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Demographic characteristics and food choices of participants in the Special Diabetes Program for American Indians Diabetes Prevention Demonstration Project

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Abstract

Objective—American Indians and Alaska Natives (AI/ANs) suffer a disproportionate burden of diabetes. Identifying food choices of AI/ANs at risk of type 2 diabetes, living in both rural and urban settings, is critical to the development of culturally relevant, evidence-based education strategies designed to reduce morbidity and mortality in this population.

Design—At baseline, 3135 AI/AN adults participating in the Special Diabetes Program for American Indians Diabetes Prevention Demonstration Project (SDPI-DP) completed a socio-demographic survey and a 27-item food frequency questionnaire (FFQ). The primary dietary behavior goal of SDPI-DP education sessions and lifestyle coaching is changes in food choices, i.e., increased fruits, vegetables and whole grains, decreased high sugar beverages, red meat, and processed foods. Subsequently, program assessment focuses on changes in food types. Foods were delineated using a ‘healthy’ and ‘unhealthy’ classification as defined by the educators advising participants. Urban and rural differences were examined using χ^2 tests and two sample t-tests. Multiple linear regressions and linear mixed models were used to assess the association between socio-demographic factors and food choice.

Results—Retired participants, those living in urban areas and with high income and education selected healthy foods most frequently. Young males, those with low income and education consumed unhealthy foods most frequently. Selection of unhealthy foods did not differ by urban and rural setting.

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Conclusions—The ubiquitous nature of unhealthy food choices makes them hard to avoid. Food choice differences by gender, age, income, and setting suggest that nutrition education should more effectively target and meets the needs of young AI/AN males.

Keywords

American Indians/Alaska Natives; diabetes prevention; food choice

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Diabetes prevention is a priority for both American Indian and Alaska Native (AI/AN) communities and the Indian Health Service (IHS). AI/ANs have the highest rates of type 2 diabetes in the world (CDC 2011; USDHHS 2000a, 2000b). Diabetes is the fourth leading cause of mortality and a consistent cause of morbidity for AI/ANs (National Center for Health Statistics 2009; USDHHS 2007). In 2002, the US Congress authorized funds and directed IHS to develop evidence-based diabetes programs and, further, to evaluate the effectiveness of these activities within AI/AN communities. IHS developed a competitive funding opportunity open to tribal and urban Indian health programs and invited applicants to implement demonstration projects designed to assess the feasibility of applying proven intervention strategies to disease prevention in Native communities. The Special Diabetes Program for AI/ANs Diabetes Prevention Demonstration Project (SDPI-DP) adapted and implemented the efficacious strategies of the National Institutes of Health Diabetes Prevention Program (DPP) to assess their feasibility in the prevention of diabetes with AI/AN populations (USDHHS 2000a).

For all populations, dietary patterns are inextricably linked to diabetes risk and prevention. Diets high in red and processed meat, fried foods, highly sugared beverages, and processed or fiber depleted wheat flour are associated with poor insulin sensitivity and glucose homeostasis, intra-abdominal fat deposition, and high body mass index (BMI), all risk factors for type 2 diabetes (Bray et al. 2008; Dhingra et al. 2007; Steinbrecher et al. 2011; Wolfram and Ismail-Beigi 2011). These low fiber and high fat sugar and protein food choices yield a delayed sense of satiation which promotes excessive intakes of energy, saturated fats, sodium, and simple carbohydrates or sugars (Gulliford and Ukomunne 2001; Psaltopoulou, Ilias, and Alevizaki 2010). In contrast, regular consumption of vegetables and whole grains reduces fasting blood glucose (FBG), improves glucose metabolism in individuals with and without diabetes, and significantly reduces the risk of type 2 diabetes (Carter et al. 2010; Psaltopoulou, Ilias, and Alevizaki 2010; Wolfram and Ismail-Beigi 2011). In the tailoring education sessions and lifestyle coaching resources available to the SDPI-DP participants, the primary dietary behavior goal of the program is change in food choices, specifically increased consumption of vegetables and whole grains and reduced intake of red and processed meat, fried foods, and highly sugared beverages.

To date, the literature describing AI/AN dietary patterns has focused on behaviors of participants from a specific tribe or region, has been dominated by information collected from women given that AI/AN men less frequently participate in health studies and projects, and rarely provides insight into the habits of AI/ANs living in urban areas. With growing numbers of urban AI/ANs (US Census Bureau 2000) and the rise of AI/AN men being diagnosed with diabetes and secondary complications (Acton et al. 2002; Hardy and Bell

2004), the SDPI-DP data provide a unique opportunity to investigate dietary patterns and associated socio-demographic variables among AI/ANs, with particular attention paid to the similarities and differences in the food behaviors of old and young, male and female participants living in urban and rural settings. Here, we investigate the pre-intervention, baseline characteristics of food choices in this unique sample.

Methods

In 2004, 36 health-care programs received funds to implement the SDPI-DP Program. These programs include 6 hospitals/clinics and 30 tribal or IHS-contracted health-care programs administered by tribes. They represent a mix of programs, serving 80 tribes in 18 states. The University of Colorado Denver was awarded the contract to serve as the Coordinating Center (CC) and worked under the guidance and leadership of the IHS Division of Diabetes Treatment and Prevention to provide technical assistance to the programs and to collect, manage, and analyze the data from each of the 36 sites.

The SPDI-DP programs were asked to: (1) recruit and gain informed consent from 48 AI/AN adults (≥18 years) each year; (2) collect participants' data from a clinical examination and a voluntary questionnaire covering demographics, food choice, physical activity patterns, alcohol and tobacco use, and a range of psychosocial characteristics, at baseline, after the intensive phase of the intervention, and annually after baseline; (3) deliver the 16-session *Lifestyle Balance* curriculum drawn from the National DPP (http://diabetes.niddk.nih.gov/dm/pubs/preventionprogram); and (4) bi-monthly send participant data to the CC collaborating in the evaluation of the effectiveness of the prevention activities in Native communities.

The protocol was approved by the Colorado Multiple Institutional Review Board (COMIRB) of the University of Colorado Denver and the National IHS IRB. When required, programs obtained approval from other entities charged with overseeing research at their site, e.g., tribal review boards and tribal councils. All participants provided written informed consent.

Participants

Participants were volunteers recruited locally by each grant program. Eligibility criteria included being AI/AN (based on eligibility to receive IHS services), at least 18 years of age, and having pre-diabetes. Pre-diabetes was diagnosed as having either impaired fasting glucose (IFG, i.e., a FBG level of 100–125 mg/dl and an oral glucose-tolerance test (OGTT) result <200 mg/dl) and/or impaired glucose tolerance (IGT, i.e., an OGTT result of 140–199 mg/dl 2 hours after a 75 g oral glucose load and a FBG level <126 mg/dl). Four exclusion criteria were applied: (1) a previous diagnosis of diabetes, (2) current pregnancy, (3) diagnosis of end-stage renal disease on renal dialysis, and (4) active alcohol or substance abuse or any other condition that would affect successful participation based on a provider's judgment. Enrollment began in January 2006 and is ongoing. In consideration of fiscal and workload issues, an abbreviated participant questionnaire was implemented in August 2009. The present study involved the 3135 participants who completed the original baseline questionnaire.

Measures

At baseline, participants underwent a medical examination during which diabetes risk was assessed using glucose response to an OGTT, BMI, and lipid levels. Participants also completed a survey of 89 questions with multiple sub-questions, to record socio-demographic characteristics and health-related knowledge, attitudes, and behaviors including food choices.

Food choice—Approximate intake of 27 different food types over the last 30 days was assessed using a self-administered food frequency questionnaire (FFQ) adapted from the Multifactor Screener (http://appliedresearch.cancer.gov/surveys/nhis/multifactor/) developed and evaluated at the National Cancer Institute (NCI; Subar et al. 2001). Validation studies of short dietary assessment instruments indicate that these screeners are useful to characterize a population's median intakes, to discriminate among individuals or groups with regard to higher versus lower intakes, to track dietary changes in individuals or groups over time, and to allow examination of interrelationships between diet and other variables (Subar et al. 2001). Given the tremendous regional and cultural diversity of these participants, development of culture- or region-specific FFQ was not feasible.

For this study, some questions were culturally modified or added through group consultation with each program. The processed meat question was expanded to include Spam™ (Hormel Foods Corporation, Austin, MN) and corned beef; corn tortillas were added to the whole grain food query; a question about fry bread (a deep fried wheat flour dough) and other fried pastries was added; piñon nuts and sunflower seeds were added to the nuts and seeds query; a culturally specific composite foods query was added to include menudo (beef stomach and red chili), guysava (roasted ground corn, beef, and chili), red meat and green chili, Indian tacos (ground beef, beans, and fry bread), dried corn soup and wild rice soup; and a general question for foods traditional to the tribe was added. As stated, the primary dietary behavior change goal of the SDPI-DP program was food choice; modification of portion size was the secondary goal. Subsequently, the intent of this FFQ was to track only food choices that might change as a result of project participation. The FFQ does not ask portion size questions and does not attempt to assess nutrient or total dietary intake.

To facilitate the identification of food choice patterns and to track future behavior change in participants, the 27 food types were categorized as ‘healthy,’ ‘not healthy,’ or ‘undetermined.’ In September 2007, a questionnaire was distributed to program staff member(s) most frequently involved in nutrition education to report whether they recommended that participants increase or decrease intake of each of the 27 food types. Educators could report that a specific recommendation could not be made for a particular food type; this option was selected if the food type was quite variable nutritionally, e.g., cereal which depends on the variety, whether high fiber, vitamin fortified, or presweetened. Food types recommended for increased consumption by >60% of the educators were categorized as ‘healthy.’ Foods discouraged by >60% educators were categorized as ‘unhealthy.’ The remaining food types were classified as ‘undetermined.’ These categories reflect the educators’ thoughts and generally guide the advice they give to participants.

Classifying food types using this system allows tracking change among participants who receive regular dietary advice from these educators.

The healthy food score was constructed by averaging the intake frequency of the six healthy foods (e.g., whole grain bread, fruit). The frequency for each type of food was reported as: (1) less than once a month, (2) 1–3 times a month, (3) about once a week, (4) 2–3 times per week, (5) about once a day, and (6) more than once a day. Internal consistency among the six healthy food items was acceptable with a Cronbach's alpha of 0.70. The unhealthy food score was the mean intake frequency of the 12 unhealthy foods (e.g., processed meats, regular soft drinks). The internal consistency among the 12 unhealthy food items was also acceptable with a Cronbach's alpha of 0.74. The undetermined food score was the mean intake frequency of the nine nutritionally variable foods (e.g., cereals, pasta). The Cronbach's alpha of the nine undetermined foods was 0.58, indicating relatively weak internal consistency, likely reflecting the variability in these items.

Socio-demographic characteristics—Participants answered questions about their age, gender, educational attainment, employment status, marital status, and annual household income.

Geographic setting—Each program was asked to self-identify as urban or rural, based on the location of its health-care facility and residence of potential participants. Although some health-care facilities are located close to urban areas, they self-identified themselves as rural sites based on the primary location of their service population. This self-classification was used in the analysis.

Data analysis

The differences in socio-demographic characteristics between participants in urban and rural grant programs were examined using χ^2 tests. The intake of each food type was compared between participants in rural and urban grant programs using two sample *t*-tests. Multiple linear regressions were used to further assess the association between socio-demographic factors and healthy and unhealthy diet scores while controlling for the other variables in the model. To account for within-site clustering, linear mixed models with a random effect at the site level were utilized for the multivariable models. All the analyses above were conducted using SAS 9.2 software (SAS Institute 2008). Results are considered to be statistically significant if the *P*-value is ≤.05.

Missing data were uncommon for most of the variables included in this analysis (≤6%) except income and marital status (20% and 16%, respectively). Still, in the multiple regression models without imputation, 34% of the observations were excluded due to missing data on one or more variables. To avoid potential bias caused by excluding incomplete cases and to maximize the power of the analysis, a multiple imputation method was used to impute missing data before the final multivariable models were fit.

The multiple imputations were performed using IVEware developed by the University of Michigan Survey Methodology Center (Raghunathan, Solenberger, and Hoewyk 2009). IVEware is based on the sequential regression methodology (Raghunathan, Solenberger, and

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Hoewyk 2001) by which a linear, logistic, polytomous logistic, Poisson, or two-part regression model was used to impute the missing value for a continuous, binary, categorical, count, or mixed variable. Five imputed data-sets were generated this way and the final linear mixed models for healthy and unhealthy diet scores were fit in each of the five data-sets. The results were combined using the SASMOD module available in IVEware to obtain the proper estimate for the standard error of each parameter of interest.

Results

Table 1 illustrates the socio-demographic characteristics of the SDPI-DP baseline sample by geographic setting. The majority of the 3135 participants included in this analysis live in rural areas (77.5%), are ≥40 years of age (70.3%), are female (74.3%), have completed some college or are college graduates (63.2%), are employed (71.2%), are married or living with a partner (57.9%) and have an annual household income ≥$30,000 (56.6%). The employment question was a single-choice question; participants were asked to choose the option that best described their situation. Less than 3% of the SDPI-DP participants self-identified as students; this category was combined with unemployed for analysis purposes. Rural participants tend to be younger, more often employed, more often married or living with a partner, and have a higher household income than their urban peers. The gender distribution and level of educational attainment within the rural and urban samples are comparable.

As shown in Table 2, at baseline participants reported eating five of the six healthy foods at least once per week. Participants reported eating 4 of the 12 unhealthy foods more than once a week and 7 of the 12 more than 1–3 times a month but slightly less than once a week. Of the undetermined foods, participants reported consuming five at least once a week and two less than 1–3 times a month.

In a comparison of food scores by geographic setting, urban participants reported more frequent consumption of healthy foods than did rural participants. Urban participants selected all six types of healthy foods significantly more often and their overall mean score for healthy food was significantly higher than for the rural participants.

For unhealthy food items, the summary mean score was not different between rural and urban participants. Urban participants reported eating bacon or sausage, processed meat, processed flour, and fried potatoes significantly less often than rural participants but ate red meat and regular fat salad dressing or mayonnaise significantly more often than did their rural counterparts.

The only significant difference between the urban and rural participants' selection of the undetermined foods was in the consumption of nuts and seeds and foods traditional to the tribe. Urban participants report a significantly greater intake of nuts and seeds; rural participants reported a significantly greater intake of foods traditional to the tribe. However in both groups, intake frequency of traditional foods was low, less than 1–3 times a month.

Table 3 reveals the statistical association between mean food scores and the socio-demographic variables using bivariable and multivariable analyses. Due to the mixed nature of the undetermined food scores, in terms of both face validity and Cronbach's alpha, their associations with socio-demographic variables were not included in these analyses. Examining the healthy food score using bivariable analyses, participants who were retired or married were more likely to report greater consumption of healthy foods, while those who were younger, had less formal education, lower household incomes, or rural residence were more likely than others to score low on the healthy foods. In the multivariable analysis which simultaneously included all of the socio-demographic characteristics, age and marital status were no longer significant. Participants who were retired continued to be more likely to consume healthy foods, and those with less formal education, lower household incomes, or rural residence continued to consume healthy foods less often. The association between healthy food score and gender was not significant.

The bivariable analyses for the unhealthy food score reveal that participants of younger age, male gender, lower formal educational level, or lower household income were associated with increased consumption of unhealthy foods, while being retired or being ever married or living with a significant other were associated with decreased consumption of unhealthy foods. In the multivariable analysis, marital status was no longer statistically significant, while younger age, male gender, lower education, and lower household income continued to be associated with an increase in unhealthy food choices and being retired continued to be associated with a decrease in unhealthy food choices. Urban/rural setting was not associated with the consumption of unhealthy foods.

Discussion

The SDPI-DP Program provides a national picture of the health and health behaviors of pre-diabetic AI/AN adults interested in decreasing their risk of diabetes. In comparison to the AI/AN adult population in the country today (US Census Bureau 2000), SDPI-DP participants were more likely to be female, live in rural areas, have higher income households, be ≥40 years of age, and have a higher level of education. These differences are not unusual for clinical populations, who tend to be older and include more women than the general population (Liptor et al. 2003; Walker et al. 2007). Also, with the use of self-identification to determine race and ethnicity, the US Census is known to include more urban AI/ANs than does the IHS service population definitions, which rely on tribal and federal determinations of Native status (Sandefur and Rindfuss 1996). While perhaps not fully representative of the nation's AI/ANs, this sample provides heretofore unavailable insights into the food choices of AI/AN adults at risk of diabetes and provides important direction for diabetes prevention programs.

At baseline, the SPDI-DP participants’ food choices are similar to those reported for US populations nationwide (O'Neil et al. 2010; Wang et al. 2010). In a review of a national data-set for US adults aged ≥18 years from 1988 through 2004, Wang et al. (23) found that roughly 89% of Americans failed to meet the US Department of Agriculture (USDA) Dietary Guidelines for daily consumption of vegetables (2–3 servings/day), fruits (2–3 servings/day), and whole grains (3 servings/day). The SDPI-DP participants’ less than daily selection of whole grain breads, fruits and vegetables and regular consumption of processed flour, soda/soft drinks, fried potatoes, red meat and fast food parallels the high fat, low fiber diet of the US population nationwide and yields a diet associated with insulin resistance (Fisher-Wellman and Bloomer 2009).

A comparison of rural and urban food choices illustrates that participants living in urban settings were more likely to consume healthy foods than were their rural counterparts. Differences may be related to access, familiarity, and preference. Rural, low-income residents' limited access to healthy foods has been documented throughout North America (Gittelsohn and Sharma 2009; Larson, Story, and Nelson 2009; Savoca et al. 2009; Sharkey, Johnson, and Dean 2010). Gittelsohn and Sharma (2009) and Dillinger et al. (1999) documented the food environments in rural American Indian reservation communities as dependent on small convenience type stores and gas stations that sell canned and packaged food and fast food, and as having moderate availability of fresh produce.

Since SDPI-DP participants in rural areas more often lived in higher income households than their urban counterparts, healthy food options, if more readily available, might have been affordable. Availability may not be the only barrier; familiarity and preference play key roles in food selection. Working in rural reservation communities, both Gittelsohn et al. (2006) and Dillinger et al. (1999) reported that sugar and fat content did not influence decisions around food choice.

Urban and rural participants are comparable in their consumption of unhealthy foods. This similarity may indicate the pervasiveness and convenience of unhealthy foods in all environments, which makes these foods ubiquitous and harder to avoid for everyone.

Differences in rural and urban participants' consumption of undetermined foods may also be influenced by access. In rural areas, consumption of nuts and seeds, specifically piñon nuts and sunflower seeds, tends to be seasonal, linked to local harvests and sales (Teufel 1999). In contrast, urban participants may be purchasing these items in grocery stores with a consistent annual supply of these seasonal items. Rural participants' greater intake of foods traditional to the tribe may be linked to their greater access to wild foods and foods made for ceremonies.

A review of the association between food choice and other socio-demographic characteristics reveals household income, education, male gender, and age were independently associated with an unhealthy food score. These associations are observed in non-AI/AN populations nationwide and again suggest that AI/AN's unhealthy food choices parallel the patterns of the nation (Thompson et al. 2009). In national and regional studies of non-AI/AN populations, those reporting low household income and low education attainment (<12 years of education) are particularly vulnerable to make unhealthy food choices (McCabe-Sellers et al. 2007; Kant and Graubard 2007). Young, low-income households report having less control over their families' food choices, less support for attempts to eat healthily, fewer opportunities to observe and learn good food-related practices, more perceived environmental constraints and more ambiguous beliefs about the consequences of eating a nutritious diet (Lawrence et al. 2009; Hampson et al. 2009).

The limitations of this study are related to sample inclusion, data collection instrument, and potential impact of missing data. Project participation was voluntary and included only those identified as pre-diabetic, thus, the sample represents those most interested in health behavior change as a means to prevent diabetes. The food choice questionnaire was adapted from NCI's Multifactor Screener, a tool intended to provide estimates of usual intake. The actual instrument was reviewed by health professionals at each of the 36 sites for comprehension and relevance but not validated using another method of dietary data collection. The results were used only to assess food choice and not nutrient intake.

Furthermore, 34% of the observations were missing the diet score or one of the seven independent variables included in the final multivariable model, mostly due to missing data on income and/or marital status. A multiple imputation approach was used to maximize the validity and power of analysis. A basic assumption of multiple imputation is that data are missing at random (Rubin and Peyrot 2001), an assumption hard to fully evaluate with observed data only. However, comparing the baseline characteristics between those with and without reported income or marital status showed that the indicators of missingness were not associated with either diet scores, suggesting the missing data mechanism is likely to be missing at random.

Conclusions

The prevention and delay of diabetes in AI/AN communities would reduce incalculable suffering, decrease health-care costs for IHS, a grossly underfunded medical system, but most importantly enhance quality and length of life. Within the SDPI-DP program, the responses of the participants at baseline offer a nation-wide picture of the food selection patterns of AI/AN adults at risk of diabetes. Similar to patterns noted for all US populations, AI/ANs with pre-diabetes in both urban and rural settings failed to meet the USDA Dietary Guidelines for vegetables, fruits, and whole grains. Teaching the health benefits of increased consumption of whole foods, including wild foods when available and improving access to these foods particularly in rural areas would contribute to establishing lifetime healthy food habits conducive to normoglycemia and ultimately a decrease in diabetes onset.

Analysis of the association between socio-demographic variables and project generated healthy and unhealthy food scores reveals that retired AI/AN participants living in urban settings and those with higher income household most frequently consume healthy foods. Conversely, young males (18 to <39 years) and those living in low-income households reported consuming unhealthy foods most frequently. These food choice patterns defined by socio-demographic characteristics suggest that nutrition education efforts designed to prevent or delay diabetes should consider the informational needs of young AI/AN men particularly those living in rural or low-income households. The literature offers no report of an AI/AN health promotion campaign or educational program targeting this sector of the population specifically and AI/AN men's participation in community-based health events is notably low (Teufel-Shone et al. 2009). Furthermore, young AI/AN men least frequently seek medical advice and care (USDHHS 2000a).

Despite more than a decade of federally funded tribe- and urban-based diabetes prevention programs, these data suggest that even more vigorous intervention efforts to promote healthy eating and prevent diabetes may be in order. The differences observed in the associations between age, income, and geographic setting provide guidance to future directions for interventions and suggest the programs that target specific sectors of the population might prove beneficial.

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Key messages

(1) Retired AI/AN participants living in urban areas with high income and education selected healthy foods most frequently.

(2) Young AI/AN males reporting low income and education consumed unhealthy foods most frequently.

(3) Selection of unhealthy foods by AI/AN participants was not different by urban and rural setting suggesting that the ubiquitous presence of unhealthy food choices in all environments makes them hard to avoid.

(4) The food choice differences by gender, age, income, and setting suggest that nutrition education efforts should design strategies to reach young AI/AN males.

Table 1

Participants' socio-demographic characteristics by geographic setting.

	Total (*N* = 3135) *n* (%)	**Rural (*N* = 2430) *n* (%)**	**Urban (*N* = 705) *n* (%)**	***P*** [a]
Age (*y*)				.030
18 to <40	930 (29.7)	751 (30.9)	179 (25.4)	
40 to <50	911 (29.1)	700 (28.8)	211 (29.9)	
50 to <60	795 (25.4)	596 (24.5)	199 (28.2)	
≥60	499 (15.9)	383 (15.8)	116 (16.5)	
Gender				.329
Female	2330 (74.3)	1816 (74.7)	514 (72.9)	
Male	805 (25.7)	614 (25.3)	191 (27.1)	
Education status				.139
<High school	449 (15.2)	327 (14.4)	122 (17.9)	
High school graduate	641 (21.7)	501 (22.0)	140 (20.5)	
Some college	1330 (45.0)	1025 (45.1)	305 (44.7)	
≥College graduate	538 (18.2)	422 (18.5)	116 (17.0)	
Employment status				<.001
Employed	2091 (71.2)	1732 (76.6)	359 (53.0)	
Retired	205 (7.0)	148 (6.5)	57 (8.4)	
Unemployed/student	642 (21.9)	381 (16.9)	261 (38.6)	
Marital status				<.001
Married or live together	1532 (57.9)	1251 (61.2)	281 (46.6)	
Separated, divorced, or widowed	666 (25.2)	474 (23.2)	192 (31.8)	
Never married	450 (17.0)	320 (15.6)	130 (21.6)	
Annual household income				<.001
<15 k	539 (21.4)	355 (18.5)	184 (30.8)	
15 to <30 k	551 (21.9)	431 (22.5)	120 (20.1)	
30 to <50 k	721 (28.6)	566 (29.5)	155 (25.9)	
≥50k	706 (28.0)	567 (29.5)	139 (3.2)	

[a] *P*-values for χ^2 tests comparing rural and urban participants in their proportion of each category for each variable.

Table 2

Participants' reported frequency of specific food items at baseline.

Category	Food	Total (*n* = 3135) Mean (SD)	Rural (*n* = 2430) Frequency[a] Mean (SD)	Urban (*n* = 705) Mean (SD)	*P*[b]
Healthy foods	Whole grain bread	3.74 (1.55)	3.68 (1.56)	3.94 (1.47)	<.001
	Fruit	3.74 (1.38)	3.70 (1.37)	3.89 (1.38)	.001
	Green leafy salad	3.26 (1.30)	3.24 (1.29)	3.36 (1.33)	.025
	Cooked dried beans	2.23 (1.06)	2.19 (1.04)	2.38 (1.13)	<.001
	Fish, chicken, game	3.45 (1.13)	3.41 (1.14)	3.62 (1.05)	<.001
	Vegetables	3.98 (1.26)	3.95 (1.27)	4.07 (1.23)	.025
	Mean score	3.40 (0.82)	3.36 (0.81)	3.55 (0.82)	<.001
Unhealthy foods	Bacon or sausage	2.53 (1.13)	2.57 (1.12)	2.40 (1.13)	<.001
	Processed meat	2.77 (1.26)	2.79 (1.24)	2.69 (1.33)	.048
	Bread from processed flour	3.23 (1.52)	3.28 (1.51)	3.07 (1.55)	.002
	Fry bread or other fried pastries	1.83 (1.03)	1.85 (1.03)	1.78 (1.02)	.120
	Baked goods	2.57 (1.24)	2.55 (1.23)	2.62 (1.27)	.251
	Regular soft drinks/pop/soda	3.13 (1.87)	3.16 (1.86)	3.03 (1.87)	.133
	100% fruit juice	2.86 (1.52)	2.85 (1.51)	2.91 (1.53)	.350
	Add sugar/creamer to coffee or tea	3.51 (2.05)	3.48 (2.05)	3.61 (2.05)	.137
	Regular fat salad dressing or mayonnaise	2.94 (1.35)	2.92 (1.33)	3.04 (1.42)	.030
	French fries or fried potatoes	2.94 (1.16)	2.97 (1.15)	2.86 (1.21)	.038
	Red meat	3.43 (1.33)	3.40 (1.34)	3.55 (1.32)	.010
	Fast food	2.97 (1.22)	2.98 (1.21)	2.93 (1.25)	.404
	Mean score	2.89 (0.73)	2.89 (0.73)	2.87 (0.74)	.402
Undetermined items	Cereals	3.11 (1.44)	3.08 (1.44)	3.20 (1.44)	.064
	Regular coffee and/or tea	4.35 (1.82)	4.35 (1.81)	4.34 (1.85)	.926
	Other white potatoes	2.90 (1.11)	2.90 (1.10)	2.89 (1.15)	.748
	Pasta	3.26 (1.09)	3.24 (1.08)	3.30 (1.09)	.226
	Nuts or seeds	2.57 (1.36)	2.54 (1.34)	2.69 (1.42)	.009
	Snacks	3.25 (1.33)	3.24 (1.33)	3.30 (1.35)	.291
	Soups or stews	1.82 (1.02)	1.83 (1.01)	1.79 (1.08)	.467
	Milk	3.50 (1.60)	3.50 (1.59)	3.48 (1.62)	.685
	Foods traditional to tribe	1.90 (1.20)	1.95 (1.22)	1.72 (1.13)	<.001
	Mean score	2.97 (0.66)	2.96 (0.65)	2.98 (0.67)	.652

[a]The frequency for each type of food was reported as: 1, less than once a month; 2, 1–3 times a month; 3, about once a week; 4, 2–3 times per week; 5, about once a day; and 6, more than once a day.

[b]*P*-values for two sample *t*-tests comparing the food frequencies between urban and rural participants.

Table 3

Association of food choice and socio-demographic characteristics at baseline.

	Healthy food score				Unhealthy food score			
	Bivariable regression		Multivariable regression		Bivariable regression		Multivariable regression	
	β	*P*	*β*	*P*	*β*	*P*	*β*	*P*
Baseline age group (*y*)								
18 to <40	−.201	<.001	−.049	.380	.519	<.001	.367	<.001
40 to <50	−.145	.002	−.029	.581	.370	<.001	.251	<.001
50 to <60	−.081	.085	.008	.878	.221	<.001	.132	.005
≥60	0		0		0		0	
Gender								
Female	.031	.351	.044	.187	−.234	<.001	−.252	<.001
Male	0		0		0		0	
Education status								
<High school	−.239	<.001	−.234	.001	.196	<.001	.117	.040
High school graduate	−.244	<.001	−.233	<.001	.126	.003	.078	.107
Some college	−.174	<.001	−.141	.001	.082	.028	.037	.366
≥College graduate	0		0		0		0	
Employment status								
Employed	−.058	.118	−.079	.070	−.034	.293	.032	.380
Retired	.255	.001	.171	.042	−.499	<.001	−.212	.001
Unemployed/student	0		0		0		0	
Marital status								
Married or live together	.087	.048	.049	.262	−.191	<.001	−.068	.104
Separated, divorced, or widowed	.085	.089	.033	.495	−.294	<.001	−.076	.085
Never married	0		0		0		0	
Annual household income								
<15 k	−.167	.004	−.147	.007	.157	.002	.108	.096
15 to <30 k	−.160	.005	−.118	.033	.158	.001	.098	.036
30 to <50 k	−.190	<.001	−.127	.002	.055	.156	.026	.494
≥50 k	0		0		0		0	
Geographic setting								
Rural	−.187	<.001	−.211	.005	.026	.402	.033	.576
Urban	0		0		0		0	