Relationship of Fruit and Vegetable Servings and Self-Reported Diabetics in the Southeast and Northeast

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Abstract

According to the American Diabetes Association, most diabetic patients are not consuming the recommended 3-5 servings of vegetables and 2-4 servings of fruits a day. This study examined fruit and vegetable servings of self-reported diabetics (N=35,407) in select southeastern and northeastern states using Behavioral Risk Factor Surveillance System (BRFSS) 2005 data. The estimate for both fruit and vegetable servings and self-reported diabetes was determined using multivariate logistic regression, adjusting for sociodemographics and geographic region. The results indicated a significant difference between fruit and vegetable servings for diabetics and non-diabetics ($p<0.0001$). A higher percentage of diabetics in the northeast consumed more than three servings of fruit and vegetables when compared to diabetics in the southeast. Respondents in the northeast were 21% more likely to consume five or more servings of fruit and vegetables and 16% less likely to be diabetic than those in the southeast after adjusting for age, race, sex, and geographic region. In conclusion, diabetics in the northeast consumed more servings of fruit and vegetables than did those in the southeast. Multiple factors influence fruit and vegetable consumption and diabetes and should be considered when developing targeted nutritional interventions. Diabetes educators, nurses, and physicians can encourage diabetic patients to consume more fruit and vegetables and motivate them to continue eating fruit and vegetables.

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INTRODUCTION

Diabetes is an increasing problem in the United States. Currently, there are 20.8 million children and adults in the United States, or 7% of the population, who have diabetes. While an estimated 14.6 million have been diagnosed, 6.2 million people (or nearly one-third) are unaware that they have the disease. Similarly, most diabetic patients are not consuming the recommended 3-5 servings of vegetables and 2-4 servings of fruit a day (American Diabetes Association [ADA], 2006).

Diet and exercise are considered important components of treatment for adults with type 2 diabetes. In a survey of 2,000 adult diabetics, the most frequently reported barriers in diabetes self-management were adherence to diet and exercise (Glasgow, 1997). Only 60% of individuals with diabetes in the National Health Interview Survey report that they "follow a diabetic diet," and several non-U.S. studies have reported that actual nutrient intake among individuals with diabetes may be suboptimal (Harris, 1996; Toeller, 1996; Eeley, 1996; Campbell, 1989; Virtanen, 2000).

Previous studies suggest individuals with diabetes may not follow recommended guidelines for diet and exercise, although there have been no nationally representative studies in the United States examining nutritional intake among adults with type 2 diabetes. Culture in different parts of the United States determines the type and frequency of food one eats. However, an extensive literature review found few studies analyzing the differences in diet between North and South in the United States. Previous studies analyzing BRFSS data have studied fruit and vegetable consumption in different states (Serdula & Coates, 2000; Serdula & Gillespie, 2000). However, previous studies have not measured the association between fruit and vegetable servings, self-reported diabetes, and geographic region (Montonen, 2005; Snowdon, 1985; Li, 2000).

The purpose of this study was to examine the fruit and vegetable consumption of diabetics in select southeast and northeast states in the U. S. The authors hypothesize diabetics in select northeast states will consume more servings of fruit and vegetables than those in select southeast states.

MATERIALS AND METHODS

Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance Survey (BRFSS) data from 2005 were used to accomplish the study's objectives (Centers for Disease Control and Prevention [CDC], 2006). BRFSS collects information on health behaviors and risk factors for various diseases by using random-digit dialing telephone survey techniques. One adult resident above 18 years was randomly chosen from each household to answer survey questions. The instrument consisted of core questions and state-optional modules. The core questionnaire consisted of items that measure the fruit and vegetable servings, state of residence, and diabetes status. Inclusion criteria were diabetics and non-diabetics age 18 and older who live in New Hampshire, Vermont, Massachusetts, Georgia, Alabama, and Mississippi. Those who were diabetic only while pregnant were excluded. The data contained detailed information on age, race, sex, diabetes status, fruit and vegetable consumption, and geographic region. The main independent variable was geographic region, which included northeastern and southeastern states.

The outcome or dependent variables were diabetes and fruit and vegetable servings. Diabetes was measured by asking the respondents if they have ever been told by a doctor that they had diabetes. Fruit and vegetable consumption was based on self-reported daily average number of servings. Fruit and vegetable servings were calculated according to the BRFSS categories of less than 1 per day or never, 1 to less than 3 times per day, 3 to less than 5 times per day, 5 or more times per day. The age group included 7 categories which were 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, and 75 and above. The seven categories of race were White, Black, Asian, Hawaiian and Pacific Islander, American Indians and Alaskan Natives, other races, and mixed races.

STATISTICAL ANALYSIS

Data were analyzed using SAS, Statistical Software Package (SAS Institute Inc., Gary, NC, 1999). Descriptive statistics were calculated to examine the mean age of the participants living in both regions. The proportion of residents and diabetics in the southeast and northeast were adjusted for age according to the standard 2000 US population. A t-test was used to determine if there were significant differences in the mean age of respondents in the northeastern and southeastern states. Chi-Square tests were conducted to determine the difference between race in the southeast and northeast, sex in the southeast and northeast, fruit and vegetable servings in the southeast and northeast, and diabetes status in the northeast and southeast. The relationship between diabetes and fruit and vegetable servings was determined by using a Chi-Square test. The association of fruit and vegetable servings of diabetics and non-diabetics in the southeast and northeast was determined using the Mantel-Haenszel Chi-Square Test. The fruit and vegetable servings of diabetics were estimated for age group, race, sex, and geographic region using a logistic regression model.

RESULTS

Demographic characteristics of respondents in the southeast and northeast were summarized in Table 1. The sample consisted of 35,407 participants. People in the northeast were slightly older (mean age 46 years) than people in the southeast (mean age 45 years), ($p < 0.0001$). However, age structure was similar for the northeast and southeast ($p < 0.0001$). In the 35-44 age group, 20.16% of participants lived in the southeast and 20.58% lived in the northeast. In the southeast, there were 52.76% of whites, 33.65% of blacks, 36.85% who consumed 1 to less than 3 fruit and vegetable servings a day, and 8.99% who were diabetic. In the northeast, there were 64.78% of whites, 10.41% of blacks, 37.07% who consumed 3 to less than 5 fruit and vegetable servings a day, and 6.34% who were diabetic. Although survey participants were predominately white, there were more African Americans in the south than in the north ($p < 0.0001$). For gender, there were equal proportions of males and females in both regions ($p = 0.46$). For fruit and vegetable servings, more respondents consumed >3 servings per day ($p < 0.0001$). Finally, there were more self-reported diabetics in the south than in the north ($p < 0.0001$). In Table 2, 37.61% of diabetics and 36.34% of non-diabetics reported that they consumed 3 or less than 5 fruit and vegetables servings a day. Fruit and vegetable servings of self-reported diabetics and non-diabetics in both regions were similar ($p = 0.0807$). When comparing fruit and vegetable servings in diabetics and non-diabetics in the two regions, more diabetics in the northeast ate three or more servings of fruit and vegetables than did diabetics in the southeast ($p < 0.0001$), as depicted in Table 3. In the southeast, 37.46% of diabetics ate 3 to less than 5 fruit and vegetable servings a day. Similarly in the northeast, 38.01% of diabetics ate 3 to

Table 1
Characteristics of respondents in Southeastern and Northeastern States

Demographic Characteristics	Southeastern states N=13700	Northeastern states N=21707	Test for difference p-value
Age: mean (std dev)	44.59(0.15)	45.87(0.12)	<.0001
18-24	13.96%	12.08%	<.0001
25-34	19.23%	17.32%	
35-44	20.16%	20.58%	
45-54	18.21%	18.60%	
55-64	13.25%	13.94%	
65-74	8.27%	8.56%	
75+	6.93%	8.91%	
Race			
White, NH	52.76%	64.78%	<.0001
Black, NH	33.65%	10.41%	
Asian, NH	2.24%	1.59%	
Hawaii/PI, NH	0.00%	0.55%	
AI/AN, NH	7.57%	2.40%	
Other, NH	1.31%	3.04%	
MR, NH	2.47%	17.23%	
Sex			
Male	48.21%	47.76%	0.4621
Female	51.79%	52.24%	
Fruit and Vegetable Servings			
<1 per day or never	5.92%	3.51%	<.0001
1 to less than 3 times per day	36.85%	30.59%	
3 to less than 5 times per day	36.07%	37.07%	
5 or more times per day	21.15%	28.83%	
Diabetes			
Yes	8.99%	6.34%	<.0001
No	91.01%	93.66%	

less than 5 fruit and vegetable servings a day.

Multivariate logistic regression analysis was performed on fruit and vegetable consumption (5 or more servings) and diabetes (Table 4). After adjusting for age, race, sex and geographic region, people aged 75 and older were 50% less likely to consume five or more servings of fruit and vegetables and 21 times more likely to be diabetic than those younger than 75. People aged 45-74 were 15 times more likely to be diabetic and 41% less likely to consume 5 or more servings of fruits and vegetables than those aged 18-44.

Women were 21% less likely than men to consume the recommended servings. Women were 1.7 times more likely then men to be diabetic.

African Americans were 2.18 times more likely to consume 5 or more servings of fruits and vegetables and 7.71 times more likely to be diabetic when compared to whites. Asians, Hawaiians, Pacific

Table 2
Association of Diabetes and Fruit and Vegetable Servings

	Diabetes		Test for difference
	Yes	No	p-value
Fruit and Vegetable Servings			0.0807
Less than 1 per day or never	4.90%	5.10%	
1 to less than 3 times per day	32.41%	34.90%	
3 to less than 5 times per day	37.61%	36.34%	
5 or more times per day	25.08%	23.66%	

Islanders, American Indians, Alaska Natives, and other races were 19% less likely to consume 5 or more fruit and vegetable servings and 8.51 times more likely to be diabetic than whites.

Respondents in the northeast were 1.2 times more likely to consume 5 or more servings of fruit and vegetables than those in the southeast. Respondents in the northeast were 16% less likely to be diabetic than those in the southeast.

DISCUSSION

Diabetics consumed more servings of fruits and vegetables than non-diabetics. Respondents in the northeast were more likely to consume five or more servings of fruit and vegetables and less likely to be diabetic than those in the southeast after adjusting for age, race, sex, and geographic region.

This study confirmed the authors' hypothesis that self-reported diabetics in the northeast consumed more servings of fruit and vegetables than in the southeast. Previous studies analyzing BRFSS data have studied fruit and vegetable consumption across the United States, not specifically northeast and southeast states (Ford, 2001; Nelson, 2002). Also, previous studies have not measured the association between diabetics, fruit and vegetable consumption, and geographic region (Serdula & Coates, 1995; Serdula & Gillespie, 2000).

Fruit and vegetable consumption differences in the south and north may be influenced by food preferences, physiological state, nutritional knowledge, education, perceptions of healthy eating, and psychological factors, income, employment status, work schedule, transportation, language barriers, physical activity, stress levels (Raine, 2005; Essa, 2001).

Serdula and Gillespie's (2000) study supports the influence of a variety of factors in diabetes self-management. The authors conclude that differences in smoking, obesity, stress levels, physical activity, and other lifestyle behaviors may explain these differences in diabetics, fruit consumption, and geographic region. In addition, blood glucose monitoring, insulin therapy, and a balanced diet should be considered when considering diabetics and their fruit and vegetable consumption.

According to the American Diabetes Association, most diabetic patients are not consuming the recommended 3-5 servings of vegetables and 2-4 servings of fruit a day (ADA, 2006). Diabetics' higher consumption of fruits and vegetables in this study support a previous study stating diabetics consume more fruit and vegetables than non-diabetics (Serdula & Coates, 1995.) However, other previous studies indicate that diabetics' nutrient intake may be lower than non-diabetics (Li, 2000; CDC, 2006; Ford, 2001; Serdula & Gillespie, 2000).

One of the strengths of this study is that it determines the association between diabetes, fruit consumption, and geographic region (Southern versus Northern states) through the use of current BRFSS data. Previous studies analyzing BRFSS data have examined fruit and vegetable consumption in different

Table 3

Association of Fruit and Vegetable Servings of Diabetics in Southeast and Northeast States

	Southeastern Diabetes		Northeastern Diabetes		Test for difference
	Yes	No	Yes	No	p-value
Fruit and Vegetable Servings					<.0001
Less than 1 per day or never	5.57%	5.95%	3.08%	3.54%	
1 to less than 3 times per day	32.89%	37.27%	31.11%	30.53%	
3 to less than 5 times per day	37.46%	35.96%	38.01%	37.03%	
5 or more times per day	24.08%	20.82%	27.81%	28.90%	

Table 4

Multivariate Logistic Regression Analyses of Fruit and Vegetable Consumption and Diabetes

Independent Variables	Fruit and Vegetable Consumption* OR (95% CI)	Diabetes OR (95% CI)
Age		
18-44	Reference	Reference
45-74	0.592 (0.36-0.96)	15.2 (4.69-49.24)
75+	0.502(0.26-0.97)	21.05 (5.63-78.69)
Race		
White, NH	Reference	Reference
Black, NH	2.18 (1.3-3.67)	7.71 (2.73-21.73)
Asian, Hawaii/PI, AI/AN, Other NH	0.81(0.45-1.46)	8.51 (2.62-27.65)
Sex		
Male	Reference	Reference
Female	0.79 (0.51-1.21)	1.71 (0.71-4.10)
States		
Southeastern	Reference	Reference
Northeastern	1.21 (0.74-1.99)	0.84 (0.28-2.54)

*Fruit and vegetable consumption indicates 5 or more servings

states without exploring differences between aggregate region or overall association (Ford, 2001; Nelson, 2002).

However, previous studies have not measured the association between these three variables (Serdula & Coates, 1995; Serdula & Gillespie, 2000; Raine, 2005).

Another strength of this study is its use of BRFSS data when examining fruit and vegetable consumption in diabetics in the northeast and southeast. BRFSS is a reliable and widely used instrument, used

by the CDC to measure health beliefs and behaviors across the United States (CDC, 2006).

A weakness of the current study is that the results cannot be generalized to the entire United States population. This study's sample excluded individuals below the age of 18, where nutritional choices are more important, and also those with gestational diabetes. Diabetes and fruit consumption are associated with other factors such as fat intake, stress levels, health problems, and other chronic diseases. These differences in results may be affected by unmeasured conditions such as physical activity, job stress levels, or quality of life. Since the BRFSS is a self-report measure, researchers should consider the validity of the answers. This may have changed the actual proportions of diabetics and fruit consumption. Also, respondents may not be aware of their condition when answering the diabetes question. Participants may be diabetic and identify themselves as non-diabetic if their physicians have not diagnosed them.

This study presents many implications for the field of public health. Physicians, nurses, diabetes educators, diabetics and their family members may all benefit from the results of this study. Diabetes educators, nurses, and physicians can encourage diabetic patients to consume more fruit and vegetables and motivate them to continue eating fruit and vegetables. With the help of dieticians, they can design and implement diabetes education programs to inform the general public, such as the obese population, to consume more fruit and vegetables and lower their risk of diabetes. The results can provide guidance for diabetes education programs in the northeast and southeast to improve their current curriculum and focus on modifying lifestyle behaviors such as diet, exercise, smoking, alcohol consumption, and stress levels.

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