

Am J Public Health. Author manuscript; available in PMC 2014 May 30.

Published in final edited form as:

Am J Public Health. 2012 July; 102(7): 1346-1352. doi:10.2105/AJPH.2011.300522.

High Food Insecurity and Its Correlates Among Families Living on a Rural American Indian Reservation

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Abstract

Objectives—We examined associations of food insecurity with family sociodemographic characteristics, parents' and children's weight, children's dietary patterns, and the home food environment among American Indian families.

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Contributors

K. W. Bauer conducted the statistical analysis and wrote the article. J. H. Himes, M. Smyth, B. Holy Rock, P. J. Hannan, and M. Story were responsible for the development, implementation, and evaluation of the Bright Start intervention. All authors contributed to the conceptualization of the study and provided significant editing of the article.

Human Participant Protection

The University of Minnesota's institutional review board Human Subjects Committee and the Oglala Sioux Tribal Council and Aberdeen Indian Health Service Area institutional review boards approved all study procedures. The Oglala Sioux and Aberdeen Indian Health Service Area institutional review boards also approved this manuscript before journal submission.

Methods—Participants were a sample of kindergarten-age children and their parents or caregivers (dyad n = 432) living on the Pine Ridge Reservation in South Dakota who enrolled in the Bright Start study. Parents or caregivers completed a questionnaire on their child's dietary intake, the home food environment, and food security. We assessed food security with a standard 6-item scale.

Results—Almost 40% of families reported experiencing food insecurity. Children from food-insecure households were more likely to eat some less healthful types of foods, including items purchased at convenience stores (P = .002), and food-insecure parents reported experiencing many barriers to accessing healthful food. Food security status was not associated with differences in home food availability or children's or parents' weight status.

Conclusions—Food insecurity is prevalent among families living on the Pine Ridge Reservation. Increasing reservation access to food that is high quality, reasonably priced, and healthful should be a public health goal.

Food insecurity is defined as the state of either having limited or uncertain access to food that is nutritionally adequate, culturally acceptable, and safe or having an uncertain ability to acquire acceptable foods in socially acceptable ways. Food insecurity harms children's physical, social, and emotional health. Compared with food-secure children, children who experience food insecurity are less likely to have a diet that meets recommended guidelines for nutrition^{2–4}; are more likely to experience chronic illnesses, acute illness, ^{5,6} psychosocial problems, and psychiatric distress^{5,7–9}; and are more likely to have lower academic performance. 10 There is some evidence to suggest that food insecurity contributes to overeating and obesity, 11-13 although several studies of preschool- and grade schoolaged children have not observed associations between food insecurity and weight status. ^{2,12,14,15} The roots of food insecurity for a family often lie in economic factors such as having insufficient income, limited wealth, excessive debt, and high living expenses. However, psychosocial factors, including maternal mental and physical health status, domestic violence, parental cooking and financial skills, parental education level, and familial social networks, also play roles in food insecurity. ^{7,16} Additionally, lack of access to food in their community increases families' likelihood of being food insecure. 16 Nationwide in 2009, 21.3% of US households with children experienced food insecurity during the previous year.¹⁷

Since the middle of the twentieth century, substantial changes have occurred in the availability of and access to healthful food on American Indian reservations. ^{18,19} Although, traditionally, American Indian populations used the land they lived on for hunting and growing food, and therefore consumed a plant-based diet supplemented with fish or low-fat meat, today this is no longer the case. ²⁰ American Indians living on reservations often rely on food–commodity and nutrition assistance programs ^{21,22} and frequently purchase food from fast-food outlets and small grocery or convenience stores, which typically have limited availability of high-quality produce and low-fat foods. ¹⁹

Given the high rates of poverty²³ on American Indian reservations and poor food access on rural reservations, food insecurity and its health impacts among American Indian families living on or near reservations are of great concern.^{24,25} Using data from the 2001–2004

Current Population Survey, Gundersen²⁴ examined food insecurity among American Indians living on and those living off reservations and found that during this period 28% of American Indian households with children experienced food insecurity, compared with 16% of non–American Indian households with children. This disparity remained even after adjusting for education, income, marital status, and age, suggesting that American Indians had additional specific risk factors for food insecurity. Further, American Indians living in nonmetropolitan areas were more likely to be food insecure than were those living in metropolitan areas—although identifying those individuals specifically residing on or near reservations was not possible with this data set. Small, reservation-specific studies have examined food insecurity among selected groups of American Indians living on reservations, such as young adults, and have similarly observed that food insecurity is a prevalent and significant problem for these subpopulations.^{26–28}

Although it is clear that a sizable proportion of American Indians experience food insecurity, the correlates and consequences of food insecurity among American Indian families of young children living on or near reservations are not well understood. To address this need, we examined the prevalence and correlates of food insecurity among Lakota children and their families living on the Pine Ridge Reservation in South Dakota.

METHODS

We drew data for this study from the baseline survey of Bright Start, a group-randomized controlled school-based trial to reduce excess weight gain among Lakota children residing on or near the Pine Ridge Reservation in South Dakota. We recruited all 14 schools on the reservation (including 1 with 80% American Indian enrollment just outside the border) into the study. We distributed letters of consent to the parents or caregivers (henceforth referred to as parents) of all kindergarten students, inviting them and their child to have their height and weight measured and for the parents to complete a survey. We enrolled 2 cohorts of kindergarten students in the study and collected baseline data in fall 2005 and fall 2006, before randomizing schools to intervention and control conditions. Measurements were voluntary, and all enrolled students were eligible to participate. There were no exclusion criteria, and we allowed children who did not participate in measurements to participate in the intervention activities if parents agreed. Among the 472 kindergarten students attending all 14 schools, parental consent was obtained for 99% of the children, and 97% of children with parental consent agreed to participate in the study; therefore, 454 children (96% of the total eligible) had baseline measurements. Among these 454 children, 432 (95%) parents completed a parent survey and therefore were included in this study. On the basis of parent report and school records, 99.3% of children were of American Indian heritage, with almost all children from the Oglala Sioux Tribe (Lakota people).

Study Measures

Food security—We assessed food security with the 6-item short form of the Household Food Security Scale.²⁹ This scale has been shown to be valid when compared with the full 18-item scale included in the Current Population Survey.³⁰ The 6 items assessed families' ability to obtain food and the behaviors they engaged in to conserve food over the previous

12 months. Parents were excluded from analyses if they had missing data for any of the 6 items (n=11). We categorized parents who responded in the affirmative to fewer than 2 items as experiencing "food security," those that responded in the affirmative to 2 to 4 items as experiencing "low food security," and those that responded in the affirmative to 5 or more items as experiencing "very low food security."

Sociodemographic characteristics—Parents completed questions regarding their highest level of education attained; current marital status; total household income in the past year including wages, salaries, social security, public assistance, unemployment compensation, and child support; personal relationship with the kindergarten child enrolled in Bright Start; current work situation; and whether anyone in their household currently received food stamps (now known as the Supplemental Nutrition Assistance Program) or commodity foods (via the Food Distribution on Indian Reservations program) or were enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program.

Ti ole—Ti ole is a Lakota tradition to address hunger among families within the community. The phrase can be translated as "looking for a home." The practice involves either going to another home where there is enough food to share a meal or inviting another family who may not have enough food over for a meal. The food received is often exchanged for help around the house, such as with construction work. We asked parents a single survey item with dichotomous, yes or no, response options regarding whether in the past 12 months their family had ever gone ti ole when there was not enough food.

Children's body mass index—A team of trained, local American Indian research staff traveling to each school took anthropometric measurements. J. H. H. trained team members in anthropometric measurements using the protocols that Lohman et al. developed. We measured height to the nearest 0.1 cm using a portable stadiometer (Perspective Enterprises, Portage, MI). We measured weight using Tanita scales (model TBF-300) to the nearest 0.1 kg. Age- and gender-specific body mass index (BMI; defined as weight in kilograms divided by the square of height in meters) percentiles were calculated, and we categorized children whose BMI was < the 85th percentile as normal weight, those whose BMI was the 85th percentile and < the 95th percentile as overweight, and those whose BMI was the 95th percentile as obese. 33

Parents' BMI—The trained research staff measured parents' body weight (kg) and height (cm) using standardized measurement protocols. We categorized parents with BMI < 25 as normal weight, those with a BMI between 25 and 30 as overweight, and those with a BMI of 30 as obese. We did not obtain measured height and weight for 17% of parents in the current sample (n = 72). For these parents, we imputed BMI using the parents' self-reported height and weight collected at baseline, self-reported height and weight collected during the follow-up measurement period, or measured BMI collected during the follow-up data measurement period.

Children's dietary intake—Parents reported the frequency of their child's consumption of specific foods and beverages over the past month. Response categories included never, 1–

3 times last month, 1-2 times a week, 3-4 times a week, 5-6 times a week, once a day, and more than once a day. Types of foods included fruits, vegetables, whole or 2% milk, nonfat or 1% milk, 100% fruit juice, and other calorically dense savory foods, including pizza, fry bread, and fried chicken. We also asked parents the frequency with which their child consumed "food from a fast-food restaurant" and "hot or ready-made food from a convenience store or gas station" over the past month. This measure of dietary intake was used in the Girls' Health Enrichment Multi-site Studies (GEMS) trial. 35 For foods that are commonly consumed on a daily basis (e.g., fruit, vegetables, milk), we recoded the response options to reflect daily intake with never = 0, 1-3 times last month = 0.1, 1-2 times a week = 0.2, 3-4 times a week = 0.5, 5-6 times a week = 0.8, once a day = 1, and more than once a day = 2. For foods that are commonly consumed less than daily (e.g., pizza, fast food, hot or ready-made food from a convenience store or gas station), we recoded the response options to reflect weekly intake with never = 0, 1-3 times last month = 0.5, 1-2 times a week = 1.5, 3-4 times a week = 3.5, 5-6 times a week = 5.5, once a day = 7, and more than once a day = 9. We calculated total daily intake of sugar-sweetened beverages by summing the intake of fruit drinks, energy drinks, sports drinks, Kool-Aid, and regular soft drinks, and total intake of sweet and salty snacks by summing intake of cake, potato chips, pretzels, ice cream, donuts, and candy.

Home food availability—We assessed home food availability with a series of yes or no questions asking parents to report whether specific types of fruits, vegetables, beverages, snacks, and energy-dense foods were available in their home during the past week. This item was adapted from the measure of home food availability that Patterson et al. developed. In the GEMS trial. The measure has been shown to validly assess home food availability when compared with individuals' dietary intake, nutrition awareness, and nutrition-related stage of change. We modified foods assessed by the home food availability inventory on the basis of pilot testing of the instrument. Trained research staff, who were members of the tribe, conducted individual semistructured interviews with 36 parents or caregivers to assess factors such as the appropriateness of types of foods listed, response options, and length of time to complete the inventory.

Family food practices—Parents reported the frequency of family dinners per week and family fast-food visits per week. Response options for these questions ranged from never to 7 or more times a week. We assessed food shopping with the question, "How often do you (or someone in your household) do a major food shopping trip?" Response options ranged from more than once a week to less than once a month, and we recoded these to reflect shopping trips per week.

Barriers to healthful food in the home—We asked parents the extent to which they agreed or disagreed with 8 statements of barriers to serving healthful food to their families on a 4-point Likert scale. These items included, "I don't buy many fruits because my family doesn't like them" and "I don't buy many vegetables because they cost too much." We combined items that assessed barriers for fruits and vegetables separately.

Statistical Analysis

We used χ^2 tests to examine associations between the 3 levels of food security and sociodemographic characteristics represented categorically. To examine associations between food security status and children's daily or weekly intake of specific foods, we square-root-transformed the dietary intake variables to approximate a Gaussian distribution. We then developed hierarchical linear regression models including food security status as the independent variable and children's daily or weekly intake of foods represented continuously as the dependent variable. To account for potential clustering of behaviors among children who attended schools together, we included a school-level variable in the regression models as a random effect. We calculated adjusted daily or weekly mean intake of specific foods by level of food security and back-transformed them to obtain the geometrical mean. If the overall F-statistic was significant, we used an adjusted Tukey test to highlight sources of differences between the adjusted means. We developed similar regression models to examine associations between food security and nontransformed, continuous measures of home food availability, family food practices, and barriers to healthful food in the home.

RESULTS

Approximately 40% of parents reported that their households had experienced food insecurity within the past 12 months. About a third of these 124 families (10.5% of all families) experienced very low food security. Food insecurity was more prevalent among families with a lower total household income and those in which the parent was not currently employed for pay. We found significant differences in the percentage of families receiving food stamps (P = .002) and having gone ti ole (P < .001) by families' food security status. We did not observe significant differences in either children's or parents' weight status by food security status (Table 1).

We observed few differences in children's dietary intake by food security status. Children whose families experienced very low food security consumed hot food or ready-made food from a convenience store or gas station more than twice as often as children whose families whose families experienced food security (P = .002), and food-insecure children consumed pizza and fried chicken more often than did food-secure children (Table 2). We did not observe any differences in families' home food availability or frequency of families' fast-food visits, family meals, or food shopping trips by food security status (Table 3).

Parents' experience of barriers to having healthful food in the home differed by food security status. Food-insecure parents were most likely to agree that there was little variety of fruit and vegetables where they buy groceries (P = .003) and were more likely to report that where they buy groceries the fruit and vegetables were in poor condition (P = .03). Food-insecure parents were also more likely to report that their family does not like fruits and vegetables (P = .01) and that it is difficult to find time to cook in the evening (P = .01; Table 3).

DISCUSSION

We have extended the results of previous research by demonstrating a high prevalence of food insecurity among American Indians and identifying correlates and potential determinants and consequences of food insecurity such as convenience store use, parents' perceptions of barriers to healthful eating, and participation in ti ole. As previously observed among American Indian populations, both those living on and those living off reservations, food insecurity was common. The prevalence of food insecurity (39.9%) was nearly twice as high as that of households with children nationally.¹⁷

We observed few differences in children's dietary intake by food security status. However, children from food-insecure households consumed hot or ready-made foods from convenience stores or gas stations more often than did food-secure children. The differences observed in children's intake of pizza and fried chicken by food security status likely reflect the ready-made foods that children and families purchase from these establishments. Similar positive associations between food insecurity and intake of fried and high-fat foods, and specifically fried chicken, were seen in a study of Mexican-born children of migrant workers in California.³⁷ On the Pine Ridge Reservation, as in many rural areas, ^{38,39} convenience stores and gas stations are common and provide fast and inexpensive, although rarely nutritionally adequate, meals for families. Food-insecure families may be particularly reliant on food from convenience stores because of the inability to travel to larger grocery stores, which are farther away, or to budget and plan for less frequent shopping trips. American Indian parents may also be more likely to feed their children high-fat, calorically dense foods because of their communities' histories of food scarcity and the desire to have heavier children who can withstand illness and leaner times. ^{20,37,40,41}

Among the Lakota Indians participating in Bright Start, food-insecure families were more likely to be receiving Supplemental Nutrition Assistance Program benefits than were foodsecure families, and a higher proportion of food-insecure families received assistance through the Food Distribution Program on Indian Reservations and WIC programs, although the differences across level of food security were not statistically significant. The high enrollment in these programs of food-insecure American Indian families suggests that improvements to the quantity and quality of food offered through these programs, as well as the complementary nutrition education components, may be important mechanisms through which to improve the food security and dietary intake patterns of participating families. Specifically, a focus on helping parents reduce their children's consumption of unhealthful choices frequently available at convenience stores, as well as increasing menu planning and food budgeting skills, may be particularly beneficial. Additionally, although federal food assistance programs are making progress in the promotion of healthful foods, 42 the majority of food retailers on reservations are convenience stores that do not consistently stock fresh produce, whole grain products, or low and nonfat dairy products. To address this need, policies that encourage larger grocery stores that have the purchasing power to provide lower cost fresh foods to open on or near rural reservations and enable the proprietors of small grocery and convenience stores to stock healthful food in an economically viable manner would help Supplemental Nutrition Assistance Program and WIC participants to make the best use of the nutrition assistance services they receive.

In this study, food insecurity was consistently associated with parents' perceptions of barriers to obtaining healthful food for their families. Several of these barriers are likely a reflection of families' economic limitations; however, barriers such as family members not liking fruits and vegetables and not having time to cook in the evenings have little obvious association with food access. Although in this cross-sectional study we cannot ascertain the causal mechanisms that drive these findings, the consistency with which food-insecure parents reported barriers to obtaining healthful food suggests that the accumulation of stress or experience of depression that often accompanies food insecurity ^{9,43,44} may contribute to a pervasive feeling that feeding one's family healthfully is a very difficult or even unachievable goal. These findings suggest a need for food security programs to not only increase access to food but also work with families and communities to address the mental health concerns that may accompany a history of food insecurity and increase individuals' self-efficacy for feeding their families healthfully.

A strength of this study is that it is among the first to examine the correlates of food insecurity among a rural reservation-residing American Indian tribe, a population that experiences high rates of poverty and is at great risk for nutrition-related chronic diseases. However, this study is not without limitations. Specifically, the measures of home food availability we used in this study assessed only whether a limited number of foods were available in the home or not during the past week and did not determine the quantity or quality of such foods. Future research examining food availability among food-insecure families in greater detail would benefit from using a more comprehensive measure of home food availability, as well as assessing food availability at multiple points in time, as the quantity and quality of food in the home are likely to vary on the basis of proximity to the time when financial food support is received.^{45,46}

Factors at multiple socioecological levels affect families' experience of food insecurity, from individuals' health status and food preparation skills to governmental policies. Specifically among the Lakota people residing on the Pine Ridge Reservation, community-and family-based efforts such as shared gardens, organized transportation to high-quality supermarkets, home economics classes for adults and children that teach skills to create simple and healthful meals, and cooking and canning collectives may increase access to and knowledge about healthful food while building social networks and social capital in communities, which can buffer the harmful effect that poverty, unemployment, and discrimination have on health. As the Lakota people specifically have a cultural foundation for sharing food and ensuring that others are fed, community-driven efforts built on the ti ole tradition may be particularly successful.

Acknowledgments

The National Heart, Lung, and Blood Institute, National Institutes of Health supported this research (grant 1 R01HL078846). K.W.B was supported by a postdoctoral fellowship from the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health (grant T32DK083250).

Thanks are expressed to the school administrators, teachers, staff, and parents on the Pine Ridge Reservation for their interest in and support of the Bright Start project.

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TABLE 1

Sociodemographic Characteristics and Weight Status of Bright Start Families by Household Food Security Status: Lakota People, Pine Ridge Reservation. South Dakota. 2005–2006

Parent's educational attainment < high school Completed high school Some college or technical school Completed college or graduate school Completed college or graduate school		Food Security", %	Low Food Security', %	Very Low Food Security ^d , %	7 10 7
	23.3 (98)	58.2	28.6	13.3	
	22.6 (95)	63.2	29.5	7.4	
	35.0 (147)	55.1	29.9	15.0	
	19.1 (80)	67.5	30.0	2.5	60:
Parents' relationship status					
Single or never married 30	30.6 (128)	59.4	30.5	10.2	
Married 28	28.4 (119)	64.7	26.9	8.4	
Living in marriage-like relationship 20	20.3 (85)	65.9	25.9	8.2	
Separated, divorced, or widowed 20	20.8 (87)	49.4	35.6	14.9	.33
Total household income, \$					
< 15 000 49	49.5 (203)	51.2	32.5	16.3	
15 000–34 999	32.2 (132)	65.2	29.6	5.3	
35 000	18.3 (75)	74.7	21.3	4.0	< .001
Parent's relationship to child					
Biological or stepmother 67	67.8 (284)	63.0	27.5	9.5	
Biological or stepfather 8	8.8 (37)	67.6	24.3	8.1	
Other 23	23.4 (98)	48.0	37.8	14.3	60:
Parent's employment status					
Not currently employed for pay 48	48.1 (202)	54.0	32.7	13.4	
Employed part time	9.3 (39)	76.9	20.5	2.6	
Employed full time 42	42.6 (179)	63.1	28.0	8.9	.05
Child's weight status					
Normal weight 19	19.8 (289)	58.8	31.8	9.3	
Overweight 14	14.7 (61)	63.9	23.0	13.1	
Obese 15	15.5 (64)	62.5	23.4	14.1	.40

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Characteristic	p(N) %	Food Security b , %	Low Food Security ^c , %	% $(N)^d$ Food Security ^b , % Low Food Security ^c , % Very Low Food Security ^d , % P or χ^2	$P \text{ or } \chi^2$
Normal weight	13.8 (58)	60.3	31.0	8.6	
Overweight	24.8 (104)	56.7	33.7	9.6	
Obese	61.3 (257)	61.1	27.6	11.3	.81
Food support in household, %					
Receive food stamps	63.0 (249)	57.0	8.79	83.3	.002
Receive commodities	37.0 (127)	34.1	39.8	50.0	.31
Receive WIC	43.7 (162)	42.9	43.9	47.4	88.
Those having gone ti ole, %	8.7 (36)	1.2	13.2	38.1	< .001

Note. WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

 $^{^{\}it d}_{\it N}$ may vary within descriptive characteristics because of nonresponse.

 $^{^{}b}$ Total % (n) = 60.1 (253).

 $^{^{}C}$ Total % (n) = 29.5 (124).

dTotal % (n) = 10.5 (44).

TABLE 2

Parent-Reported Children's Mean Weekly Dietary Intake by Food Security Status: Lakota People, Pine Ridge Reservation, South Dakota, 2005–2006

Food Item	Food Security	Low Food Security	Very Low Food Security	$P_{\mathrm{df}=2}$
Fruit, times/d	0.77	0.70	0.56	.08
Vegetables, times/d	0.95	0.86	0.81	.41
French fries or fried potatoes, times/wk	1.72	1.94	1.99	.38
Pizza, times/wk	1.12 ^b	1.32 ^{b,c}	1.68 ^c	.03
Fried chicken, times/wk	0.78	1.03	1.16	.041
Sugar-sweetened beverages, times/d	1.13	1.02	1.31	.23
Sweet and salty snacks, times/d	1.36	1.51	1.49	.45
Skim or 1% milk, times/d	0.13	0.16	0.15	.63
Whole or 2% milk, times/d	0.84	0.80	0.61	.17
Chocolate milk, times/d	0.34	0.31	0.34	.80
Fast-food, times/wk	0.81	0.95	0.99	.41
Hot or ready-made foods from a convenience store or gas station, times/wk	0.64 ^b	0.96 ^c	1.30^{c}	.002

Note. Means and P values derived from square-root-transformed outcome variables. Means with different superscripts are statistically significantly different using Tukey-Kramer adjusted P value < .05.

^aAs the adjusted Tukey-Kramer test is more conservative than the overall F test, the post hoc comparison of means resulted in no significant differences between means.

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TABLE 3

Parent-Reported Home Food Availability, Food Practices, and Barriers to Healthful Eating by Food Security Status: Lakota People, Pine Ridge Reservation, South Dakota, 2005–2006

Variable	Range	Food Security, Mean	Low Food Security, Mean	Food Security, Mean Low Food Security, Mean Very Low Food Security, Mean	$P_{\mathrm{df}=2}$
Weekly home food availability					
Fruit	0.00-8.00	5.65	5.80	6.24	.14
Vegetables	0.00-9.00	6.49	6.29	6.23	.51
French fries or fried potatoes	0.00-1.00	0.77	0.77	0.81	.80
Sugar-sweetened beverages	0.00-5.00	2.21	2.43	2.65	90.
Salty snacks	0.00-3.00	1.42	1.52	1.46	09:
Sweet snacks	0.00-5.00	2.59	2.92	2.78	.10
Energy-dense foods (e.g., lunch meat, fried meat, ramen noodles)	1.00-9.00	5.98	6.25	6.42	.19
Family food practices					
Fast-food visits per week	0.00-5.50	0.80	0.63	0.61	60:
Family meals per week	0.00-7.50	6.20	5.95	5.92	.43
Food shopping trips per week	0.15-2.00	0.59	0.56	0.45	.13
Barriers to healthful food in the home: strongly agree = 1; strongly disagree = 4	4				
Little variety of fruit and vegetables		2.95^{a}	2.70 ^b	2.56 ^b	.003
Poor condition of fruit and vegetables		3.07^{a}	2.99 ^{a,b}	2.76 ^b	.03
Family doesn't like fruit and vegetables		3.28 ^a	3.14ª,b	3.03^{b}	.01
Fruit and vegetables cost too much		3.24^{a}	3.00^{b}	2.76 ^b	< .001
Difficult to find time to cook in the evening		3.21^{a}	2.99 ^b	2.91 ^{a,b}	.01
Not easy to buy food near where I live		2.69^{a}	2.45 ^b	2.26^{b}	.003

Note. Means with different superscripts are statistically significantly different using Tukey-Kramer adjusted P value < .05.