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# Dietary Fat Reduction Behaviors among African American, American Indian, and White Older Adults with Diabetes

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## Abstract

Dietary self-management of diabetes is often difficult for older adults to practice, particularly in rural communities. We describe patterns and correlates of dietary fat reduction among older rural adults with diabetes of any type. In-home interviews were conducted with a multiethnic random sample of 701 adults ≥65 with diabetes from two North Carolina counties. The Fat and Fiber Behavior Questionnaire was used to measure dietary behaviors. Separate multiple linear regressions assessed effects of gender, ethnicity, and diabetes education. In general, scores were more favorable for practices that involved modifying food preparation (e.g., avoiding frying) and less favorable for practices that involved changing foods consumed (e.g., substituting fruits and vegetables as desserts or snacks). American Indians and African Americans had less favorable scores than whites, and diabetes education was associated with greater fat restriction for women than men. Older men and ethnic minorities with diabetes should be targeted for dietary change education.

### Keywords

diabetes; African Americans; American Indians; gender differences; diet; self-management

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## INTRODUCTION

Dietary self-management is a core component of overall self-management of diabetes; it is associated with improved glycemic control and reduced risk of diabetes- related complications (1). Yet dietary modification may be difficult to achieve because it often requires changes in long term food consumption and food preparation habits. Such changes may be particularly difficult for older adults to make because they may lack resources necessary to adopt new dietary behaviors, such as sufficient income to afford more expensive substitute foods (2,3). In addition, food habits developed over a lifetime may result in resistance to dietary change (4). For older adults in rural communities, consuming a modified diet may be more difficult than for urban and suburban residents because of the limited grocery selection in stores, difficulties in transportation for grocery shopping, and lower availability of services such as diabetes education (5–9).

The principal dietary modifications recommended to persons with diabetes are reduction in saturated and trans dietary fats and increase in dietary fiber (1,10). The body of evidence supporting such changes for primary and secondary prevention of cardiovascular disease, a comorbidity of diabetes, is compelling (11). Constituent or added fats are consumed across all food groups, including dairy products, grains, meats, fruits and vegetables, and sweets. Saturated fats are common in meat, dairy products, and sweets. Trans fats cross all food groups in processed foods. Therefore, reduction of these fats usually requires adoption of multiple new behaviors. These behaviors include substituting low fat alternative foods, reduction in fat used as flavoring, and avoiding high fat cooking methods (12). Through substitution of low fat foods (e.g., fruit for dessert), dietary fiber can also be increased.

This study examines the dietary self-management practices among rural adults 65 years and older with diabetes. Its purpose is to: (1) describe the fat-related dietary practices among older rural adults, and present differences by sex and ethnicity; and (2) examine the association of these dietary practices with participation in an American Diabetes Association-certified diabetes education class.

## MATERIALS AND METHODS

### Study Description

The ELDER (Evaluating Long-term Diabetes Self-management among Elder Rural Adults) Study was a population-based cross-sectional survey that comprehensively assessed the self-management strategies of rural adults aged ≥ 65 years with diagnosed diabetes of any type (13–15). Participants were selected from two largely rural counties in central North Carolina with a high proportion of ethnic minorities and persons living below the poverty level. The participants provided informed consent as approved by the Institutional Review Board of Wake Forest University School of Medicine.

**Participant Recruitment and Selection—**The ELDER Study recruited a random sample of community-dwelling older adults with diabetes, stratified by sex and ethnicity (African Americans, American Indians and Euro-Americans). The sampling frame was Medicare claims records for residents in the two study counties with at least two outpatient claims for diabetes (ICD-9 250.x) in 1998–2000. The study began in 2001, with recruitment of participants conducted from May to October, 2002. An interviewer contacted each participant to confirm diabetes status and ethnicity, and assess further eligibility (English speaking, physically and mentally able to participate in survey), and willingness to participate in the study. Interviewers were trained to detect confusion or inconsistent answers indicative of dementia. If dementia was suspected, the interviewer administered the Mini Mental State Examination (MMSE)

(16). Persons scoring 17 or less (with eight or fewer years of education) or 23 or less (with nine or more years of education) were excluded from the study (17).

The final sample included 701 individuals. The overall response rate for eligible participants was 89% (701/787). A total of 691 participants were used for this analysis. Three participants who did not fit the three ethnic categories targeted for the study were excluded, and the remainder seven participants were excluded due to missing data on the FFB scale.

## Study Measures

Face-to-face interviews were conducted by local, trained interviewers. Participation in the study involved a 1.5 hour interview. Interview data were recorded on paper forms and were entered into Epi Info (Centers for Disease Control and Prevention, Atlanta, GA, version 6.0).

Personal data collected included sex, race/ethnicity, age, education, marital status, income, and duration of diabetes. Education was obtained as years of school completed, and collapsed to four ordered categories: eighth grade or less, ninth through eleventh grade, high school diploma or GED, and at least some college. Income and Medicaid status were used to create ordered categories of income, with receiving Medicaid as the lowest, followed by persons not receiving Medicaid but reporting household incomes less than $25,000, followed by those with household incomes equal to $25,000 or more.

Dietary behavior was measured using the Fat and Fiber Behavior Questionnaire (FFB), which has been found to be a reliable and sensitive indicator of fat consumption behaviors (12,18, 19). This instrument has been used in several different versions, ranging from 12 to 21 items (19,21). For this study the 12 item version was chosen because of the need to reduce participant burden due to the age of the participants. Like the longer versions, the 12-item version assesses five dimensions of low-fat dietary behaviors: (1) substituting manufactured fat-modified foods for high fat foods (e.g., low-fat dairy products); (2) modifying meats to be lower in fat (e.g., removing skin from chicken); (3) avoiding fried food (e.g., eating potatoes other than fried); (4) replacing high fat foods with fruits and vegetables (e.g., eat fruit for dessert); and (5) avoiding fat as flavoring (e.g., eating vegetables without added fat). The time period assessed was the three months prior to the interview. Each item was preceded by an introductory question (e.g., Did you eat chicken?). If answered in the affirmative, the follow-up scale item was asked (e.g., How often was it fried?). Responses to this question were recorded on a four point scale (usually/always, often, sometimes, and rarely/never). Subscale scores were calculated per Kristal et al. (19) by averaging the non-missing items in each dimension. Missing items resulted only from the introductory question not being affirmed; for example, if the response to “Did you eat chicken?” was “no”, “How often was it fried?” was missing. To calculate the summary scores, items related to fried chicken and fried potatoes were first reverse coded for consistency with the intent of the other questions—that is, to make the behavior result in lower fat consumption. Summary scores were then calculated as follows: “substitute low fat” as mean of high fat milk, high fat frozen dessert and high calories dressing item responses; “modify meats” as mean of chicken skin and removal of visible fat item responses; “avoid frying” as mean of fried chicken and fried potato item responses; “fruit and vegetables” as mean of non-fruit dessert responses; and “fat as flavoring” as mean of the buttered bread, buttered vegetables, and buttered potatoes item responses. An overall “summary score” was calculated as the mean of these five summaries. A summary score was calculated by averaging the non-missing subscale scores. For all scales, lower scores reflected lower fat intake.

Attendance at ADA-certified diabetes self-management courses was measured using responses to two questions: (1) “Have you ever been to a class or program that has taught you about diabetes or about what you need to do to take care of your diabetes?” If yes, (2) “Where did this class or program meet?” Responses to the latter question were coded affirmative for ADA class attendance if they were included on a list of thirteen ADA-certified programs in the region or if they were outside the region but could be verified as an ADA-certified program.

## STATISTICAL ANALYSIS

Demographic and health characteristics are summarized using counts and percentages, or means and standard deviations. Fat behavior questionnaire scores are summarized using percentages by item (e.g., ‘drink low fat milk?’). The five subscales and the overall summary score were then modeled as a function of potential predictor variables using separate multiple linear regressions. The first set of models included demographic covariates (sex and ethnic group); whites and males were used as reference groups. ADA class attendance, the main factor of interest, was then added to the same set of models for evaluation as an independent predictor of dietary behaviors. An interaction term between sex and ADA class attendance was added to test whether ADA class attendance had a differential effect in men and women. Finally, additional covariates (age, education, marital status, income, and duration of diabetes) were added to evaluate whether the effects of ethnicity, sex, and ADA class remained significant as in the previous models. The modeling results are expressed as estimated regression coefficients ($\beta$s) and corresponding standard errors. Hypothesis tests for nonzero coefficients were performed at the significance level $\alpha = 0.05$; P values are reported as well. SAS Statistical Software was used for all analyses (SAS Institute, Inc., Cary, NC, version 8.2)

## RESULTS

Characteristics of the ELDER Study sample are shown in Table 1. Of the 691 participants in this analysis, 31.4% were African American, 26.2% American Indian, and the remaining 42.4%, white. The mean age was 74 years, and mean duration of diabetes was 12 years. Sixty-five percent had less than a high school education. Thirty-six percent received Medicaid and another 45% reported household incomes less than $25,000 per year.

Only 12.5% were not on medication to control their diabetes. The average body mass index (29.6 $kg/m^2$) was at the borderline for obesity. The rates of diabetes-related chronic conditions were high, with 45.7% reporting heart disease, 40.5% eye disease, and 25.3% stroke. Only 16.5% had attended an ADA-recognized diabetes education class.

Table 2 shows the percentage of persons answering “usually/always” [1] and “often” [2] by sex and ethnicity for individual FFB items. For the total sample, the most favorable scores were for avoiding fried foods, while the least favorable were for substituting fruits and vegetables for high fat foods. Women scored better than men on all items except those related to the use of fat as flavoring.

Table 3 shows the results of multivariable analysis of the effects of gender, ethnicity, and ADA diabetes education class attendance on the different subscales and total score of the FFB. For substituting low fat foods, white ethnicity and being female were associated with better scores. Participating in diabetes education classes, and the interaction between gender and diabetes education class participation, were not significant in the final models.

Whites were also more likely to report modifying meats. While gender and diabetes education class participation alone were not significantly associated with modifying meat, there was a gender-diabetes education class interaction for this behavior: Diabetes education class attendance was associated with greater reports of fat-restricting behaviors for women, but not for men.

While women appeared more likely to avoid frying food in the simplest model, this effect was not statistically significant in the final model. This indicates that attending a diabetes education class accounted for the gender differences: women who had attended this class were more likely to avoid frying foods than men and than women who had not attended this class.

Substituting fruits and vegetables for high fat foods was reported by whites significantly more than by American Indians, but not African Americans, and by women more than men. Diabetes education class participation, and the interaction with gender, was not associated with fruit and vegetable substitution.

No ethnic differences were observed for reducing fat as flavoring in the simplest model. Men were more likely to report this behavior than women. Having taken a diabetes education class improved the practice of this behavior, but the effect was greater in women than in men.

The overall summary score was associated with ethnicity in the simplest model, as well as models with ADA class and ADA class×gender included as covariates. Scores were better for whites than for American Indians or African Americans. The difference between American Indians and African Americans was not statistically significant ($P = 0.12$ simple model). The independent effects of gender and diabetes education class attendance were not significant in the final models, but diabetes education predicted a better summary score for women than for men.

In analyses adding age, education, marital status, income, and duration of diabetes to the model (results not shown), the independent associations with ethnicity, gender, ADA class, and gender-diabetes education class interactions remained significant, though the p-values for ethnicity were somewhat attenuated.

## DISCUSSION

The measurement of dietary habits using the FFB has been found to be highly correlated with other dietary measures, such as percent calories from fat as calculated from dietary records (18). Its advantage over more traditional measures of dietary intake is its ease of administration and its focus on the specific types of behaviors that affect fat intake. This approach allows for a more targeted approach in behavioral interventions for reducing fat intake.

The results of these analyses indicate that persons with diabetes, all of whom should have received instructions as part of standards of care for diabetes patients to consume low levels of dietary fat, particularly saturated and trans fats (1), vary in the extent to which they perform different types of behaviors that would lead to a reduction in these dietary fats. Overall, both men and women score best on food changes that required modification in the preparation of foods, but do not change the actual foods consumed. That is, they reported the best scores on avoiding frying and worst on substituting fruits and vegetables for desserts and high fat snacks. Changes such as avoiding frying as a preparation method can be implemented without an overall change in the foods consumed. This is consistent with other work on food behavior change that indicates foods may hold core social and cultural meaning for individuals, leading to reluctance to eliminate less healthy foods from the diet (4). Alternatively, it is consistent with observations that fresh fruits and vegetables are relatively less available in rural grocery stores and are higher priced than more traditional snack and dessert foods (22–24).

The finding that men were more likely to practice healthier behaviors with fat as flavoring is inconsistent with the better performance of women on other behaviors related to changes in food preparation (e.g., avoiding frying). Further investigation is needed to ascertain whether men and women have different attitudes toward the use of fat as flavoring or whether the responses of men might be less valid because they are less involved in food preparation and may therefore be unaware of the use of fat to flavor their foods. While it is stereotypic to assume that women always have responsibility for food purchase and preparation within families, this is quite commonly the case among older adults (3,25). This suggests that women may be more knowledgeable than men with diabetes about how their food has been prepared and any modifications made to reduce the fat content. This is further enhanced by our finding that women more often benefited from participation in diabetes education classes compared to men (not adding fat as flavoring, modifying meat, avoiding frying).

Significant ethnic differences were observed in this study in that whites were often more likely than American Indians or African Americans to report performing some of the healthy eating behaviors leading to decreased fat consumption. This finding is of concern given the higher rates of diabetes complications among ethnic minorities (26–29). However, this is consistent with our other findings regarding ethnic difference in adoption of healthy eating in this population (30,31), and in performance of diabetes-related behaviors (32–34). In general, ethnic minorities in these communities have higher rates of poverty and less formal education, which may contribute to reduced participation in diabetes education programs, as well as lower rates of adopting recommendations from health care providers, despite living in the same communities and having generally similar geographic access to diabetes education.

Another finding that draws concern is the relative lack of benefit seen in adopting healthy eating behaviors through participation in diabetes education classes. A number of factors may have contributed to this finding. First, these older adults may have received their education many years ago, and may have either forgotten the recommendations they received, or received education that has since become outdated. Second, it is possible that there may have been some misclassification of participation in diabetes education classes: older adults may have misstated where they attended classes, and class sites not recognized by the investigators may have provided ADA-recognized training but been classified as non-ADA. Finally, we did not ascertain specifically how many of the class sessions the respondents participated in, leaving the possibility of equating minimal participation with full participation. Further investigation of the impact of diabetes education on adoption of healthy behaviors in this population is warranted.

This study has a number of limitations which should be considered in interpreting these findings. First, this is a cross-sectional study, so we are unable to determine the impact of these behaviors on future health outcomes. Second, it is possible that there was some misclassification of performance of healthy eating behaviors or participation in ADA education classes. We attempted to minimize the impact of the first issue by using a relatively simple instrument that captures specific behaviors rather than nutrient intake, such as a food frequency questionnaire. There are limited data on the validity and use of the FFB, particularly the 12-item version, among older adults in rural communities, particularly those of ethnic minority groups. However, this instrument was used successfully in a study of the Catawba Indian nation in rural South Carolina (35). For the second issue, we relied on our knowledge and experience in working with health care providers in these communities to minimize misclassifying programs identified by study participants.

Despite these limitations, this study has a number of strengths, including a large, ethnically diverse sample, a focus on a rural, socioeconomic and health disparate population, and the use of a standardized dietary instrument. This study provides important information for health care providers treating patients with diabetes in rural communities. Greater emphasis needs to be placed on specific eating behaviors that are necessary for appropriate diabetes management, leading to reduced fat intake and increased consumption of fruits and vegetables. Ethnic minorities appear to be particularly vulnerable to poor eating behaviors. Strategies aimed at reducing the barriers to adopting these practices, particularly in rural communities with limited access to affordable, healthy foods, are critical. Finally, diabetes education programs may need to consider the degree to which the classroom setting is an effective means of helping older adults achieve their self-management goals, or provide more avenues for older adults to more regularly participate in education programs to receive the most up-to-date information on strategies for diabetes self-management.

## TAKE AWAY POINTS

- Older adults with diabetes in rural communities are not adequately adopting healthy eating behaviors necessary for reducing the complications associated with diabetes. Less than 50% report drinking low fat milk or eating vegetables without added fat.
- Population segments at high risk for diabetes complications—men and minorities—are especially less likely to adopt health eating behaviors.
- High quality diabetes education is reaching only a fraction of those older adults with diabetes who need it.
- Further research is needed to more fully understand these disparities and develop effective interventions to reduce this burden.

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## REFERENCES

1. American Diabetes Association. Standards of medical care in diabetes—2009. Diabetes Care 2009;30:S13–S61.
2. Blumberg J. Nutritional needs of seniors. J Am Coll Nutr 1997;16:517–523. [PubMed: 9430078]
3. Quandt SA, McDonald J, Arcury TA, Bell RA, Vitolins MZ. Nutritional self-management of elderly widows in rural communities. Gerontologist 2000;40:86–96. [PubMed: 10750316]
4. Quandt SA, Vitolins MZ, DeWalt KM, Roos GM. Meal patterns of older adults in rural communities: Life course analysis and implications for undernutrition. J Appl Gerontol 1997;16:152–171.
5. Morland K, Wing S, Diez Roux A. The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. Am J Public Health 2002;92:1761–1767. [PubMed: 12406805]
6. Choi NG, Smith J. Reaching out to racial/ethnic minority older persons for elderly nutrition programs. J Nutr Elder 2004;24:89–104. [PubMed: 15339723]
7. Dettori N, Flook BN, Pessl E, Quesenberry K, Loh J, Harris C, et al. Improvements in care and reduced self-management barriers among rural patients with diabetes. J Rural Health 2005;21:172–177. [PubMed: 15859055]
8. Powell MP, Glover SH, Probst JC, Laditka SB. Barriers associated with the delivery of Medicare-reimbursed diabetes self-management education. Diabetes Educ 2005;31:890–899. [PubMed: 16288096]
9. Hendrix SJ, Fischer JG, Reddy S, Lommel TS, Speer EM, Stephens H, et al. Fruit and vegetable intake and knowledge increased following a community-based intervention in older adults in Georgia senior centers. J Nutr Elder 2008;27:155–178. [PubMed: 18928195]
10. Josse AR, Panahi S, Esfahani A, Leiter LA, Jenkins DJA, Kendall CWC. Nutritional considerations for older adults with type 2 diabetes. J Nutr Elder 2008;27:363–380. [PubMed: 19042580]
11. Parillo M, Riccardi G. Diet composition and the risk of type 2 diabetes: epidemiological and clinical evidence. Br J Nutr 2004;92:7–19. [PubMed: 15230984]
12. Shannon J, Kristal AR, Curry SJ, Beresford SA. Application of a behavioral approach to measuring dietary change: the fat- and fiber-related diet behavior questionnaire. Cancer Epidemiol Biomarkers Prev 1997;6:355–361. [PubMed: 9149896]

13. Quandt SA, Bell RA, Snively BM, Smith SL, Stafford JM, Wetmore LK, et al. Ethnic disparities in glycemic control among rural older adults with type 2 diabetes. Ethn Dis 2005;15:656–663. [PubMed: 16259490]

14. Bell RA, Smith SL, Arcury TA, Snively BM, Stafford JM, Quandt SA. Prevalence and correlates of depressive symptoms among rural older African Americans, Native Americans and whites with diabetes. Diabetes Care 2005;28:823–829. [PubMed: 15793180]

15. Bell RA, Davis CC, Tooze JA, Vitolins MZ, Smith SL, Arcury TA, et al. Consumption of sugar- and fat-modified foods among rural older adults: the Rural Nutrition and Health (RUN) Study. J Nutr Elder 2006;25:23–40. [PubMed: 18032214]

16. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189–198. [PubMed: 1202204]

17. Crum RM, Anthony JC, Bassett SS, Folstein MF. Population-based norms for the Mini-Mental State Examination by age and educational level. JAMA 1993;269:2386–2391. [PubMed: 8479064]

18. Kristal AR, Shattuck AL, Henry HJ. Patterns of dietary behavior associated with selecting diets low in fat: reliability and validity of a behavioral approach to dietary assessment. J Am Diet Assoc 199;90:214–220. [PubMed: 2303658]

19. Kristal AR, Curry SJ, Shattuck AL, Feng Z, Li S. A randomized trial of a tailored, self-help dietary intervention: The Puget Sound Eating Patterns Study. Prev Med 2000;31:380–389. [PubMed: 11006063]

20. Glasgow RF, Perry JD, Toobery DJ, Hollis JF. Brief assessments of dietary behavior in field settings. Addict Behav 1996;21:239–247. [PubMed: 8730527]

21. Neuhouser ML, Thompson B, Coronado GD, Solomon CC. Higher fat intake and lower fruit and vegetable intakes are associated with greater acculturation among Mexicans living in Washington state. J Am Diet Assoc 2004;104:51–57. [PubMed: 14702584]

22. Bustillos B, Sharkey JR, Anding J, McIntosh A. Availability of healthful foods in rural areas: A challenge to older adults. FASEB J 2007;21:837–839.

23. Rose R, Richards R. Food store access and household fruit and vegetable use among participants in the US Food Stamp program. Public Health Nutr 2004;7:1081–1088. [PubMed: 15548347]

24. Kaufman, PR.; MacDonald, JM.; Lutz, SM.; Smallwood, DM. Item Selection and Price Differences Affect Low-income Household Food Costs. Agricultural Economic Report No. 759. Economic Research Service, US Department of Agriculture: Washington, DC; 1997. Do the Poor Pay More for Food?.

25. McDonald J, Quandt SA, Arcury TA, Bell RA, Vitolins MZ. On their own: Nutritional self-management strategies of rural widowers. Gerontologist 2000;40:480–491. [PubMed: 10961037]

26. Egede LE, Dagogo-Jack S. Epidemiology of type 2 diabetes: Focus on ethnic minorities. Med Clin North Am 2005;89:949–975. [PubMed: 16129107]

27. Lanting LC, Joung IM, Mackenbach JP, Lamberts SW, Bootsma AH. Ethnic differences in mortality, end-stage complications, and quality of care among diabetic patients: a review. Diabetes Care 2005;28:2280–2288. [PubMed: 16123507]

28. Shen JJ, Washington EL. Identification of diabetic complications among minority populations. Ethn Dis 2008;18:136–140. [PubMed: 18507263]

29. Burrows NR, Li Y, Williams DE. Racial and ethnic differences in trends of end-stage renal disease: United States, 1995 to 2005. Adv Chronic Kidney Dis 2008;15:147–152. [PubMed: 18334239]

30. Vitolins MZ, Quandt SA, Case LD, Bell RA, Arcury TA, McDonald J. Ethnic and gender variation in the dietary intake of rural elders. J Nutr Elder 2000;19:15–29.

31. Bell RA, Vitolins MZ, Arcury TA, Quandt SA. Food consumption patterns of rural older African American, Native American, and European American adults in North Carolina: The Rural Nutrition (RUN) and Health Study. J Nutr Elder 2003;23:1–16. [PubMed: 14714678]

32. Skelly AH, Arcury TA, Snively BM, Bell RA, Smith SL, Wetmore LK, Quandt SA. Self-monitoring of blood glucose among rural elders with diabetes: The ELDER Study. Diabetes Educ 2005;31:84–90. [PubMed: 15779249]

33. Arcury TA, Snively BM, Bell RA, Smith SL, Stafford J, Wetmore LK, Quandt SA. Physical activity among rural older adults with diabetes. J Rural Health 2006;22:164–168. [PubMed: 16606429]

34. Bell RA, Stafford JM, Arcury TA, Quandt SA, Snively BM, Smith SL. Availability of diabetes self-management equipment among rural older adults: Gender and ethnic differences. J Rural Health 2007;23:332–338. [PubMed: 17868240]

35. Costacou T, Levin S, Mayer-Davis EJ. Dietary patterns among members of the Catawba Indian nation. J Am Diet Assoc 2000;100:833–835. [PubMed: 10916525]

**Table 1**

Demographic and Health Characteristics of ELDER Participants, Overall

| | Overall* Count (%) or Mean ± SD |
|---|---|
| Demographic variables | |
| Ethnicity | |
| African American | 217 (31.4) |
| American Indian | 181 (26.2) |
| White | 293 (42.4) |
| Female | 339 (49.1) |
| Age (yrs) | 74.1 ± 5.40 |
| Married | 347 (50.2) |
| Formal education n=690 | |
| ≤ 8th grade | 281 (40.7) |
| 9th grade -11 grade (some high school) | 168 (24.4) |
| High school diploma/GED | 143 (20.7) |
| At least some college | 98 (14.2) |
| Annual Household Income/Medicaid Status n=661 | |
| Medicaid | 236 (35.7) |
| No Medicaid, income < $25,000 | 298 (45.1) |
| No Medicaid, income ≥ $25,000 | 127 (19.2) |
| Number of persons in home | |
| One | 213 (30.8) |
| Two | 335 (48.5) |
| Three or more | 143 (20.7) |
| Health variables | |
| Diabetes duration (yrs) | 12.4 ± 10.98 |
| HbA1c (%) n=686 | 6.8 ± 1.31 |
| Body Mass Index (kg/m$^2$) n=659 | 29.6 ± 5.89 |
| Diabetes medication | |
| No medication | 86 (12.5) |
| Oral agents only | 414 (59.9) |
| Insulin with or without oral agents | 191 (27.6) |
| Number of prescription medications n=686 | 6.5 ± 4.20 |
| Self-Reported diabetes-related chronic health conditions | |
| Heart disease | 316 (45.7) |
| Stroke | 175 (25.3) |
| Thrombosis/blood clots in legs | 58 (8.4) |
| Kidney disease | 78 (11.3) |
| Eye disease | 280 (40.5) |
| Extremity amputation | 20 (2.9) |
| Neuropathy | 158 (22.9) |

| | **Overall*** |
|---|---|
| | **Count (%) or Mean ± SD** |
| Diabetes class attendance | 114 (16.5) |

*(n = 691, except where specified otherwise)

## Table 2

Percent of older adults reporting “usually/always” and “often” for each FFB item* by gender and ethnicity

| Name | Females | | | | Males | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Af-Am† | Am-Ind‡ | White | Total | Af-Am | Am-Ind | White | Total | Total |
| | N=101 | N=92 | N=146 | N=339 | N=116 | N=89 | N=147 | N=352 | N=691 |
| **Substitute Low Fat** | | | | | | | | | |
| Drink low fat milk? | 44.7 | 26.9 | 50.4 | 42.5 | 38.8 | 25.6 | 59.4 | 43.8 | 43.2 |
| Eat low fat frozen dessert? | 46.3 | 35.1 | 43.0 | 41.8 | 25.5 | 30.4 | 36.9 | 31.5 | 36.5 |
| Use low fat salad dressing? | 57.1 | 57.4 | 56.1 | 56.7 | 44.0 | 31.7 | 52.0 | 45.0 | 50.7 |
| **Modify Meats** | | | | | | | | | |
| Take skin off chicken? | 45.5 | 49.4 | 56.6 | 51.4 | 37.5 | 43.0 | 53.2 | 45.4 | 48.4 |
| Trim visible fat? | 61.2 | 61.9 | 73.3 | 66.8 | 58.2 | 55.3 | 69.3 | 62.1 | 64.3 |
| **Avoid frying** | | | | | | | | | |
| Eat chicken not fried? | 84.9 | 78.2 | 82.8 | 82.2 | 77.7 | 82.6 | 71.2 | 76.3 | 79.2 |
| Eat potatoes not fried? | 92.6 | 95.1 | 94.4 | 94.0 | 91.8 | 95.3 | 89.0 | 91.5 | 92.7 |
| **Substitute Fruit & Vegetables** | | | | | | | | | |
| Eat only fruit for dessert? | 44.9 | 38.5 | 45.9 | 43.7 | 33.3 | 26.2 | 34.6 | 32.0 | 37.6 |
| Eat raw vegetable or fruit for snack? | 36.3 | 19.7 | 38.6 | 33.3 | 31.6 | 12.9 | 32.7 | 27.3 | 30.2 |
| **Avoid Fat as Flavoring** | | | | | | | | | |
| Eat breads without added fat? | 51.6 | 44.7 | 50.7 | 49.4 | 53.9 | 60.5 | 49.3 | 53.6 | 51.6 |
| Eat vegetable without added fat? | 27.7 | 24.1 | 40.4 | 32.3 | 45.6 | 39.1 | 59.7 | 49.9 | 41.2 |
| Eat potato without added fat? | 37.9 | 42.9 | 33.1 | 37.1 | 35.2 | 43.0 | 33.3 | 36.3 | 36.7 |

* Responses based on a 4-point scale with 1=usually/always, 2=often, 3=sometimes, 4=rarely/never.

† African American

‡ American Indian

**Table 3**

Multivariable analysis of variables[*] associated with Fat Behavior subscales.

| Fat-Related Subscale | American Indian β[†] ±SE (P-value) | African American β ±SE (P-value) | Gender β ±SE (P-value) | ADA class β ±SE (P-value) | ADA Class x Gender β ±SE (P-value) |
|---|---|---|---|---|---|
| Substitute Low Fat | | | | | |
| Model 0[‡] | 0.409 | 0.221 | −0.210 | | |
| | ±0.098 | ±0.093 | ±0.079 | | |
| | (<0.0001) | (0.018) | (0.0083) | | |
| Model 1[§] | 0.391 | 0.221 | −0.201 | −0.209 | |
| | ±0.098 | ±0.093 | ±0.079 | ±0.107 | |
| | (<0.0001) | (0.018) | (0.012) | (0.052) | |
| Model 2[‖] | 0.390 | 0.220 | −0.209 | −0.236 | 0.049 |
| | ±0.098 | ±0.094 | ±0.087 | ±0.161 | ±0.215 |
| | (<0.0001) | (0.019) | (0.017) | (0.14) | (0.82) |
| Modify Meats | | | | | |
| Model 0 | 0.306 | 0.382 | −0.139 | | |
| | ±0.105 | ±0.099 | ±0.084 | | |
| | (0.0036) | (<0.0001) | (0.098) | | |
| Model 1 | 0.272 | 0.377 | −0.121 | −0.386 | |
| | ±0.104 | ±0.098 | ±0.084 | ±0.113 | |
| | (0.0093) | (<0.0001) | (0.15) | (0.0007) | |
| Model 2 | 0.277 | 0.382 | −0.042 | −0.111 | −0.488 |
| | ±0.104 | ±0.098 | ±0.091 | ±0.170 | ±0.226 |
| | (0.0078) | (0.0001) | (0.65) | (0.51) | (0.031) |
| Avoid Frying | | | | | |
| Model 0 | −0.025 | −0.029 | −0.141 | | |
| | ±0.059 | ±0.056 | ±0.048 | | |
| | (0.67) | (0.61) | (0.0032) | | |

| Fat-Related Subscale | American Indian $\beta^{\dagger}$ ±SE (P-value) | African American β ±SE (P-value) | Gender β ±SE (P-value) | ADA class β ±SE (P-value) | ADA Class x Gender β ±SE (P-value) |
|---|---|---|---|---|---|
| Model 1 | −0.037 ±0.056 (0.54) | −0.029 ±0.056 (0.61) | −0.136 ±0.048 (0.0047) | −0.133 ±0.064 (0.039) | |
| Model 2 | −0.034 ±0.059 (0.57) | −0.026 ±0.056 (0.65) | −0.085 ±0.052 (0.10) | 0.041 ±0.097 (0.67) | −0.310 ±0.129 (0.017) |
| Fruits and Vegetables | | | | | |
| Model 0 | 0.276 ±0.077 (0.0004) | −0.039 ±0.073 (0.59) | −0.133 ±0.062 (0.032) | | |
| Model 1 | 0.263 ±0.077 (0.0007) | −0.038 ±0.073 (0.60) | −0.130 ±0.062 (0.036) | −0.145 ±0.084 (0.086) | |
| Model 2 | 0.262 ±0.077 (0.0007) | −0.036 ±0.073 (0.59) | −0.148 ±0.068 (0.030) | −0.205 ±0.126 (0.11) | 0.107 ±0.169 (0.52) |
| Fat as Flavoring | | | | | |
| Model 0 | 0.036 ±0.074 (0.62) | 0.098 ±0.070 (0.16) | 0.203 ±0.060 (0.0007) | | |
| Model 1 | 0.027 ±0.074 (0.72) | 0.091 ±0.070 (0.19) | 0.212 ±0.060 (0.0004) | −0.106 ±0.081 (0.19) | |
| Model 2 | 0.032 ±0.074 (0.66) | 0.097 ±0.070 (0.16) | 0.302 ±0.065 (<0.0001) | 0.208 ±0.121 (0.086) | −0.558 ±0.161 (0.0006) |
| Summary | | | | | |

| | American Indian | African American | Gender | ADA class | ADA Class x Gender |
|---|---|---|---|---|---|
| Fat-Related Subscale | β[†] ±SE (P-value) | β ±SE (P-value) | β ±SE (P-value) | β ±SE (P-value) | β ±SE (P-value) |
| Model 0 | 0.204 | 0.125 | −0.081 | | |
| | ±0.047 | ±0.045 | ±0.038 | | |
| | (<0.0001) | (0.0053) | (0.033) | | |
| Model 1 | 0.186 | 0.123 | −0.072 | −0.197 | |
| | ±0.047 | ±0.044 | ±0.038 | ±0.051 | |
| | (<0.0001) | (0.0056) | (0.056) | (0.0001) | |
| Model 2 | 0.189 | 0.126 | −0.033 | −0.060 | −0.244 |
| | ±0.047 | ±0.044 | ±0.041 | ±0.077 | ±0.102 |
| | (<0.0001) | (0.0045) | (0.43) | (0.44) | (0.017) |

[*] Whites and males are used a reference groups

[†] Betas are the estimated regression coefficients, adjusting for other covariates in the model

[‡] Model 0: ethnic group + sex

[§] Model 1: ethnic group + sex + ADA class

[‖] Model 2: ethnic group + sex + ADA class + ADA class×sex