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Consumption of Sugar- and Fat-Modified Foods among Rural Older Adults: The Rural Nutrition and Health (RUN) Study

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Abstract

This study examines the levels of and factors associated with consumption of sugar- and fat-reduced foods in a sample of rural, ethnically diverse older adults. Data were collected from 122 older adults, including demographic and health characteristics and six 24-hour recalls over a 16 month period. About one-quarter of sweetened foods were modified, while intake of fat-modified foods ranged from 4.4–76.1%. Few differences in intake of modified foods were observed by gender, and ethnic group. Diabetes status was associated with higher use of sugar-modified foods. This study shows a high level of acceptance of sugar- and fat-modified foods among rural older adults across a variety of demographic and health characteristics.

Keywords

Nutrition; Elderly; African Americans; Native Americans; Dietary Modification; Low Socioeconomic Status; Dietary Modification

Introduction

Diet plays a significant role in risk for chronic health conditions, such as cardiovascular disease, cancer, obesity, diabetes, and hypertension (Kant et al., 2004; National Research Council, 1989; Diehr & Beresford, 2003). Nutrition guidelines developed for primary and

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secondary chronic disease risk reduction have focused on reducing calorie consumption; reducing consumption of total fat and cholesterol, saturated fats, and refined sugars; and increasing consumption of fiber and fruits and vegetables (US Department of Agriculture and US Department of Health and Human Services, 2005). Partly in response to these concerns, the US food supply has expanded dramatically in recent decades, with increased availability of foods modified in calories, fat and sugar. This includes the availability of artificial sweeteners, leaner meats, and reduced fat dairy products that are now marketed along with their full fat and sugar counterparts. However, there is limited information available on the impact that consumption of modified foods has on overall dietary intake.

Since chronic conditions such as diabetes and cardiovascular disease are increasing in the US, and are more prevalent among older adults, it is important to understand the dietary practices of older adults and their willingness to change their dietary intake in order to develop effective interventions to improve nutritional status and reduce chronic disease risk. Because older adults make food choices based on life-long exposure to foods and not just based on nutrition education or marketing, they are often perceived as reluctant to change food consumption patterns (Quandt, 2006).

Understanding the dietary practices of minority elders in rural communities is especially important as they are at increased risk for chronic disease morbidity and mortality, have limited access to food sources and nutritional education and often come from food traditions built around high fat and high sugar foods (Arcury et al., 1998; Quandt et al., 1997; Vitolins et al., 2002). The purposes of this study are three-fold: 1) to document the consumption of sugar- and fat-modified foods in a sample of rural older adults; 2) to determine the demographic and health correlates of sugar- and fat-modified food consumption; and, 3) to examine the correlation between consumption of sugar- and fat-modified foods and dietary intake. Implications of this research with regard to dietary intervention will also be discussed.

Methods

Participant Recruitment

Data for this study were collected as part of the Rural Nutrition and Health (RUN) study. The RUN studies, funded by the National Institutes on Aging, were designed to assess the nutritional self-management strategies of older adults, and to develop effective strategies to assess dietary intake among rural older adults. Study participants were recruited in two rural North Carolina counties to obtain a representative, non-random sample. Recruitment strategies included seeking referrals from senior and low-income housing personnel, senior center and meal site staff, county Social Service agencies, and interviewers who were native to the research counties. Candidates were screened over the telephone when possible, in their homes, or at a local senior health fair. Local housing personnel allowed research staff to conduct screening in several apartment complexes. All participants signed informed consent upon enrollment. The study was approved by the Wake Forest University School of Medicine Institutional Review Board.

Study Population

Participants were selected to equally represent men and women and three ethnic groups: White, African American, and Native American (see table 1). Eligibility criteria were (1) residence in a study county, (2) age 65 or older, (3) ≤ 12 years of formal education, (4) low income (defined as 150% of the poverty line or less OR Medicaid recipient), (5) community-dwelling, (6) not blind, (7) mentally able to answer interview questions without assistance, and (8) not on kidney dialysis. One hundred thirty-seven elders enrolled in the study. One

hundred twenty-two completed at least five 24-hour diet recalls and at least two food frequency questionnaires and are included in these analyses. Of the fifteen who did not complete the study, three died during the study period, five withdrew, one was admitted to a nursing home (and died there), one suffered significant cognitive decline and failed the Mini Mental State Exam (MMSE) (Cockrell & Folstein, 1988), one moved out of the study county, and four were dropped from the study by the research team because they became too ill to keep interview appointments or were unable to answer questions without assistance. Those 15 who did not complete the study were not significantly different from the 122 who did complete the study in age, education, income, receipt of Medicaid, gender or ethnicity.

Diet Assessment

Respondents were interviewed nine times in their homes over a 7-month period as part of a larger study on dietary assessment validation in this population (Quandt et al., In Press). Data collection was completed in three phases (40 participants per phase) during a 16-month period from mid-February, 2003 through early May, 2004. The first six interviews were 24-hour diet recalls and were conducted at one-month intervals. 24-hour diet recall data were entered by interviewers into a laptop computer on site, using the Nutrition Data System for Research (NDS-R) software, version 4.05_33 (Minneapolis, MN). For each 24-hour diet recall, participants were asked to recall all foods, beverages, medication, and vitamin/mineral supplements consumed the previous day beginning at midnight. Each item was entered into NDS-R as the participant described them. Food and beverage portions were recorded, as well as any condiments and seasonings added, and whether the items were prepared at home, prepackaged, or prepared at a restaurant. Personal recipes were collected when necessary, to assure the accuracy of nutrient values during analysis. Of the six diet recalls, at least one and no more than two were collected for weekend days.

Interviewers attended a two-day training session on administering the dietary data collection instruments that was conducted by the investigators. The first day was focused on administering the 24-hour recall and entering data electronically in the NDS-R system on a personal laptop. The second day was devoted to the paper administration of other data collection forms. Each interviewer was required after the training to audiotape and submit multiple practice diet interviews on persons in their community who were ineligible to participate in the study for review by one study investigator (MZ) and to receive certification to collect data. Audiotapes were compared to data collection forms to evaluate accuracy, as well as to assess interviewer style and skill. During the course of the study, 5% of diet recalls were tape-recorded and reviewed to ensure that drift did not occur in interviewer technique and that data were entered accurately. To verify the interview process and assess participant experience with the interviewer, 19% of participants were contacted by phone regarding their diet recalls.

Outcome Measures

The primary outcome measure for this study was consumption of sugar- and fat-modified foods. Classifications of modifications to foods were based on supporting information collected during the 24-hour recall interview and entered into NDS on whether the food that was consumed was sugar- or fat-modified. Groupings of these foods were developed utilizing the food grouping method recently developed by the Nutrition Coordinating Center (NCC) (University of Minnesota). Foods were sorted into categories of sugar- or fat-modified foods and regular foods. The fat-modified grouping included: lean meats (beef or pork), poultry, fish and cold cuts and sausages; reduced fat or fat free dairy products (milk, cheese, cream, butter or margarine), salad dressing, gravy, sauces or condiments. The regular fat foods included all whole and full fat versions of the above mentioned foods. For sugar-modified foods, the grouping included use of sugar substitute products (e.g., Equal™,

Sweet-n-Low™), and consumption of artificially sweetened and unsweetened beverages, including tea. The comparison regular sugar group included sugar and all sweetened beverages. Consumption of modified foods is indicated as the percentage of total foods consumed in that category. For example, percent consumption of sugar substitute products in Table 2 is calculated as the servings of sugar substitute products divided by the total servings of sugar and sugar substitute products.

Additional measures

A brief questionnaire was used to ascertain age, formal education, number of persons in the household, annual household income, occupational status, amount of time participant lived outside the county and self-rated health (Table 1). Participants were also asked if they had been diagnosed with any of the following conditions: diabetes, cardiovascular disease, hypertension (Table 3). Participant weight was measured in pounds using a portable, calibrated electronic scale. A portable stadiometer was used to measure height in centimeters at baseline. Height and weight measurements were not conducted on participants who were unable to stand unassisted. Body mass index was calculated, and participants were classified as obese if their body mass index was ≥30 kg/m^2 (Table 3).

Comparisons were made between intake of modified foods and dietary quality (Table 4). Dietary quality was assessed by calculating across the available 24-hour recalls the average consumption of: percent of calories from fat and carbohydrates; total fiber and cholesterol per 1,000 kilocalories; servings of fruits and vegetables, and Healthy Eating Index (HEI) (Vitolins, et al., In Press). The 1999–2000 version of the HEI as described by Basiotis et al. (2002) was utilized to determine the HEI scores for the average of the recalls for all components of the HEI except for the variety score (scores in a range of 0–10 provided for consuming a variety of foods in a day) (Basiotis et al., 2002). Ten items were weighted equally to compute an HEI score which was based on intake of the FGP groups of grains, vegetables, fruits, milk, meat, as well as total fat, saturated fat, cholesterol, sodium, and a measure of diet variety. The highest total score for the 10 items was 100. A diet given an HEI score of 51 or less was considered a “poor” diet, an HEI score of greater than 51 and less than or equal to 80 was considered a diet that “needs improvement,” and a score above 80 was considered a “good” diet (Basiotis et al., 2002).

Statistical Analysis

Consumption of each food group was calculated as an average across all available 24 hour recalls for each participant and was divided as average percent consumption of modified food and regular food. Descriptive statistics were calculated for the entire sample and stratified by gender (Table 1). The average percent of food group consumption from a modified food was calculated by ethnic group, gender (Table 2), and disease status (Table 3). The average percent modified food consumption was compared across ethnic groups using analysis of variance, while percent modified food intake by gender and disease status variables were compared using a two-sample t-test. To compare the nutritional intake of high versus low consumers of sugar- and fat-modified foods (Table 4), participants were divided into two groups corresponding to their average consumption of modified foods as a percentage of total food group intake by dividing the sample at the median for that food group. Because not all of the distributions were symmetric due to significant numbers of participants with average consumption of foods as zero, this sometimes resulted in unbalanced groups. However, this imbalance did not influence statistical testing. Dietary characteristics and diet quality were compared for these two groups using a two-group t-test. All analyses were performed in SAS (SAS Institute, Cary, NC, version 8.2), using a two-sided alpha level of 0.05.

Results

Table 1 presents demographic and health characteristics of the sample. The sample was nearly equally distributed among men and women and across ethnicities. A substantial proportion of the sample had indicators of low socioeconomic status: 60.7% had annual household incomes of <$10,000, and 80.4% had less than a high school education. Health status was low, with nearly half of participants rating their health as fair or poor. A majority of participants had been told by a doctor that they had high blood pressure (76.9%) or high cholesterol (51.2%), with high rates of diabetes (43.8%), heart disease (39.7%), and gastrointestinal problems (30.6%).

Table 2 shows consumption of modified sweetened and fat foods, overall and by gender and ethnic group. Twenty seven percent of all sweeteners consumed were artificial sweeteners: 25.1% of all pre-sweetened beverages, were artificially sweetened, and 30.1% of all iced tea was either artificially sweetened or unsweetened. No differences in consumption of these modified foods were observed by gender or ethnicity, with one exception: whites consumed significantly higher levels of artificially sweetened beverages (34.5%) compared to Native Americans (24.5%) and African Americans (17.0%).

The proportion of foods consumed that were modified fat foods ranged from 4.4% for salad dressings to 76.1% for gravy, sauces or condiments. Only two differences were observed across subgroups: when women consumed gravy, sauces or condiments, they were significantly more likely than men to use fat-modified product (82.2% vs. 69.9%); whites who consumed cold cuts and sausages were significantly more likely to consume those fat-modified (16.5%) compared to African Americans (5.2%) and Native Americans (3.5%).

Table 3 shows consumption of modified sweetened and fat foods according to chronic disease status. Persons with diabetes were significantly more likely to consume artificial sweeteners, artificially sweetened beverages, and artificially sweetened iced tea, and significantly more likely to use fat-modified butter or margarine, salad dressing, and gravy, sauces or condiments compared to those without diabetes. Persons with hypertension were significantly more likely to consume beverages pre-sweetened with artificial sweeteners and fat-modified butter or margarine compared to those without hypertension. Persons classified as obese were significantly less likely to use reduced-fat salad dressing compared to those who were not obese. No differences in consumption of sugar- or fat-modified foods were observed between those with and without a history of cardiovascular disease.

Table 4 presents selected nutritional indicators according to high or low consumption of sugar- and fat-modified foods. Percent of calories from fat was higher for persons consuming high levels of artificially sweetened beverages. Percent of calories from carbohydrates was lower for those who consumed high levels of artificially sweetened beverages as well as those with high levels of consumption of reduced-fat salad dressings. Intake of total fiber/1,000 kilocalories, was higher for those in the high category of consumption of artificial sweeteners, artificially sweetened beverages, iced tea, and reduced-fat milk. HEI score was highest among those in the high consumption category for fat-modified cheese.

Discussion

The U.S. food supply has changed dramatically in recent years with the addition of calorie-modified food products. This modification includes foods with sugar and fat substitutes, as well as foods in which the sugar and fat content has been reduced. Despite these changes, the prevalence of diet-related chronic diseases, such as obesity, diabetes, and hypertension, has increased dramatically, especially among ethnic minority groups (Centers for Disease

Control and Prevention, 2005). There is little information about the level of consumption of these foods in population studies, and the impact that consumption of these foods have on other parameters of nutrient intake. Examination of these issues is important in understanding dietary patterns and their influence on and utility for primary and secondary disease prevention, particularly in vulnerable populations.

In the present study, we examined the intake of sugar- and fat-modified foods in a sample of ethnically-diverse, low-income older adults in the southeastern US. We found that about one-quarter to one-third of sweeteners and beverages consumed were modified products. We also found a wide range of intake of fat-reduced foods. The majority of poultry, milk, and gravy, sauces and condiments were lean or fat-reduced, while a very small proportion of cold cuts or sausages, as well as salad dressings, were reduced fat.

This is, to our knowledge, the first attempt to specifically quantify consumption of servings of sugar- and fat-modified foods in this type of study population. Others have taken a more general approach to examination of this topic. For example, Abusabha and colleagues (2001) examined dietary fat reduction strategies among older adults in Pennsylvania; however, their analyses were limited to include only the elimination of high-fat foods, and were not specific enough to consider consumption of foods manufactured for lower fat content. Sigman-Grant and colleagues (2003) compared the diets of adults that consumed any modified-fat foods to those that did not consume these foods, showing that these foods positively impact nutrient quality. Their study, however, did not provide specific detail foods that were consumed. Patterson and colleagues (1996) examined the reduced-fat food consumption patterns of older women at their baseline screening for participation in the Women's Health Initiative. However, the instrument used to quantify the frequency of these consumption patterns was categorical (e.g., rarely/never, sometimes, usually) and did not consider the actual number of servings of these foods that were consumed.

The older adults in this study have consciously reduced their intake of sugar and fat through the use of sugar alternatives and some fat modified foods. While the substitution of one food item for another has been shown to be easier than totally eliminating a "food" from the diet, their willingness to make these types of dietary changes is encouraging. These healthy dietary modifications may be motivated by the desire to maintain their independent living style. Rural elders have been noted to express concern about becoming dependent on others for their care (Quandt & Arcury, 2001); perhaps making these dietary improvements allows them to feel in control of their health and well being. Additional investigation into the motivations behind these dietary modifications is certainly warranted.

We observed very few gender and ethnic differences in consumption of these products. The only gender differences were that women were more likely to use fat-modified gravy, sauces and condiments compared to men. This lack of variation by gender in use of these modified foods may reflect the fact that many older men in this culture are highly dependent on their spouses or female relatives for food preparation (Quandt et al., 2000). Whites were more likely to use artificially-sweetened beverages and fat-modified cold cuts and sausages compared to African Americans and Native Americans, the latter possibly reflecting differences in cultural norms across ethnic groups and/or the ability to purchase higher-priced meats due to differences in income patterns. We have observed an absence of ethnic differences in food patterns in other studies in this population (Bell et al., 2003a; Bell et al., 2003b), that may reflect shared experience across ethnic groups with regard to access to foods, particularly among low-income individuals.

We did observe some variation in intake of modified foods according to chronic disease status, particularly diabetes. Those with diabetes were significantly more likely to use

artificial sweetener, artificially sweetened beverages, and unsweetened or artificially sweetened iced tea, and more likely to use fat-modified butter or margarine, salad dressing, and gravy, sauces or condiments. This finding may reflect successful nutritional education among diabetes patients in this population. This is important given the high rates of diabetes and diabetes-related complications in this population, particularly among ethnic minorities (Centers for Disease Control and Prevention, 2005). Unfortunately, few differences were observed among those with other chronic conditions. Further research is needed to understand this relationship more fully, particularly with regard to access to nutrition education.

Some differences were observed in indicators of nutritional intake. High consumption of artificial sweetener, artificially sweetened beverages, and unsweetened or artificially sweetened iced tea and fat-modified milk was associated with increased consumption of fiber per 1,000 kilocalories. There may be some connection to use of these products with consuming an overall healthier diet including the intake of foods high in fiber, such as whole wheat bread and legumes. It is of interest that there was no association observed between consumption of sugar- and fat-modified foods and consumption of fruits and vegetables, conceivably a high source of fiber in this population. However, most of the associations, especially for sugar-modified foods, were in the same direction, so sample size may have been a limiting factor.

Limitations of this study warrant discussion. First, these data were drawn from one region of southeastern North Carolina, so there may be some concern with regard to the generalizability of these findings to other populations. Second, these findings are based on self-report of food intake and disease status, so there may be recall error or biases introduced at more than one level. It is possible that some bias may have been introduced in the collection of dietary data by some participants providing a more healthy description of their diet than what they actually consume. Finally, our sample size limits our confidence in making sub-group comparisons. Despite these limitations, there are a number of strengths of this study, including the lack of published data on the intake of calorie-modified foods, the ethnic diversity of the sample, the high number of 24-hour recalls conducted for each participant, and the opportunity to examine the use of modified foods in lower income older adults.

One strategy of nutrition education for chronic disease prevention and management is to explore opportunities to reduce intake of discretionary calories and fats. Given the availability of calorie-modified foods in the US food supply, it is important to understand how commonly these foods are being consumed, and their relationship to other indicators of health, particularly in older adults. The scientific literature supports that, along with physical activity and social support, good nutrition is an important lifestyle factor that has long-term health and quality of life implications and consequences, even at older ages (McReynolds & Rossen, 2004; Rowe & Kahn, 1998). However, when providing older adults nutrition intervention, health care professionals must be careful to monitor calorie intake. As people age they experience progressive reductions in muscle mass and strength and reduced calorie intake and weight loss have been identified as components of this process. Therefore, when counseling older adults to modify their diets, it is necessary to make certain that total calorie consumption is sufficient to maintain body weight for those elders in which there is a concern about body wasting (Evans, 2004). Also, it is of interest to note that a significant number of elders intentionally made changes in their diet from traditionally “southern foods” (e.g., sweetened tea) to healthier options.

In summary, we found that the use of sugar- and fat-modified foods is common in the diets of older adults in rural communities, and that consumption of these foods vary across

demographic and health characteristics and by underlying nutritional patterns. This study adds to the very limited information in the literature on the consumption of these foods. Further research is needed in this area to examine more specifically what factors influence healthy food choices, such as the consumption of modified foods. Such information would be useful so that nutrition interventions can be more effective in assisting those at risk to adhere to a diet that is more conducive to optimal health.

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Table 1

Demographic and health characteristics of RUN Phase 2 study participants, overall and by gender.

Characteristic	Female *n*=64	Male *n*=58	Total *n*=122
Ethnicity			
African American	23 (35.9)	18 (31.0)	41 (33.6)
Native American	21 (32.8)	23 (39.7)	44 (36.1)
White	20 (31.3)	17 (29.3)	37 (30.3)
Age, y ($\bar{x}$ ± SD)	75.5 ± 7.0	75.0 ± 6.2	75.2 ± 6.6
Formal education			
≤ 8th grade	36 (56.3)	33 (56.9)	69 (56.6)
9–11 grade	17 (26.6)	12 (20.7)	29 (23.8)
High school/GED	11 (17.2)	13 (22.4)	24 (19.7)
Persons in household (n)			
1	44 (68.8)	27 (46.6)	71 (58.2)
2	16 (25.0)	21 (36.2)	37 (30.3)
≥ 3	4 (6.3)	10 (17.2)	14 (11.5)
Household income			
< $10,000	50 (78.1)	24 (41.4)	74 (60.7)
≥ $10,000	14 (21.9)	34 (58.6)	48 (39.3)
Occupation classifications			
Agricultural worker	21 (32.9)	22 (27.9)	43 (35.3)
Construction worker	0 (0.0)	10 (17.2)	10 (8.2)
Clerical, sales	5 (7.8)	6 (10.3)	11 (9.0)
Homemaker	6 (9.4)	0 (0.0)	6 (4.9)
Machine operator	16 (25.0)	13 (22.4)	29 (23.8)
Service industry worker	16 (25.0)	7 (12.1)	23 (18.9)
Time lived in outside area (y)			
0	20 (31.3)	12 (20.7)	32 (26.2)
1–2	18 (28.1)	8 (13.8)	26 (21.3)
3–25	12 (18.8)	23 (39.7)	35 (28.7)
>25	14 (21.9)	15 (25.9)	29 (23.8)
Self-rated health[1]			
Excellent	6 (9.4)	4 (7.0)	10 (8.3)
Very Good	13 (20.3)	14 (24.6)	27 (22.3)
Good	16 (25.0)	13 (22.8)	29 (24.0)
Fair	21 (32.8)	22 (38.6)	43 (35.5)
Poor	8 (12.5)	3 (5.3)	11 (9.1)
Health conditions			
Heart disease	20 (31.3)	28 (49.1)	48 (39.7)
Obese	35 (54.6)	25 (44.6)	60 (50.9)
Gout	7 (10.9)	16 (28.1)	23 (19.0)
Diabetes	29 (45.3)	24 (42.1)	53 (43.8)

Characteristic	Female *n*=64	Male *n*=58	Total *n*=122
High blood pressure	50 (78.1)	43 (75.4)	93 (76.9)
High cholesterol	33 (51.6)	29 (50.9)	62 (51.2)
Cancer	7 (10.9)	14 (24.6)	21 (17.4)
Stomach, intestines	18 (28.1)	19 (33.3)	37 (30.6)

[1] Percents may not add to 100% due to “Don’t Know” responses

Table 2

Average percentage of servings* of sugar- and fat-modified foods among RUN Phase 2 participants, overall and by gender and ethnic group

Food	N††	Overall	Men	Women	African American	Native American	White
Sugar Modified							
Sweetener	100	27.0	32.2	21.9	27.6	24.1	29.8
Pre-sweetened Beverages	116	25.1	26.0	24.2	17.0	24.5	34.5**
Iced Tea	68	30.1	34.4	26.0	27.8	24.0	38.4
Fat Modified							
Beef or Pork	120	35.3	30.9	39.6	35.1	33.0	38.3
Poultry	109	67.4	69.2	65.7	59.0	66.9	78.0
Cold Cuts and Sausage	106	8.4	8.8	8.1	5.2	3.5	16.5**
Milk†	112	65.0	66.8	63.1	59.3	60.5	75.7
Cheese†	79	21.4	18.2	24.3	22.5	23.2	18.8
Cream†	20	19.0	29.3	0.0	0.0	30.1	22.2
Butter or Margarine†	120	20.8	18.7	22.7	23.8	21.2	16.7
Salad Dressing	100	4.4	2.5	6.2	7.4	2.9	3.5
Gravy, Sauces or Condiments	104	76.1	69.9	82.2**	69.2	79.6	78.2

*Percentages in each cell are the percentage of servings of modified sugar and fat foods relative to all foods in that category. For example, the percentage of sugar-modified sweetener is calculated as the average number of servings per day for sugar-modified sweetener divided the average number of servings of sugar **and** sweetener

†Reduced fat, low fat, or fat free

††Number of participants consuming foods in each category.

**p≤0.05 by t-test or ANOVA

Table 3

Average percentage of servings of sugar- and fat-modified foods among RUN Phase 2 study participants, according to various disease states

Food	Diabetes		Cardiovascular Disease		Hypertension		Obese	
	Yes (n=53)	No (n=68)	Yes (n =48)	No (n =73)	Yes (n=93)	No (n=28)	Yes (n =60)	No (n =58)
Sugar Modified								
Sweetener	45.2	11.5**	27.6	26.7	27.9	24.4	26.3	28.7
Pre-sweetened Beverages	40.5	13.2**	27.2	24.0	30.6	7.9**	28.2	21.9
Iced Tea	48.3	18.2**	36.0	26.7	27.5	38.0	30.6	29.6
Fat Modified								
Beef or Pork	40.6	31.7	33.5	37.0	35.9	34.5	33.1	38.6
Poultry	65.9	68.7	59.9	72.4	67.6	67.2	64.6	70.5
Cold Cuts and Sausage	7.0	9.7	8.6	8.5	8.0	10.7	7.3	8.9
Milk†	69.5	60.9	68.9	61.9	62.7	71.0	66.9	61.9
Cheese†	28.8	15.0	17.9	24.5	21.1	23.7	18.7	25.2
Cream†	14.3	21.6	31.2	9.1	15.4	25.8	25.5	11.1
Butter or Margarine†	27.3	14.5**	21.5	19.3	22.8	11.4**	18.5	24.3
Salad Dressing	9.3	0.4**	3.6	5.1	5.5	1.2	0.8	8.1**
Gravy, Sauces or Condiments	88.7	66.4**	77.9	74.8	77.7	70.7	77.8	73.0

*Percentages in each cell are the percentage of servings of modified sugar and fat foods relative to all foods in that category. For example, the percentage of sugar-modified sweetener is calculated as the average number of servings per day for sugar-modified sweetener divided the average number of servings of sugar **and** sweetener

†Reduced fat, low fat, or fat free

**p≤0.05 using a two-sample t-test

Table 4

Relationship between consumption of sugar- and fat-modified foods and indicators of nutrient intake among RUN Phase 2 study participants

	n[†]	% of Calories from Fat	% of Calories from CHOs	Total Cholesterol (mg)/1,000 Kcals	Total Fiber (g)/1,000 Kcals	Fruits and Vegetables (servings)	HEI Score (0–100)
Sugar Modified							
Sweetener							
Low	63	35.5 (0.53)	51.6 (0.72)	176.4 (10.2)	7.16 (0.23)	3.07 (0.20)	60.5 (1.24)
High	37	35.5 (0.82)	50.2 (1.07)	167.1 (10.8)	8.32 (0.46)*	3.45 (0.30)	62.0 (1.68)
Pre-sweetened Beverage							
Low	67	34.6 (0.60)	52.5 (0.77)	176.2 (10.4)	6.87 (0.27)	3.01 (0.21)	60.1 (1.31)
High	49	36.4 (0.59)*	48.8 (0.78)**	177.6 (9.2)	8.04 (0.31)**	3.29 (0.25)	61.0 (1.37)
Iced Tea							
Low	43	35.8 (0.71)	50.9 (0.86)	173.6 (10.9)	6.94 (0.24)	2.92 (0.24)	58.8 (1.50)
High	25	36.0 (0.78)	50.0 (0.95)	169.9 (10.1)	8.53 (0.62)*	3.48 (0.26)	63.3 (2.12)
Fat Modified							
Beef or Pork							
Low	60	35.8 (0.59)	50.7 (0.84)	154.8 (9.1)	7.40 (0.32)	3.19 (0.23)	60.1 (1.37)
High	60	35.2 (0.54)	50.9 (0.69)	162.2 (10.2)	7.41 (0.28)	2.97 (0.20)	60.5 (1.23)
Poultry							
Low	55	35.9 (0.55)	50.1 (0.77)	185.6 (10.4)	7.20 (0.27)	3.41 (0.26)	60.6 (1.34)
High	54	35.1 (0.65)	51.2 (0.87)	165.4 (9.5)	7.90 (0.38)	2.89 (0.19)	61.2 (1.42)
Cold Cuts and Sausage							
Low	83	35.5 (0.43)	50.6 (0.58)	186.3 (8.7)	7.39 (0.28)	2.97 (0.17)	57.6 (1.15)
High	23	37.2 (0.85)	48.9 (1.27)	178.0 (13.0)	7.14 (0.40)	3.44 (0.45)	61.0 (1.79)
Milk							
Low	56	35.1 (0.50)	51.4 (0.72)	183.6 (9.5)	7.07 (0.27)	3.12 (0.23)	60.2 (1.24)
High	56	35.5 (0.71)	50.5 (0.92)	174.4 (10.4)	7.97 (0.36)*	3.17 (0.23)	60.9 (1.51)
Cheese							
Low	57	36.4 (0.66)	50.4 (0.89)	163.4 (8.9)	7.48 (0.31)	3.01 (0.17)	59.1 (1.27)
High	22	36.0 (0.77)	49.8 (1.09)	170.0 (10.7)	7.55 (0.45)	3.83 (0.46)	64.3 (2.40)*
Cream							

	n†	% of Calories from Fat	% of Calories from CHOs	Total Cholesterol (mg)/1,000 Kcals	Total Fiber (g)/1,000 Kcals	Fruits and Vegetables (servings)	HEI Score (0–100)
Low	16	36.1 (1.10)	51.6 (1.18)	121.9 (11.3)	8.03 (0.82)	2.77 (0.34)	60.4 (2.10)
High	4	37.3 (3.54)	50.0 (2.52)	178.9 (40.9)	7.09 (1.02)	2.17 (0.39)	51.9 (3.33)
Butter or Margarine							
Low	62	35.4 (0.56)	51.3 (0.71)	168.0 (10.1)	7.37 (0.32)	2.87 (0.24)	59.0 (1.18)
High	58	35.4 (0.64)	50.6 (0.89)	182.8 (9.1)	7.65 (0.31)	3.37 (0.17)	62.3 (1.42)
Salad Dressing							
Low	91	35.6 (0.47)	51.0 (0.62)	175.0 (7.8)	7.33 (0.25)	3.17 (0.18)	60.6 (1.10)
High	9	36.5 (1.11)	48.2 (1.02)*	177.1 (14.6)	8.64 (0.89)	3.18 (0.45)	65.0 (2.68)
Gravy, Sauces or Condiments							
Low	52	36.0 (0.59)	51.0 (0.70)	168.0 (9.6)	7.19 (0.28)	3.15 (0.25)	59.6 (1.38)
High	52	35.3 (0.60)	50.5 (0.86)	184.1 (10.8)	7.55 (0.34)	3.00 (0.23)	61.2 (1.43)

† n represents the number below or above the median of intake for each food group

* p<0.05 or

** p<0.01 from two-sample t-test