Published in final edited form as:

Am J Prev Med. 2007 April ; 32(4): 264–272.

Trends in Black-White Differentials in Dietary Intakes of U.S. Adults, 1971–2002

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Abstract

Background—Disparities in the health status of blacks and whites have persisted despite considerable gains in improved health of the U.S. population. Tracking changes in black-white differentials in dietary attributes over time may help in understanding the contribution of diet to these disparities.

Methods—Data were used from four National Health and Nutrition Examination Surveys conducted between 1971 and 2002 for trends in self-reported intakes of energy, macronutrients, micronutrients, fruits and vegetables, and the energy density of foods, among U.S. non-Hispanic black ($n = 7099$) and white ($n = 23,314$) men and women aged 25–74 years. Logistic and linear regression methods were used to adjust for multiple covariates and survey design.

Results—Energy intake, amount of food, and carbohydrate energy increased, whereas percentage of energy from protein, fat, and saturated fat decreased over time in all race-gender groups ($p < 0.001$). In whites and in black women energy-density increased ($p < 0.001$) in parallel to increases in obesity prevalence. In all surveys, black men and women reported lower intakes of vegetables, potassium, and calcium ($p < 0.001$) than their white counterparts. In men, the race differential in calcium intake increased across surveys ($p = 0.004$).

Conclusions—Dietary intake trends in blacks and whites from 1971–2002 were similar—suggesting that previously identified dietary risk factors that differentially affect black Americans have not improved in a relative sense.

Introduction

Disparities in the health status of blacks and whites have persisted despite considerable gains in improved health of the population of the United States.^{1, 2} For example, the age-adjusted death rates for heart disease, cancer, and stroke remain higher in black men and women relative to whites.² These disparities reflect a complex interaction of genetic, environmental,

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No financial conflict of interest was reported by the authors of this paper.

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behavioral, and other societal factors such as access to health care, quality of health care, and discrimination.¹ There are also socioeconomic disparities in health status, but variables such as income or education cannot account for the entire race-related differential in health.^{3–7}

Diet is associated with several leading causes of morbidity and mortality,^{1, 8} and several studies have reported black-white differences in dietary intakes that are in a direction parallel to the observed health disparities.^{9–11} Furthermore, when examined within a black population, the associations of dietary variables with health outcomes are consistent with those expected based on data for whites,^{12–15} and the improvements in health outcomes among black and white participants in clinical trials of dietary change are similar.^{16–20} Hence, tracking changes in black white differentials in dietary attributes over time may provide insights useful for understanding related risk factor and disease trends.

Relatively few studies of *trends* in the association of race with dietary profiles in the U.S. population have been published,^{21, 22} and none include the recent surveys. The objective of the present study was to examine education and income adjusted time *trends in black white differentials* in self-reported dietary attributes in the U.S. population over 3 decades.

Methods

The data used were collected in successive National Health and Nutrition Examination Surveys (NHANES) I (1971–75); II (1976–1980); III (1988–1994); 1999–2000; and 2001–2002 conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention.²³ Each survey was a stratified, multistage, national probability sample of the civilian non-institutionalized population of the U.S. The survey procedures consisted of a household interview and a health examination of the sample person in the mobile examination center (MEC). Weight and height measurements and interview to collect a 24-hour dietary recall were obtained in the MEC. Survey response rates for MEC examined individuals for the NHANES I, II, III, and 1999–2000 were, 74%, 73%, 78%, and 76%, respectively.²³

Racial classification—The NHANES I and II provide only white, black, and other categories, based on interviewer observation. NHANES III and 1999–2002 provide self-reported race/ethnicity-specific categories (non-Hispanic whites, non-Hispanic black, Mexican American, Other Hispanic, and all other). Given the primary objective of assessing trends in black/white reporting of dietary intake, respondents who reported Hispanic ancestry at the household interview in the NHANES I and II were excluded. Thus, the analytic sample included black and white (non-Hispanic) respondents from all surveys.

Dietary methods

In all surveys, quantitative dietary information was collected using a 24-hour dietary recall administered by a trained dietary interviewer in the MEC.²³ Dietary interviewers used paper and pencil methods in NHANES I and II, which changed to computer assisted methods in later surveys. Recalls collected for the NHANES 1999–2002 surveys used a computer assisted multiple-pass dietary interview.

Dietary outcome variables

To obtain a comprehensive picture of secular changes in diet and race associations, two types of dietary attributes were examined. The first group relates to quantity of food, which in turn may relate to energy intake and body weight; which may be especially relevant given recent reports suggesting that the portion sizes consumed by Americans have increased over the period of surveys examined in this study.²⁴ These variables included total amount (weight) of foods and beverages, energy intake, macronutrient composition, and energy density of the reported

diet. Dietary energy density may correlate with total energy intake and body weight,^{25–29} and is also believed to have changed over the past three decades. However, the association of different energy density measures with nutrient profiles and body weight varies depending on how this variable is defined, and there is no consensus definition.^{27, 28} In this study, the dietary energy density (energy content/gram) was assessed in two different ways: (1) foods only (excluded all beverages); and (2) foods and nutritive beverages (i.e., milk, and 100% juices, but excluding all alcoholic and other non-alcoholic energy-yielding or non-energy-yielding beverages—e.g., coffee, tea, sodas, juice drinks).

The second group of dietary variables included foods/nutrients potentially related to health, e.g., variables related to dietary composition and quality. Nutrients examined were limited to those available in all surveys and included intakes of saturated fat, and the micronutrients vitamin C, calcium and potassium. Other nutrients/dietary components of potential public health significance—dietary fiber, folate, vitamin E, trans fatty acids, and the glycemic index of foods—were not available for all surveys. Estimates of vitamin C, calcium and potassium intake presented do not include contribution of supplements. Whether respondents mentioned any food from the fruit, or vegetable groups was also examined. The fruit group included all fresh, frozen or canned fruits and 100% juices, but excluded fruit drinks and fruit desserts such as fruit pies. The vegetable group included all raw, canned, and frozen vegetables and juices.

Analytic sample

The analytic sample included all nonpregnant, nonlactating respondents aged 25–74 years with a reliable, self-reported 24-hour dietary recall, with race classification of non-Hispanic black and white, and with information on poverty-income ratio (PIR) and education from each survey. The upper age cutoff of 74 years was necessary because the NHANES I and II did not include respondents older than 74 years. The total sample size for the four surveys was 30,413 (NHANES I = 9638; NHANES II = 9155; NHANES III = 7657; NHANES 1999–2002 = 3963).

Analytical methods

Gender-specific linear or logistic multiple regression models were used to assess the independent association of race with dietary attributes. Adjustment for covariates accounted for changes over time and race differences in the distributions of a number of variables potentially related to various outcomes: age, race (white, black), PIR, education, body mass index (BMI) (kg/m²), and survey (NHANES I, NHANES II, NHANES III, and NHANES 1999–2002). Changes in the association of race with dietary attributes across surveys were examined by including a race by survey interaction term in all regression models. In these models, survey was modeled as a trend variable. In an attempt to understand whether race differentials were dependent upon education and PIR, regression models stratified by categories of education and PIR were run using data combined for all surveys to compensate for small sample size within some race–socioeconomic position categories in individual surveys. Respondents missing information on any variable were excluded from regression models. The mean estimates presented in tables and figures are predictive margins obtained from fully adjusted regression models.³⁰

Because the data from four surveys were combined for analysis of trends, data from these surveys were treated as *independent* samples from different populations. Therefore, the data in all analyses were weighted using the NCHS assigned survey-specific sample weights so as to produce estimates that represented each population.³¹ All statistical analyses included sample weights and were adjusted for complex sample design of the four surveys by using SAS callable SUDAAN, Release 9.0 (Research Triangle Institute. Research Triangle Park NC, 2005). All *p* values were two-sided.

Results

Respondent characteristics

Characteristics of the study population are available online in Tables 1 and 2. Overall, a higher proportion of black adults were women, aged 25 to 39 years, had < 12 years of education or a PIR of <1, were current smokers, and reported no leisure time physical activity; however, a lower proportion of blacks reported alcohol use or dietary supplements (for all variables, p value for χ^2 test of independence ≤ 0.0001). Time trends for white and black adults were similar for education, income and dietary supplement use (all increased); and current smoking and no leisure time physical activity (both decreased) ($p < 0.0001$), although the pattern of race differences was unchanged.

Direction of time trends in self-reported dietary attributes within each race-gender group In all race-gender groups, the percent obese, the reported intakes of energy, the amount of foods and beverages, energy from carbohydrate and energy density (except black men) increased, whereas the energy from protein, fat (total and saturated), and cholesterol decreased ($p \leq 0.05$) over time (Tables 3 and 4). The percentage of white men and women who mentioned a fruit declined ($p < 0.001$) across surveys; a similar trend was significant in black women ($p = 0.03$) but not men ($p = 0.07$). The percentage of white and black women who mentioned a vegetable increased across surveys ($p = 0.05$ and 0.002 , respectively). Reported vitamin C intake declined for white women ($p = 0.02$), but was unchanged in all other race-gender groups. Reported potassium and calcium intakes increased in all race-gender groups ($p < 0.001$), except calcium intake in black men ($p = 0.3$). With adjustment for energy intake, the observed trends in intakes of food groups and nutrients were attenuated (vegetable reporting, vitamin C and potassium), and the inverse trend for calcium intake became significant in black men and women ($p \leq 0.01$).

The observation that the energy density of reported diets increased from 1971 to 2002 motivated a post-hoc exploratory analysis comparing trends in energy density with trends in prevalence of obesity. Energy-density of foods and nutritive beverages was a significant independent predictor in women ($p = 0.007$) but not in men. Energy density of foods only was not associated with BMI in either gender. These logistic regression models included age, education, PIR, race, survey, smoking status, alcohol use, and leisure time physical activity as covariates. Figure 1 shows that the trajectory of prevalence rates of obesity from 1971–2002 roughly parallels adjusted mean energy density of foods and nutritive beverages, especially among women.

Time trends in *race differentials* in self-reported dietary attributes

The lack of significant race by survey interactions in Tables 3 and 4 suggests that the race differences or (lack thereof) in most dietary attributes examined in this study were unchanged from 1971–2002. Exceptions were as follows. In NHANES I, obesity was more prevalent among black men; in later surveys these differences were not significant (Table 3, survey by race interaction $p = 0.001$). The race differential in calcium intake increased from 1971–2002 due to a significant increase in white but not black men (Table 3, survey by race interaction $p = 0.004$). Black women reported significantly lower energy intake in the NHANES I and II, in later surveys these differences were not significant (Table 4, survey by race interaction $p = 0.007$). The macronutrient composition of the diet was generally similar in all race groups in all surveys. However, race differences were noted for reported amount of food, energy from saturated fat, vegetables, vitamin C, potassium, and calcium intakes in most surveys in both men and women. In all surveys, blacks reported lower amount of foods, energy from saturated fat, vegetables, potassium, and calcium intakes relative to whites ($p < 0.05$).

Education and PIR differentials in selected dietary attributes between blacks and whites In combined data from all surveys, significant race differentials were noted in reported intakes

of potassium, calcium, and vegetable in all categories of income and education (Figure 2). Higher education and PIR predicted higher intakes of these attributes in both race groups (except that PIR did not relate to calcium intake in either race).

Discussion

The primary objective of this study was to determine if *race differentials* in dietary intake changed over time, for possible insights into trends in diet-related health disparities. Improved dietary attributes in blacks relative to whites could signify an eventual closing of gaps in related health outcomes. A static differential in the face of worsening trends would mean an absolute although not relative deterioration in dietary status of black Americans, while a static differential in the face of trends of improvement would mean an absolute but not relative improvement for black Americans. The goal of eliminating disparities is to close the black-white gap in the context of overall improved health status. Hence, to the extent possible the direction of the overall trends along with trends in race differentials was evaluated. Data on obesity prevalence were included for context. Detailed analyses of trends in obesity in NHANES data by race and socioeconomic status are available elsewhere.^{32, 33}

The results are remarkable for similarity of trajectories in self-reported food and nutrient intake in all race-gender groups. The quantity of food, total energy intake, energy from carbohydrate, and energy density increased, and energy from total and saturated fat and cholesterol intake decreased across the board. Similar trends in macronutrient intake have been reported from the Continuing Survey of Food Intakes by Individuals,³⁴ and among mostly white participants of the Minnesota Heart Survey.³⁵ These results suggest a population-wide shift in intake of energy and macronutrients over the 3-decade span of the four surveys, and may reflect changes in availability, and marketing of foods of lower fat but higher carbohydrate content that were adopted by all race-gender groups. Prevalence of obesity also increased over this period in all race-gender groups with trends parallel to energy density (especially in women). Trends in a favorable direction were noted for dietary potassium and calcium intake (except black men).

In most surveys, the race differentials in reported saturated fat and vitamin C intake were favorable for blacks (lower energy from saturated fat and higher vitamin C intake). However, in all surveys, other food or nutrient intake differences between blacks and whites were in a direction suggestive of higher chronic disease risk in blacks: lower intakes of vegetables, potassium, and calcium. The absence of a change in race differentials across surveys that might foretell a widening or narrowing of gaps in disparities between blacks and whites in diet-related health outcomes was striking, with only two noteworthy exceptions. The relative position of black compared to white men improved, in that the increase in obesity prevalence was steeper in white than black men. However, as suggested above, a small relative gain when attained by a relatively lesser *worsening* of a health problem is not really a gain in an absolute sense. For calcium intake in men, the disparity widened—white men improved while black men did not change their calcium intake. Overall then, these results indicate that essentially no progress has been made in reducing disparities in dietary intakes between U.S. blacks and whites, in either gender and, further, that adverse dietary changes in the U.S. population, when observed, will add to any underlying excess risk that is already present in the black population.

Differences in dairy food consumption between blacks and whites are well known and may have contributed to lower intakes of calcium and potassium. In the U.S. population, milk was the most important source of both calcium and potassium.³⁶ With potential advantages of a higher potassium intake in mitigating the effect of sodium sensitivity in black Americans,³⁷ the persistently low potassium intakes require attention. Although the fruit and vegetable intakes of black men and women were somewhat lower relative to whites, the dietary vitamin C intake was consistently higher among blacks. Others have also reported higher vitamin C

intake among black Americans.^{10, 11} This differential may partially reflect higher contribution of non-fruit and vegetable sources of vitamin C (e.g., vitamin C fortified beverages) to the total daily intake of this nutrient among blacks.³⁸

Race differences in dietary intakes reflect differences in food availability, selection, and preparation practices that may be mediated by a number of economic, institutional, environmental, cultural, individual preferences, and health determinants.^{10, 39} Income and especially education differentials were found to persist independently of race differentials in these surveys.⁴⁰ In the present study, the race differentials in intakes of potassium, calcium, and vegetables were present in all categories of education and PIR. Neighborhood rather than only individual socioeconomic position may be relevant as well, since neighborhood of residence may limit the ready accessibility and, therefore, consumption, of healthful foods or determine the excess availability of foods considered to be unhealthful.^{41–44} These effects may be more important in black than in white communities due to residential segregation.⁴⁵

The results of this study should be interpreted with due consideration for the following limitations. First, the methods used to collect the 24-hour dietary recall in the NHANES changed over the four surveys²³; newer surveys include automated methods and multiple-pass approach. Second, the database on nutrient composition of foods has expanded and values of many nutrients may have changed because of improved analytic technology and food sampling methods.⁴⁶ Third, the recalls obtained in the NHANES I and II were limited to weekdays, whereas weekend days were included in later surveys.²³ Because NCHS did not conduct any bridging studies to determine the systematic effect of changes in dietary methodology on food and nutrient intakes, the confounding of time (survey) effect with the method effect remains a possibility. Due to these reasons, *quantitative changes* in dietary attributes across surveys should be interpreted cautiously. Within each survey, however, the methods used for data collected from all respondents were similar; therefore, while these data may be of limited value in estimating survey effect, they are valid for *comparing the direction* of time trends in the two race groups, and for an examination of *changes in race differentials* in self-reported dietary attributes across surveys. No data are available to help examine the possibility that change in methodology may have a differential effect on different race-ethnicity groups.

Measurement error is a problem in *all* methods of assessing dietary intake.^{47, 48} A 24-hour recall provides a valid estimate of usual intakes of groups but not individuals and overestimates prevalence of nutrient inadequacy.⁴⁹ Therefore, the assessment of race differences in dietary intakes in this study was limited to estimation of mean nutrient intakes and did not derive estimates of prevalence of nutrient inadequacy.

In conclusion, dietary intake trends in blacks and whites over the past several decades appear to be similar—suggesting that previously identified dietary risk factors that differentially affect black Americans have not improved in a relative sense. The differences observed need to be confirmed with biomarkers,⁵⁰ but would seem sufficiently strong to warrant intensified study and action to better understand the sociocultural or environmental factors that anchor these persistent differentials and identify approaches to effect change while building on strengths of current dietary patterns where possible.^{51–53}

Acknowledgements

Funded in part by an NIH grant award CA108274 (AKK), the intramural research program of the Department of Health and Human Services, National Institutes of Health, National Cancer Institute (BIG), and P60 MD000209 from the National Center for Minority Health and Health Disparities at NIH (SKK).

We thank Lisa Licitra Kahle for expert SAS and SUDAAN programming support.

Appendix 1

Characteristics (%±SE) of US adult white (non-Hispanics), aged 25–74 years, NHANES 1, II, III, and 1999–2002

	All surveys	NHANES I	NHANES II	NHANES III	NHANES 1999–2002
<i>n</i>	23314	7940	8129	4447	2798
% women	51.0±0.3	52.8±0.6	51.5±0.5	50.4±0.6	49.8±0.8
Age group					
25–39 y	36.6±0.6	35.5±0.9	38.7±0.9	40.5±1.3	31.8±1.3
40–59 y	42.8±0.5	43.9±0.9	39.2±0.6	38.8±0.9	49.0±1.2
60–74 y	20.6±0.5	20.6±0.8	22.1±0.7	20.6±1.2	19.2±1.0
Years of education					
<12 y	22.7±0.6	35.0±1.2	28.9±1.2	17.9±1.2	12.3±1.1
12 y	34.8±0.6	38.7±0.9	38.5±1.2	36.0±0.9	27.2±1.5
>12 y	42.5±0.8	26.3±1.2	32.7±1.3	46.1±1.5	60.4±2.3
Poverty income ratio					
<1	6.9±0.3	7.1±0.6	7.1±0.7	6.5±0.7	7.0±0.7
1– <2	18.8±0.5	23.0±0.9	22.0±0.7	16.2±0.8	15.3±1.5
≥2	74.3±0.7	69.9±1.3	70.9±1.2	77.3±1.2	77.7±1.9
Smoking status					
Never	40.9±0.6	36.3±0.8	38.1±0.7	41.1±1.0	46.8±1.7
Former	26.2±0.4	20.3±0.7	25.3±0.6	29.5±0.7	28.5±1.0
Current	30.9±0.5	34.6±0.9	36.5±0.7	29.4±1.1	24.6±1.2
Unknown	1.9±0.1	8.8±0.5	0.01±0.01	None	0.04±0.04
Drink alcohol					
Yes	69.3±0.9	77.4±1.0	65.5±1.3	59.5±1.8	75.8±2.0
Supplement use					
Yes	45.1±0.6	35.0±1.2	38.7±0.8	44.8±1.1	59.0±1.4
Leisure-time physical activity					
None	30.0±0.6	40.9±1.2	35.7±0.7	16.7±1.0	29.7±1.6

The distribution of all variables in the table differed across surveys (*p* value for the χ^2 test of independence <0.0001).

Appendix 2

Characteristics (%±SE) of U.S. adult black (non-Hispanics), aged 25–74 years, NHANES 1, II, III, and 1999–2002

	All surveys	NHANES I	NHANES II	NHANES III	NHANES 1999–2002
<i>n</i>	7099	1698	1026	3210	1165
% women	55.2±0.8	58.1±2.4	55.5±2.1	54.4±1.1	53.8±1.5
Age group					
25–39 y	43.0±0.8	39.5±1.9	44.1±1.8	48.5±1.1	39.0±1.8
40–59 y	41.2±0.8	42.7±2.0	39.2±1.5	36.7±0.9	46.0±1.5
60–74 y	15.8±0.6	17.8±1.6	16.6±1.2	14.8±1.0	14.9±1.0
Years of education					
<12 y	42.5±1.0	62.2±2.1	52.1±2.3	30.3±1.3	34.8±2.1
12 y	28.6±0.8	23.5±2.0	28.2±2.0	38.3±1.2	22.8±1.4
>12 y	28.9±1.0	14.3±1.9	19.7±2.4	31.4±1.5	42.3±2.2
Poverty income ratio					
<1	26.6±1.1	32.9±2.7	26.3±1.9	26.1±1.7	23.4±2.4
1– <2	28.6±0.8	32.8±1.9	31.1±1.8	28.3±1.3	24.6±1.8
>2	44.7±1.3	34.3±2.4	42.6±3.0	45.6±1.9	52.0±2.6
Smoking status					
Never	46.5±1.0	38.5±2.0	41.5±1.8	45.3±1.4	56.4±2.1
Former	15.0±0.6	9.5±1.3	17.0±1.7	17.6±0.9	14.6±1.2
Current	35.4±0.8	36.8±1.9	41.3±1.3	37.1±1.4	29.0±1.7
Unknown	3.0±0.4	15.1±1.8	0.3±0.3	None	0.11±0.09
Drink alcohol					
Yes	59.3±1.0	71.1±2.2	61.0±3.0	52.4±1.3	57.2±2.0
Supplement use					
Yes	31.1±0.9	20.8±1.8	30.1±2.2	34.8±0.9	34.8±2.0
Leisure-time physical activity					
None	45.0±0.9	60.1±2.6	43.9±1.6	32.5±1.6	48.2±1.5

The distribution of all variables in the table (except gender) differed across surveys (*p* value for the χ^2 test of independence <0.0001).

Black white differences in distribution of all variables in Tables 1 and 2 were significant ($p < 0.0001$), for all surveys combined and in each of the four surveys (except gender in NHANES II and smoking status in NHANES I).

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Figure 1.

Secular trends in the prevalence of obesity and mean energy density of foods and nutritive beverages among men and women (NHANES I, 1971–75 to NHANES 1999–2002).

Figure 2.

Multivariate-adjusted intakes of potassium (top row; mean intake), calcium (middle row; mean intake), and vegetables (bottom row; percent reporting any vegetable) for non-Hispanic white (solid line) and black (dotted line) adults by education and poverty level (all surveys combined). All education trends were significant for NH whites and blacks. Poverty level trends were significant for potassium and vegetable intake. All race differentials were significant for all categories of education and poverty.

Table 1

Adjusted^a percent obese, and percent or mean $\pm$ SE of dietary attributes, among men, by race: NHANES I, II, III, and 1999–2002

	NHANES I	NHANES II	NHANES III	NHANES 1999–02	P _{trend} for survey effect
% with body mass index of $\geq 30^b$					
White	12 $\pm$ 0.8	13 $\pm$ 0.7	22 $\pm$ 0.9	29 $\pm$ 1	<0.001
Black	19 $\pm$ 2	16 $\pm$ 2	23 $\pm$ 1.2	26 $\pm$ 2	0.002
<i>p</i> for race effect	0.003	0.2	0.5	0.2	
Energy (kcal)					
White	2391 $\pm$ 29	2395 $\pm$ 26	2684 $\pm$ 27	2722 $\pm$ 27	<0.001
Black	2220 $\pm$ 61	2175 $\pm$ 53	2487 $\pm$ 42	2525 $\pm$ 47	<0.001
<i>p</i> for race effect	0.005	<0.001	<0.001	<0.001	
Amount of all reported foods and beverages (g)					
White	2714 $\pm$ 38	2790 $\pm$ 33	3144 $\pm$ 37	3224 $\pm$ 53	<0.001
Black	2050 $\pm$ 71	2013 $\pm$ 51	2314 $\pm$ 36	2572 $\pm$ 67	<0.001
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	
Energy density (Foods and nutritive beverages) (kcal/g)					
White	1.63 $\pm$ 0.01	1.66 $\pm$ 0.01	1.74 $\pm$ 0.02	1.78 $\pm$ 0.02	<0.001
Black	1.69 $\pm$ 0.04	1.73 $\pm$ 0.04	1.78 $\pm$ 0.02	1.80 $\pm$ 0.04	0.06
<i>p</i> for race effect	0.08	0.07	0.11	0.63	
Energy density (foods only) (kcal/g)					
White	2.00 $\pm$ 0.01	2.01 $\pm$ 0.01	2.03 $\pm$ 0.02	2.09 $\pm$ 0.02	<0.001
Black	1.98 $\pm$ 0.03	2.03 $\pm$ 0.04	2.00 $\pm$ 0.02	2.01 $\pm$ 0.04	0.7
<i>p</i> for race effect	0.5	0.7	0.2	0.1	
Energy (%) from carbohydrate					
White	42.0 $\pm$ 0.2	42.3 $\pm$ 0.2	48.0 $\pm$ 0.5	48.4 $\pm$ 0.4	<0.001
Black	42.3 $\pm$ 0.8	42.2 $\pm$ 0.6	46.1 $\pm$ 0.5	49.0 $\pm$ 0.5	<0.001
<i>p</i> for race effect	0.8	0.9	0.002	0.3	
Energy (%) from protein					
White	16.6 $\pm$ 0.1	16.2 $\pm$ 0.1	15.2 $\pm$ 0.1	15.2 $\pm$ 0.1	<0.001
Black	17.5 $\pm$ 0.4	16.4 $\pm$ 0.2	16.0 $\pm$ 0.2	15.5 $\pm$ 0.2	<0.001
<i>p</i> for race effect	0.02	0.5	<0.001	0.3	
Energy (%) from total fat					
White	37.0 $\pm$ 0.2	37.1 $\pm$ 0.2	34.6 $\pm$ 0.3	33.9 $\pm$ 0.3	<0.001
Black	36.0 $\pm$ 0.8	36.5 $\pm$ 0.7	34.3 $\pm$ 0.2	31.7 $\pm$ 0.5	<0.001
<i>p</i> for race effect	0.2	0.4	0.3	0.0004	
Energy (%) from saturated fat					
White	13.5 $\pm$ 0.1	13.3 $\pm$ 0.1	11.6 $\pm$ 0.1	11.1 $\pm$ 0.1	<0.001
Black	12.5 $\pm$ 0.3	12.7 $\pm$ 0.2	11.0 $\pm$ 0.1	9.7 $\pm$ 0.2	<0.001
<i>p</i> for race effect	0.004	0.03	<0.001	<0.001	
Dietary cholesterol (mg)					
White	479 $\pm$ 8	430 $\pm$ 8	344 $\pm$ 10	359 $\pm$ 9	<0.001
Black	529 $\pm$ 24	463 $\pm$ 19	396 $\pm$ 13	374 $\pm$ 12	<0.001
<i>p</i> for race effect	0.04	0.11	<0.001	0.3	
Mentioned any fruit (%)					
White	57 $\pm$ 1	55 $\pm$ 1	48 $\pm$ 1	48 $\pm$ 1	<0.001
Black	56 $\pm$ 4	54 $\pm$ 3	49 $\pm$ 1	50 $\pm$ 1	0.07
<i>p</i> for race effect	0.7	0.8	0.8	0.3	
Mentioned any vegetable (%)					
White	93 $\pm$ 0.5	91 $\pm$ 0.5	93 $\pm$ 0.7	91 $\pm$ 0.9	0.7
Black	88 $\pm$ 2	84 $\pm$ 2	89 $\pm$ 1	85 $\pm$ 1	0.5
<i>p</i> for race effect	0.004	<0.001	<0.001	<0.001	
Vitamin C (mg)					
White	91 $\pm$ 2	102 $\pm$ 2	112 $\pm$ 4	97 $\pm$ 4	0.1
Black	103 $\pm$ 6	118 $\pm$ 9	127 $\pm$ 4	120 $\pm$ 9	0.1

	NHANES I	NHANES II	NHANES III	NHANES 1999-02	P _{trend} for survey effect
<i>p</i> for race effect	0.05	0.11	0.01	0.007	
Potassium (mg)					
White	2820±40	2990±35	3488±42	3350±44	<0.001
Black	2320±74	2434±64	2808±50	2776±65	<0.001
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	
Calcium (mg)					
White	916±17	900±19	1017±19	1034±18	<0.001
Black	669±29	663±26	717±19	688±19	0.3
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	

^aFrom sex-specific regression models with each variable in the table as a continuous or binary outcome, independent variables were: age, age square, education (<12, 12, >12 y), poverty income ratio (<1, 1–2, ≥2), body mass index, race (non-Hispanic white, non-Hispanic black), survey (NHANES I, II, III, 99–02), and race by survey interaction term. Models included respondents with complete covariate information (*n* = 13,655). The interaction of race and survey (Race*Survey) was significant for BMI and calcium (*p* ≤0.004).

^bFor body mass index as outcome, additional covariates were smoking status (never, former, current, unknown), any alcohol use (yes, no), any leisure time physical activity (yes, no); (*n* = 13,595 with complete covariate information).

Table 2

Adjusted^a percent obese, and percent or mean $\pm$ SE of dietary attributes, among women, by race: NHANES I, II, III, and 1999–2002

	NHANES I	NHANES II	NHANES III	NHANES 1999–02	P _{trend} for survey effect
% with Body mass index of $\geq 30^b$					
White	16 $\pm$ 0.8	16 $\pm$ 0.7	26 $\pm$ 1.5	36 $\pm$ 1.5	<0.001
Black	24 $\pm$ 1.6	27 $\pm$ 2.0	35 $\pm$ 1.7	47 $\pm$ 2.5	<0.001
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	
Energy (kcal)					
White	1530 $\pm$ 16	1507 $\pm$ 13	1759 $\pm$ 16	1857 $\pm$ 23	<0.001
Black	1387 $\pm$ 27	1427 $\pm$ 30	1746 $\pm$ 19	1843 $\pm$ 36	<0.001
<i>p</i> for race effect	<0.001	0.01	0.6	0.7	
Amount of all reported foods and beverages (g)					
White	1975 $\pm$ 19	2014 $\pm$ 23	2243 $\pm$ 20	2306 $\pm$ 34	<0.001
Black	1489 $\pm$ 40	1488 $\pm$ 38	1766 $\pm$ 22	1823 $\pm$ 38	<0.001
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	
Energy density (foods and nutritive beverages) (kcal/g)					
White	1.52 $\pm$ 0.01	1.54 $\pm$ 0.01	1.64 $\pm$ 0.01	1.70 $\pm$ 0.03	<0.001
Black	1.57 $\pm$ 0.03	1.60 $\pm$ 0.03	1.71 $\pm$ 0.02	1.73 $\pm$ 0.03	<0.001
<i>p</i> for race effect	0.1	0.1	0.01	0.4	
Energy density (foods only) (kcal/g)					
White	1.85 $\pm$ 0.01	1.85 $\pm$ 0.01	1.90 $\pm$ 0.01	1.98 $\pm$ 0.02	<0.001
Black	1.83 $\pm$ 0.03	1.88 $\pm$ 0.04	1.91 $\pm$ 0.02	1.98 $\pm$ 0.04	0.002
<i>p</i> for race effect	0.4	0.4	0.6	0.8	
Energy (%) from carbohydrate					
White	44.9 $\pm$ 0.2	45.5 $\pm$ 0.2	50.3 $\pm$ 0.4	50.6 $\pm$ 0.4	<0.001
Black	45.1 $\pm$ 0.7	45.8 $\pm$ 0.8	49.7 $\pm$ 0.3	51.5 $\pm$ 0.5	<0.001
<i>p</i> for race effect	0.8	0.7	0.3	0.2	
Energy (%) from protein					
White	17.1 $\pm$ 0.1	16.1 $\pm$ 0.1	15.3 $\pm$ 0.1	14.7 $\pm$ 0.1	<0.001
Black	17.5 $\pm$ 0.3	16.8 $\pm$ 0.3	15.5 $\pm$ 0.1	14.8 $\pm$ 0.3	<0.001
<i>p</i> for race effect	0.2	0.05	0.2	0.9	
Energy (%) from total fat					
White	36.2 $\pm$ 0.1	36.3 $\pm$ 0.2	33.8 $\pm$ 0.3	34.3 $\pm$ 0.3	<0.001
Black	35.4 $\pm$ 0.5	35.6 $\pm$ 0.5	33.9 $\pm$ 0.3	32.9 $\pm$ 0.5	<0.001
<i>p</i> for race effect	0.1	0.2	0.7	0.02	
Percent energy from saturated fat					
White	13.0 $\pm$ 0.1	12.5 $\pm$ 0.1	11.3 $\pm$ 0.1	11.2 $\pm$ 0.1	<0.001
Black	12.2 $\pm$ 0.2	12.1 $\pm$ 0.2	10.8 $\pm$ 0.1	10.1 $\pm$ 0.2	<0.001
<i>p</i> for race effect	<0.001	0.04	0.004	<0.001	
Dietary cholesterol (mg)					
White	310 $\pm$ 5	273 $\pm$ 5	218 $\pm$ 5	233 $\pm$ 5	<0.001
Black	310 $\pm$ 13	288 $\pm$ 11	244 $\pm$ 6	260 $\pm$ 8	<0.001
<i>p</i> for race effect	0.9	0.2	<0.001	0.02	
Mentioned any fruit (%)					
White	65 $\pm$ 1	63 $\pm$ 1	54 $\pm$ 1	51 $\pm$ 2	<0.001
Black	59 $\pm$ 3	64 $\pm$ 3	55 $\pm$ 2	54 $\pm$ 2	0.03
<i>p</i> for race effect	0.04	0.6	0.4	0.4	
Mentioned any vegetable (%)					
White	92 $\pm$ 0.5	90 $\pm$ 0.5	92 $\pm$ 0.5	94 $\pm$ 1	0.05
Black	85 $\pm$ 1	85 $\pm$ 2	89 $\pm$ 0.8	89 $\pm$ 1	0.002
<i>p</i> for race effect	<0.001	<0.001	0.003	0.003	
Vitamin C (mg)					
White	86 $\pm$ 2	96 $\pm$ 2	89 $\pm$ 2	78 $\pm$ 3	0.02
Black	88 $\pm$ 4	111 $\pm$ 4	99 $\pm$ 3	94 $\pm$ 3	0.9
<i>p</i> for race effect	0.7	0.003	0.009	<0.001	

	NHANES I	NHANES II	NHANES III	NHANES 1999-02	P _{trend} for survey effect
Potassium (mg)					
White	1997±23	2093±25	2511±29	2450±48	<0.001
Black	1637±50	1775±53	2131±27	2101±38	<0.001
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	
Calcium (mg)					
White	624±10	602±12	710±11	766±15	<0.001
Black	454±16	478±19	556±9	568±16	<0.001
<i>p</i> for race effect	<0.001	<0.001	<0.001	<0.001	

^aFrom sex-specific regression models with each variable in the table as a continuous or binary outcome; independent variables were: age, age square, education (<12, 12, >12 y), poverty income ratio (<1, 1–2, ≥2), race (non-Hispanic white, non-Hispanic black), body mass index, survey (NHANES I, II, III, 99-02), and race by survey interaction term. Models included respondents with complete covariate information (*n* = 16,674). The interaction of race and survey (Race*Survey) was significant for energy intake (*p* = 0.007).

^bFor body mass index as outcome, additional covariates were smoking status (never, former, current, unknown), any alcohol use (yes, no), any leisure time physical activity (yes, no); (*n* = 16,575 with complete covariate information).