RESEARCH
Original Research

Snacking and Diet Quality Are Associated With the Coping Strategies Used By a Socioeconomically Diverse Urban Cohort of African-American and White Adults

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ABSTRACT

Background Stress affects health-related quality of life through several pathways, including physiological processes and health behaviors. There is always a relationship between stress (the stimulus) and coping (the response). The relationship between snacking and snackers' diet quality and stress coping is a topic overlooked in research.

Objective The study was primarily designed to determine whether energy provided by snacks and diet quality were associated with coping behaviors to manage stress.

Design We analyzed a baseline cohort of the Healthy Aging in Neighborhoods of Diversity across the Life Span study (2004 to 2009).

Participants The sample was composed of 2,177 socioeconomically diverse African-American and white adults who resided in Baltimore, MD.

Main outcome measures Energy from snacks was calculated from 2 days of 24-hour dietary recalls collected using the US Department of Agriculture's Automated Multiple Pass Method. Snack occasions were self-reported as distinct eating occasions. Diet quality was evaluated by the Healthy Eating Index-2010.

Statistical analyses performed Multiple regression analyses were used to determine whether coping factors were associated with either energy provided by snacks or Healthy Eating Index-2010, adjusting for age, sex, race, socioeconomic status, education, literacy, and perceived stress. Coping was measured by the Brief COPE Inventory with instrument variables categorized into three factors: problem-focused coping, emotion-focused coping, and use of support. Perceived stress was measured with the 4-item Perceived Stress Scale.

Results Adjusting for perceived stress and selected demographic characteristics, emotion-focused coping strategies were associated with greater energy intakes from snacks (P=0.020), and use of coping strategies involving support was positively associated with better diet quality (P=0.009).

Conclusions Energy contributed by snacks and diet quality were affected by the strategy that an individual used to cope with stress. The findings suggest that health professionals working with individuals seeking guidance to modify their eating practices should assess a person's coping strategies to manage stress.
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HEALTH-RELATED QUALITY OF LIFE AND well-being are multidimensional and include domains that are related to the environment and physiological and psychological functioning. Evidence suggests that stress affects health-related quality of life not only through physiological processes, but also through health behaviors, such as food intake.[1,2] Stress appears to modify overall food intake.[3,4] Even though our understanding of the stress–eating relationship is confounded by limitations in study design, greater preference for energy-dense foods—specifically foods high in sugar or fat—appears to be associated with chronic life stress.[5] Oliver and Wardle[6] found that stress was associated with increased consumption of high-fat, highly palatable snack foods, and meal-type foods were consumed less often by both men and women who were stressed. Laugero and colleagues[7] reported an inverse association between stress and fruit, vegetable, and protein intake, and a positive association between stress and the consumption of salty snacks. In another study, daily hassles were found to be associated with increased intake of high-fat and high-sugar snacks.[8]

Chronic life stress can be causally linked to weight gain, which can contribute to the development of obesity.[9-11]

Obesity is positively related with life stress in African-American women.[12] Compared to European-American women, African-American women have greater perceived life stress and a greater desire for intense sweet taste.[12] This desire for intense sweet taste can result in overconsumption of energy and subsequent weight gain, and possibly contribute to the higher prevalence of obesity among African-American women compared with white women.

Stress is considered the experience of emotional strain. According to Lazarus and Folkman,[13] the mechanism for managing a stressor is coping. There is a relationship between stress and coping in that the experience of stress always yields a coping reaction, even if the reaction is no reaction at all. Responses to stress and strategies for coping with stress vary across individuals, ethnic groups, sex, and populations. It is important to enhance our understanding of how disparate groups of people respond to and cope with stress because the associations between life stress and nutritional behavior can interact in ways that affect risk for developing chronic diseases.

For the current study, the theoretical model of behavioral self-regulation developed by Carver[14] served as the basis for assessing coping behaviors. This model considers ways in which individuals respond to stress, coping dispositions, and situation-specific coping tendencies. Carver's model distinguishes aspects of active coping and responses that may impede or interfere with active coping. Active coping is thought to be an adaptive way of dealing with stressful events and involves solving problems, reframing the meaning of the problems, or seeking information. In contrast, passive coping refers to feelings of helplessness dealing with the stressor and relying on others to resolve the stressful event or situation and results in avoidance, withdrawal, and wishful thinking.[15]

The primary study objective was to explore whether snacking and diet quality were associated with coping behaviors after adjusting for selected demographic characteristics and perceived stress. This association was examined in an urban population of socioeconomically diverse African-American and white adults who self-reported snacking. A secondary objective was to determine whether diet quality was improved by snacking.

METHODS

Healthy Aging in Neighborhoods of Diversity Across the Life Span Study Background

The HANDLS (Healthy Aging in Neighborhoods of Diversity Across the Life Span) study, a 20-year prospective study, has been described in detail elsewhere.[16] Participants were drawn from 13 predetermined Baltimore, MD, neighborhoods, yielding representative distributions of African Americans and whites, age 30 to 64 years, men and women, and socioeconomic status (SES) (self-reported household income $<125\%$ and $\geq 125\%$ of 2004 Federal Poverty Guidelines). The study design is a factorial cross of four factors: age, sex, race, and SES, with approximately equal numbers of subjects per factorial cell.

There were two interview sessions in the baseline HANDLS study, 2004 to 2009. The first session was done in the participant's home and consisted of an interview that included the first 24-hour dietary recall and questionnaires about the participant's health status, health service utilization, characteristics of the neighborhood, and demographics. The second session was completed on mobile research vehicles located in the participant's neighborhood. Assessments included such measures as the second 24-hour dietary recall, a medical history, physical examination, cognitive evaluation, and laboratory measures. Study protocol was approved by human Institutional Review Boards at MedStar Health Research Institute and University of Delaware. All HANDLS participants provided written informed consent and were compensated monetarily.

Sample

The present sample consisted of 2,177 individuals who completed 2 days of 24-hour dietary recalls (Figure 1). Participants who completed the phase 1 recall only were excluded because Brief COPE testing was performed during phase 2, along with the second dietary recall. There were no statistical differences in the distributions of demographic or nutrient data[17] or in the distributions of total Healthy Eating Index (HEI)-2010 scores between participants who completed 1 or both days of dietary recall.

Dietary Method

The US Department of Agriculture computerized Automated Multiple Pass Method was used to collect both 24-hour dietary recalls.[18] An illustrated food model booklet, measuring cups, spoons, and ruler were used to assist participants in estimating accurate quantities of foods and beverages consumed. Both recalls were administered in-person by trained interviewers, 4 to 10 days apart. After each reported list of foods consumed separated by a minimum time period of 1 hour, the participant was asked to identify the eating occasion. Eating occasions included breakfast, brunch, lunch, dinner, supper, snack, extended consumption (items consumed over a long time period),[19] and drink. For this study, snacks were self-defined by the participant as foods and beverages not consumed with main meals—breakfast, brunch, lunch, supper or dinner—or foods reported as extended consumption or drinks. Dietary recalls were coded using Survey Net, matching foods consumed with 8-digit codes in the Food and Nutrient Database for Dietary Studies version 3.0.[20]

Snack occasions were self-reported as distinct eating occasions and consisted of one or more food and beverage items. For this study, a "snacker" was defined as an individual who reported the consumption of one or more snacks. Foods reported as snacks were categorized by food groups by race and by sex over both days of dietary recalls.

Foods consumed as snacks could consist of a single item, such as a candy bar, or foods that were consumed simultaneously as one item, like a sandwich. Many foods reported as snacks were eaten simultaneously or in combination (such as crackers with cheese), and a dataset of snack foods was created. This dataset consisted of foods consumed as snacks, which were eaten as an individual item plus snack foods eaten in combination, which were recoded aggregating individual codes to reflect consumption as a single snack food item. The main food component of snack foods eaten simultaneously was used to define the appropriate food group. For example, chips with salsa were associated with

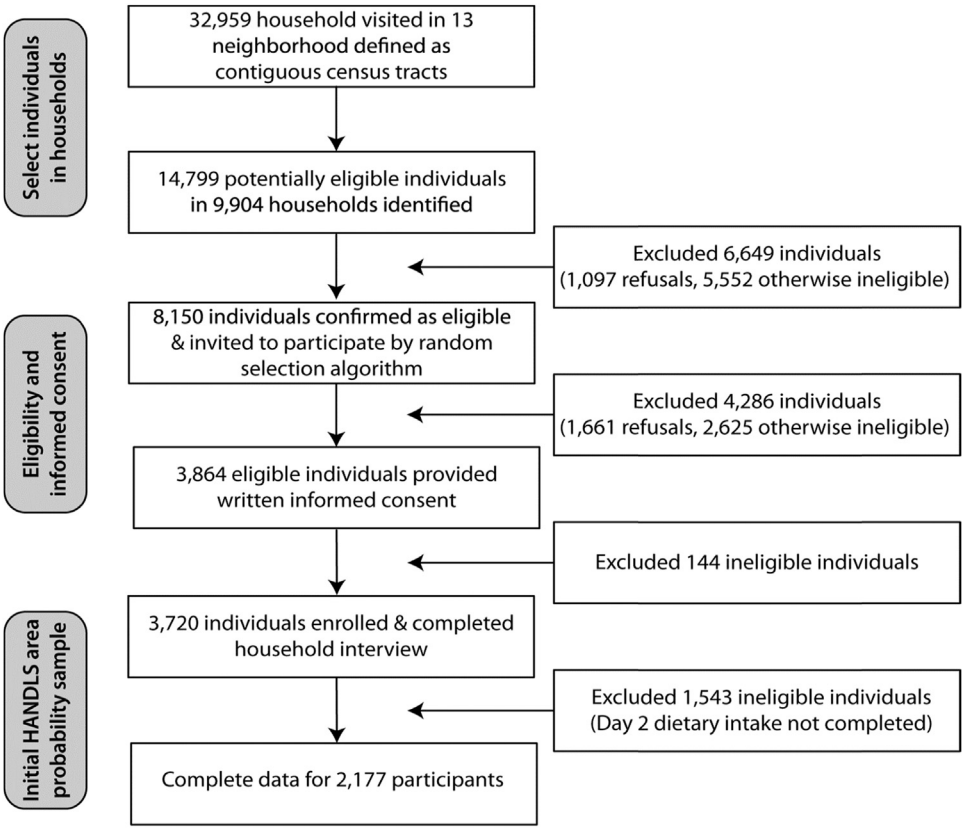

Figure 1. Flow diagram of Healthy Aging in Neighborhoods of Diversity Across the Life Span (HANDLS) study household screening, participant eligibility, and response rates.

salty snack group. A detailed description of the snack foods consumed by the HANDLS study population can be found elsewhere.[21] Preliminary analyses revealed no significant differences in energy intakes for breakfast, lunch, or dinner between individuals who snacked and those who did not consume snacks. The difference in total energy between the groups was due to foods consumed as snacks.

HEI-2010 Calculation

Diet quality was assessed by the HEI-2010.[22] The National Cancer Institute's Applied Research website provided the basic steps for calculating the HEI-2010 component and total scores and statistical code for 24-hour recalls.[23] A detailed description of the procedure used is available on the HANDLS website.[24] Total and component HEI-2010 scores were calculated for each recall day (day 1 and day 2) and then averaged to obtain the mean HEI-2010 total and component scores for both days combined.

Stress and Coping

Perceived stress was measured with the 4-item Perceived Stress Scale by Cohen and colleagues.[25] The Perceived Stress Scale is a global measure designed to measure the degree to which situations in one's life are appraised as stressful. Coping was measured by the Brief COPE Inventory.[14] The Brief COPE consists of 14 subscales: 28 items with 2 items per scale, which assessed positive reinterpretation and growth, active coping, humor, acceptance, planning, behavioral disengagement, mental disengagement, focus on and venting of emotions, self-blame, denial, substance use, religious coping, use of instrumental social support, and use of emotional social support. The items for the Brief COPE were framed to assess an individual's dispositional coping style, that is, what an individual typically does when confronted with a difficult or stressful event. Responses were scored as 0: "I usually don't do this at all," 1: "I usually do this a little bit," 2: "I usually do this a medium amount," and 3: "I usually do this a lot." The Perceived Stress and the Brief COPE were included as part of the audio computer-assisted self-interview questionnaires on the mobile research vehicles.

Based on the research of Smith and Goodfellow,[26] the variables in the Brief COPE were categorized into three factors: problem-focused coping, emotion-focused coping, and use of support (Figure 2). Problem-focused coping consisted of five subscales: active coping, positive reinterpretation and growth, planning, humor, and acceptance. Emotion-focused coping consisted of behavioral disengagement, mental disengagement, self-blame, and focus on and venting of emotions, along with two avoidance coping subscales—denial and substance use. Use of support consisted of emotional social support, instrumental social support, and religious coping. Smith and Goodfellow reported that the reliability analysis of the three factors, including problem-focused coping, emotion-focused coping, and use of support, indicated good reliability of the factors, with Cronbach's α

Problem-Focused Coping

Positive reinterpretation and growth

I usually try to see it in a different light to make it seem more positive.

I usually look for something good in what is happening.

Active coping

I usually concentrate my efforts on doing something about the situation.

I usually take action to try to make the situation better.

Humor

I usually make jokes about it.

I usually make fun of the situation.

Acceptance

When I am confronted with a difficult or stressful event, I usually accept the reality of the fact that it has happened.

When I am confronted with a difficult or stressful event, I usually learn to live with it.

Planning

I usually try to come up with a strategy about what to do.

I usually think hard about what steps to take.

Emotion-Focused Coping

Behavioral disengagement

I usually give up trying to deal with it.

I usually give up the attempt to cope.

Mental disengagement

I usually turn to work or other activities to take my mind off of things.

I usually do something to think about it less, such as going to the movies, watching TV, reading, daydreaming, sleeping, or shopping.

Focus on and venting of emotions

I usually say things to let my unpleasant feelings escape.

I usually express my negative feelings.

Self-blame

I usually criticize myself.

I usually blame myself for the things that happened.

Denial

I usually say to myself, "This isn't real."

I usually refuse to believe that it has happened.

Substance use

I usually use alcohol or other drugs to make myself feel better.

I usually use alcohol or other drugs to help me get through it.

Use of Support

Religious coping

I usually pray or meditate.

I usually try to find comfort in my religion or spiritual beliefs.

Use of instrumental social support

I usually get help and advice from other people.

I usually try to get advice or help from other people about what to do.

Use of emotional social support

I usually get emotional support from others.

I usually get comfort and understanding from someone.

Figure 2. Subscales of the Brief COPE Inventory. All statements begin with "When I am confronted with a difficult or stressful event"; responses were scored as 0: "I usually don't do this at all," 1: "I usually do this a little bit," 2: "I usually do this a medium amount," and 3: "I usually do this a lot." Total scores for each of the 14 subscales, composed of two items, were calculated.

ranging from .81 to .86. Our reliability analysis of the total Brief COPE and the three factors, namely, including problem-focused coping, emotion-focused coping, and use of support, indicated good reliability of the factors, with Cronbach's α of .83, .82, .74, and .78, respectively.

Literacy Measure

Literacy was assessed by trained examiners on the mobile research vehicles using the reading subtest of the Wide Range Achievement Test, 3rd edition (WRAT-3), a widely validated and used measurement of literacy.[27,28] The WRAT-3 Reading subtest measures ability to recognize and name letters and words. The total WRAT-3 Reading score (total correctly pronounced letters+ total correctly pronounced words) served as the literacy measurement. A WRAT-3 score between 37 and 40 represents a 6th- to 8th-grade reading level, and a score between 41 and 46 represents a high school reading level.

Body Composition

Dual-energy x-ray absorptiometry using a Lunar DPX-IQ (LunarCorp) was used to measure body fat.

Statistical Analyses

To determine whether differences in sex, race, and snacking subgroups existed for sample characteristics, diet quality was measured as HEI-2010 total and subscales scores, $2 \times 2 \times 2$ full-factorial analyses of variance, and χ^2 tests were used (χ^2 tests were used for sample characteristic's categorical data). Mean±standard error of the mean for HEI-2010 scores and percent of total energy consumption for each macronutrient (not shown) was calculated by sex, race, and snacking status groups.

Before performing the regression analyses, collinearity among coping strategies was tested. The three coping strategies were not highly related with each other and did not cause multicollinearity. Only those who consumed snacks were included in the regression analyses (n=1,829). Literacy was included along with education in the regression models because an independent and synergistic association of literacy and education with diet quality measured by HEI-2010 is known to exist.[29]

Sequential multiple regression models were used to test whether the three factors of coping predicted energy consumed as snacks and for HEI-2010 total scores after adjusting for demographic factors and other confounders. Control variables were in the first block, and included sex, race, SES, age, education, literacy, and perceived stress; the second block contained the three coping subscales. Blocks in sequential regression refer to predictors that are entered simultaneously. Entering predictors in blocks allows for testing whether the addition of multiple predictors simultaneously improves the model significantly. Perceived stress was also included as an independent variable. Stress was tested as a moderator of the associations between coping factors and snacking or diet quality, but was not significant.

It should be noted that for the regression models, all three of the two-way and three-way interactions for sex, race, and SES were tested and found to be not significant. Therefore, the models reported here do not include any interaction terms. Separate regression analyses were performed that adjusted the models for body mass index, but it was not significant; therefore, those results are not presented.

Model assumptions for the statistical procedures reported, including normality, linearity, multicollinearity, and homoscedasticity/heterogeneity of variance were tested and satisfied. One outlier was found after visual inspection of the residuals and distance measures for the regression models examining snacking and HEI-2010, the outlier was subsequently removed from all analyses. Statistical significance was established at $P<0.05$. All statistical analyses were performed with SAS statistical software.[30]

RESULTS

Sample Characteristics by Race and Sex

Demographic variables, including age, education level, literacy scores, poverty status, employment status, body fat percentage, energy consumed, perceived stress, and coping, were compared among races and sexes (Table 1). Mean age of the study participants was approximately 48 years, with no differences in mean age across race-sex groups. Literary scores for white participants were significantly higher than those for African-American participants, and indicated an average high school reading level compared with a 6th- to 8th-grade reading level for African-American participants. For both men and women, there was a significant SES×race relationship. Compared to white participants, more African-Americans subjects had incomes <125% Federal Poverty Guidelines (15% vs 29%; $P<0.001$). There was also a significant relationship between employment and race, but only for men. More African-American men were unemployed in the past month compared to white men (51% vs 49%; $P<0.01$). Compared to white men, African-American men had significantly less percent body fat as determined by dual-energy x-ray absorptiometry. There were no significant differences in perceived stress by sex or race. Mean Brief COPE scores were higher among African-American men than among white men, while there were no significant differences in Brief COPE scores for women by race.

Sample Characteristics by Snacking Status

Across race−sex groups, participants who consumed snacks completed approximately 1 additional year of education compared to those who reported consuming no snacks ($P<0.05$). Mean WRAT-3 score for literacy among men in both racial groups was significantly higher for people who snacked—39.6 for African Americans and 43.7 for whites—than nonsnackers—36.0 for African Americans and 38.9 for whites ($P<0.001$). This effect was not seen in women. There were no significant differences in percent body fat determined by dual-energy x-ray absorptiometry or perceived stress by snacking status for either race within sex group (Table 1). There were no significant differences in Brief COPE scores for women by snacking status. However, among men, Brief COPE scores were significantly higher for individuals who snacked—38.9 for African Americans and 35.6 for whites—compared to those who did not report snacking—36.2 for African Americans and 32.1 for whites (Table 1).

Energy and Foods Contributed by Snacks

Among the HANDLS study participants, 84% reported consuming snacks during the 2 dietary recall days. Snacks

Table 1. Comparison of selected characteristics of Healthy Aging in Neighborhoods of Diversity Across the Life Span study participants who snack and who do not snack within each sex and race category

	Men				Women			
	African American		White		African American		White	
Characteristic	Snacker (n=442)	Nonsnacker (n=111)	Snacker (n=339)	Nonsnacker (n=53)	Snacker (n=576)	Nonsnacker (n=131)	Snacker (n=473)	Nonsnacker (n=52)
	mean±standard error of mean							
Age, y	47.5±0.4	48.7±0.9	48.1±0.5	47.8±1.3	47.8±0.4	48.1±0.8	47.8±0.4	46.5±1.3
Education, y	12.1±0.2	11.8±0.3*	12.4±0.2	11.3±0.4*	12.3±0.1	11.9±0.3**	12.4±0.1	11.1±0.4**
Literacy score[a]	39.6±0.5	36.0±1.0***	43.7±0.6	38.9±1.3***	39.8±0.4	39.6±0.9	43.7±0.5	42.3±1.4
	n							
<125% Federal Poverty Guidelines	166	49	80	19	258	53	149	24
≥125% Federal Poverty Guidelines	168	45	216	33	206	57	265	24
Unemployed	144	44	97	22	237	50	194	26
Employed	190	50	199	30	227	60	220	22
	mean±standard error of mean							
Body fat, %[b]	23.3±0.4	22.4±0.9	26.5±0.5	27.1±1.2	41.3±0.4	43.0±0.8	41.3±0.4	42.5±1.2
Energy, kJ	10,167±176	8,146±356***	10,309±201	7,870±510***	7,464±155	5,937±326***	7,519±172	5,561±523***
Energy, kcal	2,430±42	1,947±85***	2,464±48	1,881±122***	1,784±37	1,419±78***	1,797±41	1,329±125***
Perceived stress[c]	5.3±0.2	5.2±0.4	5.3±0.2	5.3±0.6	5.1±0.2	5.4±0.3	5.8±0.2	5.7±0.5
BRIEF Cope[d]	38.9±0.7	36.2±1.4*	35.6±0.8	32.1±2.0*	39.0±0.6	37.6±1.2	37.2±0.6	36.1±1.8

[a]Literacy measured by Wide Range Achievement Test, 3rd edition.[27]
[b]Body fat measured by dual-energy x-ray absorptiometry.
[c]Measured with 4-item Perceived Stress Scale by Cohen and colleagues.[25]
[d]Coping measured by Brief COPE Inventory.[26]
*$P \leq 0.05$.
**$P \leq 0.01$.
***$P \leq 0.001$.

contributed approximately 20% of daily energy intake. Among African Americans, 80% of men and 86% of women reported snacking. Mean±standard errors of the mean energy contributed by snacks was 1,962±75 kJ (469±18 kcal) for African-American men and 2,033±88 kJ (486±21 kcal) for African-American women. Among white study participants, snacking was reported by 82% of men, providing a mean energy of 1,502±67 kJ (359±16 kcal) and by 90% women who consumed a mean energy of 1,548±75 kJ (370±18 kcal) from snacks. There were no racial differences in energy contributed (either absolute value or percent of daily energy) from snacking. Within each race there were significant differences in total energy by snacking status with people who reported snacking consuming more energy (Table 1).

The most frequently reported foods consumed as snacks by men in the HANDLS study's participants were primarily from three food groups—grain-based desserts (16.2% of all snacks), salty snacks (13.9%), and sweetened beverages (11.5%). Among women, the food groups contributing snacks were the same, but the percentage contribution differed—salty snacks (16.4%), grain-based desserts (14.8%), and then sweetened beverages (10.7%). Potato chips were the most frequently reported salty snack. Among African-American men, chips contributed 67% of all salty snacks compared to 47% for African-American women, 35% for white men, and 26% for white women. Other top salty snacks included crackers, popcorn, and pretzels. Top snacks in the grain-based dessert group in descending order were cookies, cake, pastry, and doughnuts. Cookies contributed 40% to 45% of the snacks from the dessert group. For both racial groups and sexes, soft drinks were the top sweetened beverage reported as a snack. A complete list of the snacks by food groups by race is published elsewhere.[21]

Snacking and Coping

As shown in Table 2, after adjusting for age, sex, race, SES, education, literacy, and perceived stress, the use of emotion-focused coping was positively associated (P=0.020) with more energy from snacks. For each 1-point increase in the emotion-focusing coping scale, approximately 5 kcal from snacks are consumed. Among the covariates, being male and having less education were related to having more energy from snacks.

Diet Quality and Coping

Using the same model as energy from snacks, overall diet quality, as measured by the HEI-2010 score, was tested. After adjusting for age, sex, race, SES, education, literacy, and perceived stress, the use of support-focused coping was associated with a higher HEI score (P=0.009). For each 1-point increase in the support-focused coping scale, the HEI score increases by 0.24. HEI-2010 was positively associated with age (being older) (P<0.001), education (more years) (P<0.001), SES (≥125% Federal Poverty Guidelines) (P=0.034), and negatively related to perceived stress (P=0.004) (Table 2). Overall predictability of both models were low but above the small effect, as suggested by Cohen.[31]

Table 2. Snacking[a] and Health Eating Index-2010 as predicted by Brief COPE subscales and selected sociodemographic predictors: regression models

	Energy from Snacking		Healthy Eating Index-2010	
Predictor	**β (SE[b])**	***P* value**	**β (SE)**	***P* value**
Block 1[c]				
Sex (men vs women)	**+116.31 (22.36)**	**<0.001**	−.97 (.69)	0.162
Race (AA[d] vs white)	+1.88 (23.85)	0.937	+.83 (.74)	0.258
SES[e] (<125% vs ≥125%)	+43.32 (24.12)	0.073	**+1.56 (.73)**	**0.034**
Age, y	−1.60 (1.19)	0.180	**+.15 (.04)**	**<0.001**
Education, y	**−9.15 (4.27)**	**0.033**	**+.66 (.13)**	**<0.001**
Literacy, WRAT-3[f] score	+1.94 (1.42)	0.173	+.04 (.04)	0.366
Perceived stress	−4.77 (3.77)	0.206	**−.34 (.12)**	**0.004**
Block 2[c]				
Problem-focused coping	+1.03 (2.14)	0.631	−.028 (.07)	0.672
Emotion-focused coping	**+4.97 (2.13)**	**0.020**	−.04 (.07)	0.508
Use of support	−3.01 (3.04)	0.323	**+.24 (.09)**	**0.009**
Model fit				
R^2	0.039	0.000	0.073	0.000
ΔR^2	0.005	0.101	0.005	0.057

[a]Energy (kcal) contributed by snacks.
[b]SE=standard error.
[c]Significant values and significant *P* values are shown in boldface.
[d]AA=African American.
[e]SES=socioeconomic status, defined as <125% or ≥125% 2004 federal poverty guidelines.
[f]WRAT-3=Wide Range Achievement Test, 3rd ed.[27,28]

Comparison of Diet Quality by Snacking Status

The mean±standard error of the mean for the total and component HEI-2010 scores are presented for both men and women by snacking status categorized by race in Table 3. For both African-American and white men, the total HEI-2010 score, as well as the component scores for total fruit, whole fruit, seafood and plant proteins, and sodium were significantly higher for people who snacked compared to those who did not report eating snacks (Table 3). For both African-American and white women, the total HEI-2010 score and greens and beans, and seafood and plant proteins component scores were significantly higher for individuals who reported snacking compared to those who did not report snacking. The empty calorie score for white women who snacked was greater than the white nonsnackers, and for African-American women the opposite was true.

For a number of components in men and women, the difference between snackers and nonsnackers differed depending on race (Table 3). For men, these components included total vegetables ($P<0.05$), dairy ($P<0.001$), total protein foods ($P<0.001$), fatty acids ($P<0.001$), and refined grains ($P<0.001$). African-American men had higher scores for all the components, except total vegetables and dairy components. For women, the dairy ($P<0.01$), total protein foods ($P<0.01$), and fatty acids ($P<0.001$) components were significantly different between African Americans and whites. African-American women had higher scores for the total protein and fatty acids components, and white women had higher scores for dairy component.

DISCUSSION

To our knowledge, this is the first study to report that emotion-focused coping strategies to manage stress were associated with higher energy from snacks in a socioeconomically diverse African-American and white US urban adult population. From the findings, it appears that problem-focused coping strategies, such as taking control and information seeking, were not associated with snacking. This result differed from the research conducted with Japanese 4th- to 9th-graders. Shimai and colleagues[32] reported that problem-focused coping was positively correlated with a preference for healthful snacks in this population, which may have implications as people age into adulthood.

In the nutrition-scientific literature, few studies have investigated the relationship between coping strategies to manage stress and eating behaviors. Verhoeven and colleagues[33] explored reasons for unhealthful snacking in 1,544 adults in a community setting. Snacking to cope with negative emotions was found to be higher among women than men. These investigators recommended that future health interventions focus more attention on coping strategies to diminish unhealthful snacking.

HANDLS study participants who reported using strategies involving support had HEI-2010 scores. This finding supports an association between the use of support coping strategy with diet quality. Although no publications were found that examined coping strategy with diet quality, there are reports of psycho-emotional overload that triggers a cascade of weight-changing effects, including maladaptive coping strategies, such as eating to suppress negative emotions, chronic stress, appetite up-regulation, and low-grade inflammation.[34-36] These publications suggest a need to communicate strategies to cope with stress in constructive manners.

Smith and Goodfellow[26] examined the relationship of quality of life and coping strategies of adults with celiac disease to adhere to a gluten-free diet. Dietary management for individuals with celiac disease can be challenging and, as Smith and Goodfellow[26] found, individuals who used emotion-focused coping, a negative coping strategy, had difficulty making the necessary changes in their lifestyle to cope with this disease. Although the HANDLS study participants are not attempting to adhere to a gluten-free diet, their eating patterns are in need of improvement to achieve compliance with the 2010 Dietary Guidelines for Americans.[17] The challenges of acquiring and consuming a healthful diet by this urban population can lead to stress. Knowledge of their coping strategies to manage stress can be important when attempting to change eating behaviors.

Similar to other research, snacking was associated with better diet quality compared to the diet quality of those consuming no snacks.[37,38] For instance, both men and women examined in the baseline HANDLS study who reported consuming snacks had a significantly higher score for the seafood and plant protein component of the HEI-2010 than adults who did not snack. Furthermore, men who snacked had a higher whole fruit component score compared to men who did not report eating snacks. The overall HEI-2010 scores for the HANDLS study participants were lower than the total score reported for adults examined in What We Eat in America (WWEIA)/National Health and Nutrition Examination Survey (NHANES), 2009 to 2010.[39] This difference can be attributed to the differences in income of the populations; maximal household incomes of WWEIA/NHANES respondents exceeded those of the HANDLS study participants.

In our study, snacks provided from 19% to 20% of total energy intake, a value less than the mean of 25% (adults non-Hispanic white) to 26% (adults non-Hispanic blacks) reported for the US population examined in the WWEIA/NHANES, 2007 to 2010.[39] Although the dietary collection methods used in WWEIA/NHANES and HANDLS were identical, snacks were defined differently. In WWEIA/NHANES, snacks were defined by three eating occasions—snacks, drink, and extended consumption—while in this study, snacks were defined by one eating occasion—"snack." Other researchers have defined snacks by the quality and composition of foods or time when food was eaten.[40,41] The heterogeneity in the scientific literature categorizing snacks makes it difficult to compare results, suggesting more standardization would be useful in defining eating occasions.

This study has several strengths. First, it focused on a unique, understudied, relatively large African-American and white urban population who are vulnerable to unhealthy eating practices and at higher risk for health disparities. Second, the HEI-2010 scores were based on dietary data collected from two 24-hour recalls that represent typical intakes for normal and overweight individuals.[18,42]

As with any research, there were limitations. First, even though two dietary recall interviews were administered, there is still potential for biased data due to underreporting. In addition, results describe an urban population that resided in Baltimore, MD. Even though the findings cannot be generalized to a national population, independent demographic

Table 3. Comparison of component and total Healthy Eating Index-2010 scores and energy for African-American and white adults who snack and who do not snack, categorized by sex

Variable	Maximum score	African American		White		Race comparisons by snacking status,[a] *P* value
		Snackers	Nonsnackers	Snackers	Nonsnackers	
		←———— *n* ————→				
Men		442	111	339	53	—
Healthy Eating Index-2010		←———— *mean±standard error of mean* ————→				
Total fruit	5	1.55±0.09	1.24±0.19*	1.47±0.11	1.07±0.27*	—
Whole fruit	5	0.99±0.09	0.38±0.18***	1.41±0.11	0.59±0.27***	—
Total vegetable	5	2.44±0.08	2.33±0.17	2.76±0.10	2.74±0.24	<0.05
Greens and beans	5	0.97±0.09	0.76±0.18	0.61±0.10	0.49±0.25	—
Whole grain	10	1.58±0.14	1.53±0.28	1.84±0.16	1.40±0.41	—
Dairy	10	3.05±0.16	2.58±0.31	4.52±0.18	4.25±0.45	<0.001
Total protein foods	5	4.40±0.06	4.68±0.12	4.13±0.07	4.00±0.18	<0.001
Seafood and plant proteins	5	1.57±0.10	0.84±0.20***	1.72±0.12	0.69±0.29***	—
Fatty acids	10	5.35±0.17	5.74±0.33	4.37±0.19	4.33±0.48	<0.001
Refined grains	10	6.69±0.17	6.58±0.34	5.73±0.19	5.15±0.49	<0.001
Sodium	10	5.31±0.18	4.61±0.36**	5.00±0.21	4.25±0.52**	—
Empty calories	20	8.12±0.31	8.61±0.63	8.59±0.36	8.89±0.91	—
Total score	100	42.02±0.64	39.86±1.27**	42.12±0.73	37.84±1.84**	—
		←———— *n* ————→				
Women		576	131	473	52	—
Healthy Eating Index-2010		←———— *mean±standard error of mean* ————→				
Total fruit	5	1.59±0.08	1.64±0.17	1.70±0.09	0.98±0.28	—
Whole fruit	5	1.06±0.08	0.88±0.17	1.65±0.09	0.92±0.27	—
Total vegetable	5	2.72±0.07	2.84±0.15	2.86±0.08	2.53±0.25	—
Greens and beans	5	1.17±0.08	0.90±0.16**	1.04±0.09	0.45±0.26**	—
Whole grain	10	1.94±0.12	1.27±0.26	2.03±0.14	1.35±0.42	—
Dairy	10	3.16±0.14	3.18±0.29	4.20±0.15	3.98±0.46	<0.01
Total protein foods	5	4.34±0.05	4.53±0.11	4.02±0.06	4.03±0.18	<0.01
Seafood and plant proteins	5	1.64±0.09	1.11±0.19**	1.90±0.10	1.10±0.30**	—
Fatty acids	10	5.54±0.15	5.13±0.31	4.61±0.16	3.83±0.49	<0.001
Refined grains	10	6.44±0.15	6.69±0.31	6.09±0.16	6.10±0.50	—
Sodium	10	5.02±0.16	5.01±0.33	4.89±0.18	4.65±0.53	—
Empty calories	20	8.99±0.28	9.11±0.58**	8.62±0.30	6.16±0.93**	—
Total score	100	43.60±0.56	42.29±1.17**	43.6±0.62	36.09±1.87**	<0.01

[a]Race comparison by snacking status shows whether the difference between African-American snackers and nonsnackers is different than the difference between white snackers and nonsnackers.

*$P \leq 0.05$.

**$P \leq 0.01$.

***$P \leq 0.001$.

analyses found this population representative of populations from 14 US cities with similar population densities and racial distribution.[43] Finally, the association between emotion-focused coping and energy from snacks was statistically significant, but the clinical relevance of these results remains unclear. For populations who experience more stress than the HANDLS study population, the association with emotion-focused coping may result in more energy contributed by snacks. Future investigations on this topic are needed to determine clinical relevance.

CONCLUSIONS

Overall, snacking behavior and diet quality were associated with some stress-coping strategies. The study findings suggest that health professionals working with individuals who are seeking guidance to modify their eating practices should assess the person's coping strategies. Then, professionals could introduce behavioral interventions that guide their clients to the use of positive coping strategies to manage stress, which based on the results of this study, could also potentially enhance their dietary quality.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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