 African American and white adults from an area probability sample of Baltimore City, Maryland. Areas were chosen to include a range of incomes and socioeconomic circumstances to fit the design of the study, a factorial cross of sex, race, age, and SES. Inclusion criteria for the study were ability to give informed consent, age 30-64, able to perform at least five of the following evaluations: medical history, physical performance, cognitive testing, dietary recall, audio questionnaire, body composition, carotid Doppler, or pulse wave velocity assessment, and valid photo identification. Exclusion criteria were individuals with Acquired Immunodeficiency Syndrome (AIDS) and individuals who underwent cancer treatment within six months of recruitment. Baseline data collection began in August 2004 and was completed in March 2009. Baseline data collection began with an in-home screening, recruitment, household survey, and 24-hour dietary recall. Approximately a week later, participants visited mobile research vehicles (MRV) where a physical exam, medical history, 24-hour dietary recall, psychophysiology assessments, laboratory measurements, and a cognitive evaluation were collected.[20] The study protocol was approved by the human subjects review boards at both Medstar Research Institute and the University of Delaware. All participants provided written informed consent.

HANDLS Sample

From August 2004 to January 2009, 3,724 enrolled in the study. Of these individuals, 2,436 individuals (65.4%) completed baseline phase two examinations. Only those participants who completed two 24-hour recalls judged reliable were included in this study. The final analytic cohort for this study included 1,990 individuals with 443 white women, 677 African American women, 334 white men, and 536 African American men.

Dietary Methods

Self-reported diets were collected via 24-hour dietary recalls conducted in the home and at MRVs by trained interviewers using the United States Department of Agriculture (USDA) Automated Multiple Pass Method (AMPM) versions 2.3 - 2.5. The AMPM software has five passes to obtain forgotten foods and make the dietary recall as representative of eating patterns as possible. A food model booklet and measuring cups and spoons were used to assess food portions. The validity of the AMPM was established in a study using doubly labeled water, with the AMPM measuring energy intake within 3% of total energy expenditure for normal weight subjects and within 11% over all subjects.[21] The foods reported were coded using the USDA Survey Net food coding and data processing system and nutrients from USDA's Food and Nutrient Database for Dietary Studies version 3.0 were linked to each food consumed.[22,23]

Although dietary supplement information was not collected during baseline data collection, supplement information is currently being gathered during Wave Two of the HANDLS study. Supplement information was collected over the phone using a computer-based survey adapted from the National Health and Nutrition Examination Survey (NHANES) supplement questionnaire. The data were coded using HANDLS supplement database. Supplement information collected in Wave Two was included to determine if supplements would improve diet quality and possibly modify the findings of this study. The Wave Two analytic cohort included 103 individuals who completed two supplement interviews.

Diet Quality Variables

Nutrient adequacy was determined by comparing the proportion of nutrients consumed to the Recommended Dietary Allowance (RDA). Using the models published by Murphy et al. and Foote et al., diet quality in the current study was based on the intakes of calcium, magnesium, phosphorus, vitamin A, vitamin C, vitamin E, vitamins B-6 and B12, folate, iron, thiamin, riboflavin, niacin, copper, and zinc.[24,25] First, a nutrient adequacy ratio (NAR) was calculated for all the above nutrients except calcium using the formula below:[25]

$$\text{NAR}=\frac{\text{The subjects daily intake of a nutrient}}{\text{RDA of that nutrient}}$$

For calcium, a comparison was based on the Adequate Intake (AI) since there is currently no RDA. Adequate consumption of calcium was classified according to the method of Foote et al: 0% for a mean 2-day intake ≤ one-fourth of the AI, 25% for intakes > one-fourth the AI and ≤ one-half of the AI, 50% for intakes > one-half the AI and ≤ three-fourths of the AI, 75% for intakes > three-fourths of the AI and ≤ the AI, and 100% for intakes above the AI.[24] For example, the AI for calcium is 1000 mg/d for men and women 31-50 y old; intakes between 0 and 250 mg/d would be given a 0% probability of adequacy, those between 251 and 500 mg/d would be given 25%, those between 501 and 750 mg/d would be given 50%, those between 751 and 1000 mg/day would be assigned 75%, and those above 1000 mg/d would be assigned 100%

To judge total quality of the diet, the NARs were used in the formula below to calculate a mean adequacy ratio (MAR):[24,25]

$$\text{MAR}=\frac{\text{Sum of the NARs for 15 nutrients}}{15}$$

Similar to Murphy et al., the NAR was converted to a percent, and percents greater than 100 were truncated to 100 prior to calculating the MAR.[25] The MAR was integrated into regression models.

A mean 2-day nutrient intake below 67% of the RDA was considered low because an intake above 67% of the RDA most likely represents nutrient adequacy.[26] The number of individuals with a low intake for each nutrient with an RDA was summed for descriptive purposes.

Since the MAR is based on micronutrient intakes, macronutrient intakes were determined to provide more description about the diets. Total fat, saturated fat, polyunsaturated fat, carbohydrate, protein, and sugar as percent of energy, and means for total energy, cholesterol, and dietary fiber were calculated and compared to Dietary Reference Intakes (DRI). The HEI-2005, a food-based diet quality measure, was also calculated.[27]

Independent Variables

Information on age, sex, race, education, and employment were collected by trained interviewers during an in-home interview using survey questionnaires.[20] Income and food security were collected by an audio questionnaire and cigarette use was collected as a part of the medical history on the MRV.

Age and sex were included in the regression models to control for the variance in diet quality within these variables. Sex was categorized as male or female. Age was recorded as the age at the baseline recruitment screen. Race was self-reported as either African American or white.

SES predictors included PIR, educational attainment, employment, and income. PIR is a ratio of household income and the poverty threshold defined for the 2004 US census bureau for a person or family.[28] PIR was categorized as either <125% or ≥125% of the Federal poverty level. Educational attainment was reported as the highest grade of school completed. Employment was classified as unemployed or employed with income from an employer or self-employed at the time of the interview.

Response options for income consist of no earned income plus a set of 23 income ranges ($1000-15,000 were grouped in $1000 ranges, $15,000-30,000 were grouped in $2,500 ranges, $30,000-50,000 were grouped in $10,000 ranges, the final two ranges were $50,000-74,999 and $75,000+). No income was coded as 0. The remaining responses were coded to the midpoint of the income range in thousands of dollars. The highest income response option ($75,000 or more) was coded to 137.5.

Food security and cigarette use were also included in the regression analysis since they have been shown to affect diet quality. Food security was assessed using responses to the question: In the last 12 months, did you or your household ever cut the size of your meals or skip meals because there wasn't enough money for food? Smoking status was defined as current smoker or current nonsmoker.

Statistical Analysis

Descriptive analyses of demographic characteristics of the sample and nutrient intakes compared to the DRIs were generated using SAS 9.1.3. Two sided t-tests were used to determine differences between African Americans and whites for MAR scores as well as differences between races in the NAR component scores. A regression model of the independent variables was used to assess their influence on diet quality as measured by the MAR, the dependent variable. SES indicators included PIR, educational attainment, employment, and income. Other factors were sex, race, age, food security, and smoking status. Dummy variables were included for missing income and missing education variables based on sub-group (sex × race) specific means. Preliminary analysis found food security was not a significant predictor of MAR since its effects were explained by income; thus it was dropped from subsequent analyses.

The R statistical software was used to test 1-way and 2-way interactions between sex and race in the regression models. A main effects model predicting MAR with the regressors just listed was run first. Then interaction models were run to test for differences in the regression coefficients of these same regressors by (1) race, (2) gender, (3) race and gender with just the first-order interaction terms, and (4) race and gender including first- and second-order interaction terms. Results of interaction tests indicated significant differences between races but not between sexes ($F = 4.2119$, $df = 9, 1914$; $p < .0001$). Therefore in addition to the total sample results will also be reported by race.

Results

Sample Population

The average age of the total sample was (mean±SE) 48.1 ± 0.2 years with a range of 30 to 64 years. The average age of the African American sample was 48.2 ± 0.1 years and the white sample was 47.8 ± 0.3 years. Approximately 26% of the total sample, 28.2% of African Americans, and 23.5% of whites reduced or skipped meals in the past year due to financial concern. About 46% of the total sample (46.6% of African Americans and 44.6% of whites) were current smokers.

Over half of the African American sample had income <125% of the Federal poverty level, in comparison to 37% of the white sample. Approximately 1/3 of the total sample, 34.7% of African Americans, and 31.5% of whites had less than a high school education. Almost 70% of the total sample, 65.4% of African Americans, and 76.4% of whites received money from employment (Table 1). The average annual income for African Americans was $23,665 ± $668, while the average for whites was $42,554 ± $1,352.

Macronutrients

Although the mean energy levels of African American and whites were not significantly different, African Americans consumed significantly more polyunsaturated fat and cholesterol compared to whites, and significantly less carbohydrate and fiber (Table 2). When macronutrient intake was expressed as a percent of energy, the HANDLS participants who were white had higher percentages of saturated fat and sugar. No significant differences were noted for protein, carbohydrate, or total fat as a percent of energy (Table 3).

The mean energy intake for men was 9873 kJ (2360 kcal) and 7276 kJ (1739 kcal) for women. Men had significantly higher intakes of all macronutrients compared to women, reflecting the higher total energy consumed.

Description of Diet Quality

The average bivariate MAR score was significantly lower for African Americans compared to whites, 76.4 ± 0.6 and 79.14 ± 0.6, respectively (Table 4). Similar to the finding for the MAR scores, the mean HEI-2005 score for African American participants was significantly lower than that for white participants (Table 2).

Scores for the individual components of the MAR (NARs) ranged from 40.9 for Vitamin E to 95.8 for Phosphorus. There were no significant differences between races for niacin, B6, and iron. With the exception of Vitamin C, whites had significantly higher NAR scores compared to African Americans for all nutrients.

The percentage of the sample with <67% RDA ranged from 5% for iron to 85% for vitamin E. Over half of the sample population had less than 67% RDA for 4 nutrients: Vitamin A, Vitamin C, Vitamin E, and Magnesium. About 1 in 4 people examined in HANDLS had less than 67% RDA for folate while 1 in 3 had low zinc intake (Table 5).

Regression Analysis

When analyzing the total sample, sex ($p < .0001$), race ($p = 0.0245$), PIR ($p = 0.0038$), education ($p < .0001$), and income ($p = 0.0003$) were statistically significant predictors of MAR. Sex and education remained statistically significant when the analyses were performed by race. Smoking status and employment were statistically significant predictors of MAR for whites, while for African Americans PIR, age, and income were uniquely statistically significant predictors (Table 6).

As presented in Table 6, the average MAR score for African Americans is estimated to be 1.653 units less than the average for whites, all other variables in the model constant. This difference is somewhat larger than the effect of two years of education ($2 \times 0.736 = 1.472$). The effect of four years of education, for example eight grade versus twelfth grade is $4 \times 0.736 = 2.944$ -- about twice the race effect. In this sample, the relationship between MAR and education is well approximated by a linear function. Additional effects at degree points: high school diploma, junior college, bachelor's degree, master's degree, and doctoral/professional degrees were tested. None of these degree dummy variables was statistically significant, so they were deleted from the model.

Discussion

The findings of this study indicate education was an important, if not the most important predictor of nutrient-based diet quality in the HANDLS sample. Although the parameter estimate for education was small compared to other significant predictors, it represents the change per grade completed, making education an important predictor of MAR in the HANDLS sample. Additionally, besides sex, education was the only variable that was significant in the total sample regression, as well as African American and white regression analyses. Compared to national averages, the average education of the HANDLS sample is low; 29.6% of the population did not complete a high school degree or equivalent, compared to 14.5% of the US as a whole.[29] Previous analysis of a HANDLS sample revealed a median 8th grade reading level.[30] Despite the low educational attainment of the HANDLS sample, results of these analyses are consistent with other national and regional studies that found education to be a significant predictor of food and nutrient-based diet quality[4,6,10] and in food and nutrient-based diet quality over time.[5,7]

In addition to education, the effect of race on nutrient-based diet quality cannot be discounted in this sample. Not only was race a significant predictor of MAR in the total sample regression analysis, but interaction tests indicated significant differences between races as well. MAR scores for whites were significantly higher than for African American, as were their NAR scores for thiamin, riboflavin, folate, B12, vitamin A, vitamin E, phosphorus, magnesium, copper, calcium. This finding is consistent with other studies which also reported significant differences between nutrient and food-based diet quality scores between African Americans and whites.[4,6,8] Similar results were found in micronutrient intake from nationally representative NHANES data for vitamin C, potassium, and calcium.[31] These differences may reflect beverage choices between races with African Americans choosing more vitamin C-fortified beverages and less potassium and calcium-rich milk and dairy products.[31] Kant et al. reported that African Americans are less likely to make selections from food groups rich in these nutrients such as the fruit, vegetable, and dairy groups.[31]

There have been documented differences in food availability, particularly the availability of supermarkets and grocery stores in minority neighborhoods in the US([32,33]), and fast food restaurants are more prevalent in these areas.[34] Although analysis on food availability has not been done in Baltimore City, these findings are consistent with high intake of fast foods previously documented in a HANDLS sample.[35]

Lower diet quality among African Americans examined in the HANDLS study may reflect cultural differences in selection and preparation of foods. Kittler and Sucher documented the evolution of African American soul food consisting primarily of pork, pork fat, chicken, organ meats, corn, sweet potatoes, and greens.[36] Observations from the coding of dietary data in this population indicate higher intakes of soul foods such as fried chicken, pork ribs, and collard greens cooked in fat back or ham hocks for African Americans. An earlier report of the dietary patterns in a HANDLS sample created by cluster analyses revealed high intakes of fat laden foods such as fried chicken.[35] These foods are rooted in the African American culture and are a way of preserving tradition.[36] African Americans may view making “healthy” food choices as conforming to the dominant culture.[36,37] Therefore nutrition education interventions would be helpful in this population, particularly messages aimed at individuals with low reading levels and without a high school degree.

Differences in food availability, selection, preparation, and preference, combined with differences in SES result in lower diet quality of the African American HANDLS sample, placing them at greater risk for chronic conditions and may contribute to the health disparities seen between African Americans and whites. These disparities among low-income minority populations will become more important as the US population becomes increasingly diverse, since minorities are expected to become the majority in the US by 2050.[38] If changes are not made to rectify these discrepancies, it will affect the overall health of the US population.

Comparisons to other studies are difficult due to the low SES of the HANDLS population. The macronutrient intake of the HANDLS sample in this study was similar to the sample examined in the 2005-06 NHANES for protein as a percent of energy (15.9% vs. 15.9%), carbohydrate as a percent of energy (48.4% vs. 47.8%), total fat as a percent of energy (33.8% vs. 34.8%) and saturated fat as a percent of energy (11.3% vs. 11.3%).[39] However the total energy intake of the HANDLS sample was less than that consumed by the 2005-06 NHANES sample, 8414 kJ vs. 9183 kJ, respectively. To our knowledge there are no current studies using the MAR for comparison. There was a study using the 1994-96 Continuing Survey of Food Intakes for Individuals; however, DRI values have changed since its publication.[24] Compared to NHANES 2005-06, the HANDLS sample had lower mean intakes for all micronutrients measured in the MAR; however mean intakes for all micronutrients in the HANDLS sample were within 95% confidence intervals for the NHANES mean 2005-06 intakes.[39] The mean 2005-HEI score for the HANDLS sample population was lower than the HEI-2005 scores for NHANES 2003-04 (48.7 vs. 57.5).[39] HANDLS scores were also lower than the HEI-2005 scores of NHANES low-income sample (defined as <130% of the PIR) whose HEI-2005 average was 56.5.[40]

Similar to the results of this HANDLS sample, McCabe et al. found age, race, income, and education had statistically significant impact on 1994-96 HEI scores in African American and white adults in the Lower Mississippi Delta. However in contrast to HANDLS, income was particularly important.[6] Another study using data from NHANES II and food-based measures of diet quality found whites had higher diet quality than African Americans, plus higher income and higher education were associated with better diet quality.[4]

Lack of a pervasive impact of income and PIR was contrary to the expected outcome of the regression analysis. In other studies, income or PIR were found to be significant predictors of diet quality, if not the most significant contributor.[5,8,9] However, many of these studies analyzed nationally representative samples, while the HANDLS sample was composed of primarily of individuals with low to low-middle SES residing in an urban area. Similar to the results of this analysis, a recent study of a higher income population found education to be a stronger predictor of dietary energy density than household income.[41] Therefore, differences in diet quality due to economic circumstances may disappear when samples are taken from just the low or high end of the income and PIR range.

One limitation of this study is that dietary information represents the nutrient intake from foods and not total nutrient intake. The collection of dietary supplement information began with Wave Two of the HANDLS study. Therefore, further research is necessary at the conclusion of Wave Two to determine the effect of supplementation on nutrient-based diet quality in the HANDLS sample. Another limitation is that this study did not contain the entire HANDLS sample. At the time of data analysis, baseline data were still being collected. Further research with the entire baseline sample is necessary to corroborate the results of this study. Even though the study consisted of two dietary recall interviews, the data could still be biased. Lastly, the HANDLS sample is composed of primarily low SES individuals making the application of the results limited to populations with similar characteristics.

In conclusion, to the best of our knowledge this is the first study to examine nutrient-based diet quality in an urban population of relatively low SES. Education appears to be the most important factor in predicting diet quality in this HANDLS sample. However, the effect of race cannot be discounted. Whether the racial differences in diet quality are indicative of cultural differences in food selection and preparation or of differences in SES remains unclear. Since these discrepancies in diet quality may be a contributing factor to the health disparities documented between African Americans and whites, action to help eliminate these differences is necessary as the minority populations in the US continue to grow. Culturally appropriate nutrition education to both African Americans and whites, particularly messages aimed at individuals with less than a high school education would be beneficial to improving diet quality in urban areas of low SES.

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Table 1

Summary of HANDLS* Study Sample SES† Characteristics for the Total Sample and by Race, by Percent

Characteristic	Total n = 1990	African American n = 1213	White n = 777
Income, %			
<$10,000	26.4	32.3	16.8
$10,000 - <$20,000	23.9	25.9	20.9
$20,000 - <$50,000	31.8	30.2	34.2
$ ≥50,000	18.3	11.7	28.2
< 125% PIR‡, %	46.4	52.4	37.1
Receiving Money from Employment, %	69.7	65.4	76.4
Percent with <HS§ Education, %	33.5	34.7	31.5

*HANDLS, Healthy Aging in Neighborhoods of Diversity across the Life Span;

†SES, socioeconomic status;

‡PIR, poverty income ratio;

§HS, high school

Table 2

Mean ± SEM[*] Intake of Energy, Macronutrients, and HEI[†] by Race

Average Nutrient Intake ± SEM	African American n = 1213		White n = 777		p value
	Mean	SEM	Mean	SEM	
Energy (kJ(kcal))	8368 (2000)	119.75 (28.62)	8481 (2027)	143.89 (34.39)	0.5551
Total Fat (gm)	79.0	1.3	78.8	1.6	0.9036
Saturated Fat (gm)	24.8	0.5	27.1	0.6	0.0020
Polyunsaturated Fat (gm)	17.6	0.3	16.4	0.4	0.0129
Protein (gm)	78.8	1.3	77.2	1.5	0.4292
Carbohydrate (gm)	232	3.5	246	4.3	0.0173
Total Sugar (gm)	114	2.1	121	2.8	0.0701
Dietary Fiber (gm)	11.2	0.2	13.3	0.3	<.0001
Cholesterol (mg)	358	7.1	291	7.3	<.0001
HEI[†]	48.7	0.3	49.4	0.5	<.0001

[*] SEM, standard error of the mean;

[†] HEI, Healthy Eating Index

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Table 3

Percent of Macronutrients ± SEM* as a Percent of Energy by Race

Average Nutrient Intake ± SEM	African American n = 1213		White n = 777		p value
	Mean	SEM	Mean	SEM	
Total Fat Percent Energy	35.1	0.2	34.4	0.3	0.0677
Saturated Fat Percent Energy	11.0	0.1	11.4	0.1	<.0001
Polyunsaturated Fat Percent Energy	7.9	0.1	7.8	0.1	<.0001
Protein Percent Energy	16.2	0.1	15.5	0.2	0.3962
Carbohydrate Percent Energy	47.0	0.3	49.1	0.4	0.6441
Total Sugar Percent Energy	23.2	0.3	24.3	0.4	<.0001

* SEM, standard error of the mean

Table 4

Mean ± SEM* of NAR† by Nutrient and MAR‡ by Race

Nutrient Quality Score	African American n = 1213		White n = 777		p value
	Mean	SEM	Mean	SEM	
MAR	76.4	0.5	79.1	0.6	0.0001
NAR Thiamin	83.6	0.6	88.3	0.7	<.0001
NAR Riboflavin	89.6	0.5	93.9	0.5	<.0001
NAR Niacin	91.7	0.5	91.3	0.6	0.6477
NAR B6	88.5	0.5	87.8	0.7	0.4441
NAR Folate	80.5	0.7	84.3	0.8	0.0003
NAR B12	90.2	0.6	92.6	0.6	0.0052
NAR Vitamin C	58.9	1.0	53.5	1.3	0.0010
NAR Vitamin A	50.4	0.9	56.1	1.1	<.0001
NAR Vitamin E	40.1	0.7	43.2	0.9	0.0052
NAR Phosphorus	94.5	0.4	95.8	0.4	0.0222
NAR Magnesium	50.6	0.6	58.3	0.9	<.0001
NAR Iron	95.2	0.4	95.6	0.4	0.5037
NAR Zinc	76.3	0.7	80.2	0.9	0.0003
NAR Copper	87.5	0.5	90.1	0.6	0.0014
NAR Calcium	67.9	1.0	76.2	1.0	<.0001

* SEM, standard error of the mean;

† NAR, nutrient adequacy ratio;

‡ MAR, mean adequacy ratio

Table 5

Percent of Individuals with Low Nutrient Intakes by Nutrient

Nutrient	Percent of Sample with Low Intake n= 1990
Thiamin	19.8
Riboflavin	11.4
Niacin	11.1
B6	15.7
Folate	24.9
B12	12.6
Vitamin C	56.9
Vitamin A	67.2
Vitamin E	85.3
Phosphorus	6.0
Magnesium	73.5
Iron	5.2
Zinc	32.3
Copper	14.5

Criteria for low intake is ≤ 67 of NAR score

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Table 6

Results of Regression Analysis for Mean Adequacy Ratio For Total Sample and by Race

Independent Variable	Total Sample n = 1934			African American n = 1187			White n = 747		
	b*	SE†	p value	b	SE†	p value	b	SE†	p value
Constant	66.743	2.767	<.0001	70.772	3.672	<.0001	60.482	4.015	<.0001
Sex	6.950	0.699	<.0001	6.480	0.909	<.0001	7.147	1.074	<.0001
PIR‡	2.240	0.773	0.0038	3.215	0.995	0.0013	0.411	1.223	0.7369
Age	-0.061	0.038	0.1040	-0.122	0.050	0.0144	0.027	0.057	0.6318
Education	0.736	0.131	<.0001	0.515	0.190	0.0068	0.832	0.178	<.0001
MddEduc§	0.185	1.066	0.8619	1.813	1.480	0.2208	-1.485	1.501	0.3228
Income	0.048	0.013	0.0003	0.053	0.022	0.0140	0.027	0.017	0.1017
MddInc//	-0.604	0.980	0.5379	-2.567	1.215	0.0348	3.896	1.652	0.0186
Employment	1.221	0.855	0.1534	-0.926	1.062	0.3833	5.982	1.439	<.0001
Cigarette Status	-0.398	0.283	0.1598	0.106	0.365	0.7715	-1.162	0.441	0.0085
Race	-1.653	0.735	0.0245	-	-	-	-	-	-

*b, regression parameter estimate;

†SE, standard error of the regression coefficient;

‡PIR, poverty income ratio;

§MddEduc, missing data dummy for Education;

//MddInc, missing data dummy for Income