

An Examination of Sociodemographic, Health, Psychological Factors, and Fruit and Vegetable Consumption Among Overweight and Obese U.S. Veterans

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ABSTRACT A diet high in fruits and vegetables (F&Vs) is associated with decreased risk for cardiovascular disease, diabetes, and cancer. This study investigated the relationship between sociodemographic, health, and psychosocial factors and F&V consumption among overweight and obese U.S. veterans. Participants were recruited from two Veterans Affairs medical center sites in 2005. Two hundred eighty-nine participants completed a self-administered survey. Bivariate and multivariate linear regression models were built to examine the association between sociodemographic, health, and psychosocial variables and F&V consumption. Older age ($B = 0.01$; $p < 0.001$) and being Black ($B = -0.18$; $p < 0.05$) were related to increased F&V consumption. Reported tobacco use was inversely associated with F&V consumption ($B = -0.30$; $p < 0.01$). Greater self-efficacy ($B = 0.07$; $p < 0.05$), fewer perceived barriers ($B = -0.14$; $p < 0.01$), and correct knowledge of recommended daily F&V intake ($B = 0.12$; $p < 0.05$) were related to eating more F&Vs. U.S. veterans disproportionately experience overweight and obese conditions. Age, race, tobacco use, and psychosocial factors should be considered carefully when developing dietary interventions among overweight and obese U.S. veterans.

INTRODUCTION

A diet high in fruits and vegetables (F&Vs) is associated with decreased risk for chronic diseases such as cardiovascular disease, hypertension, diabetes, and cancer.^{1,2} A goal of Healthy People 2010 is to increase to 75% the proportion of individuals aged 2 years and older who consume two or more servings of fruit daily and to 50% the proportion of those who consume three or more servings of vegetables daily.³ Despite the benefits of eating F&Vs, many American adults do not meet this national objective. According to 2009 data from the Behavioral Risk Factor Surveillance Survey, only 32.5% of adults consumed fruit two or more times per day and 26.3% consumed vegetables three or more times per day.⁴

Although well studied in the general U.S. population, factors associated with healthy diets among U.S. veterans are less understood. Studies have found that veterans have lower socioeconomic status and fewer years of education than the general population.^{5,6} Also, more patients using Veterans Affairs (VA) outpatient facilities rate their health as “fair” or “poor” than do individuals in the general population.^{5,6} Many veterans report having hypertension (37%), ischemic heart disease (16%), and diabetes (16%), all conditions for which risks may be lowered by a diet rich in F&Vs.⁷⁻⁹ Overweight and obesity are also a prevalent problem among VA users. In a study of five million

VA patients, 73% of men and 68% of women were described at least as overweight, with 33% of men and 37% of women being classified as obese.¹⁰

A large number of studies have identified associations between sociodemographic and health-related characteristics and F&V consumption in the general population, where respondents who are older, female, college graduates, non-smokers, physically active, above the poverty level, and have normal body mass index (BMI < 25) report higher F&V consumption.^{11,12} Furthermore, psychosocial factors, such as lower perceptions of barriers to and higher perceptions of benefits of eating more F&Vs, knowledge about recommended daily F&V intake, and higher self-efficacy for eating F&Vs, have been shown to increase F&V consumption.¹³ However, there is limited research on factors that are salient to F&V consumption among overweight and obese U.S. veterans.

Interventions addressing sociodemographic and psychosocial factors have been successful in increasing F&V consumption in the general population, including overweight and obese men.¹⁴⁻¹⁶ Hagler et al¹⁵ have shown that higher self-efficacy, having social support, and use of behavior change strategies were related to more healthful diets among overweight and obese men. However, no research has focused on overweight and obese veterans whose dietary practices increase their risk for health problems and who are seeking help for weight loss. Health promotion efforts to increase F&V consumption depend on understanding factors determining intake. Therefore, identifying significant associations between sociodemographics, health, and psychosocial factors and dietary intake among this population can inform the development of effective dietary interventions. The purpose of this study was to investigate sociodemographic, health-related, and psychosocial

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factors associated with F&V consumption among overweight and obese U.S. veterans participating in the Healthy Strides Healthy MOVE! (HSHM!) study. Specifically, this study examined sociodemographics (e.g., ethnicity, age, education, gender, employment), health (e.g., tobacco use), and psychosocial factors such as perceived barriers, benefits, knowledge, self-efficacy, and having social support.

METHODS

Study Design

This study used baseline data from the HSHM! study, a quasi-experimental study aimed at promoting healthy diet and weight control among U.S. veterans at two VA sites in New York state. Two hundred eighty-nine eligible participants were English-speaking veterans, had a BMI ≥ 25 , and were between the ages of 21 and 75. Participants were recruited from August through December, 2005, through referrals from primary care physicians during clinical visits at study sites. The Institutional Review Boards at the University of North Carolina at Chapel Hill and at each VA site approved all study procedures.

Participants completed a self-administered, computer-based survey and a scannable paper-and-pen F&V frequency survey. Combined, the surveys contained 60 questions that assessed sociodemographics, health status and conditions, psychosocial factors, and F&V consumption. All baseline surveys were completed at the VA sites before delivery of the HSHM! interventions.

Measures

F&V Consumption

Average daily F&V consumption was measured using a 36-item food frequency questionnaire (FFQ) validated by Resnicow et al.¹⁷ Resnicow's measure was slightly modified to ask how often food was consumed in the last month as opposed to the last week to capture and understand a more typical diet. For analysis purposes, the item "French fries, fried potatoes, or home fries" was eliminated from calculations; thus, the final F&V consumption measure was based on 35 items. The revised FFQ has been previously used in other research.^{18,19} F&V item frequencies were converted to servings/day and then summed to provide total daily consumption values for fruit, vegetables, and total F&Vs. The distribution of F&V consumption was skewed to the right; therefore, we employed a log transformation ($\ln + 1$) to improve normality.

Sociodemographics

Sociodemographic characteristics, including, age, race, ethnicity, gender, marital status, education, employment, and annual income, were collected. Age was a continuous variable, calculated using the respondent's date of birth and the date of the interview. A combination of race and ethnicity was used to create two race categories "non-Hispanic Black" and "non-Hispanic White." Individuals who responded as "other" were

too few to be used in analyses and were therefore excluded ($n = 18$). Education was assessed as the highest grade of school completed and collapsed into two categories for analyses: below high school diploma and high school diploma and above. Employment status was measured as either "employed full- or part-time" or "not employed." Annual income was collected as total yearly household income and collapsed into two categories: $< \$30,000$ and $\geq \$30,000$. These same cut points were used and have been reported in previous studies using the same data.²⁰

Health Variables

Self-rated health was measured using one question based on the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System item concerning health-related quality of life. The question asked "How would you rate your current health?" Response options were "excellent," "very good," "good," "fair," or "poor." These categories were collapsed into "in good health" (for responses of good or better) or "not in good health" (for responses of fair or poor). Obesity status was determined by calculating BMI using weight and height² (kg/m^2), which was measured by a nurse during a clinical visit. Individuals were classified into overweight (BMI, 25.0–29.9), mildly obese (BMI, 30.0–34.9), moderately obese (BMI, 35.0–39.9), and extremely obese (BMI ≥ 40) based on World Health Organization criteria.²¹ Specific health variables were collected using a checklist including heart disease, diabetes, high blood pressure, high blood cholesterol, arthritis, tobacco use, and substance abuse.

Psychosocial Variables

Self-efficacy for eating five or more servings of F&Vs each day was measured using a single standard question: "If you decided to, how sure are you that you have the ability to succeed..." with a 5-point Likert scale ranging from "very unsure" to "very sure."¹⁹

Perceived benefit of eating more servings of F&Vs was measured with one statement: "I don't think that eating more of them will make me healthier," using a 4-point scale ranging from "disagree a lot" to "agree a lot."¹⁹

Perceived barriers to eating more servings of F&Vs were measured with five pretested items.^{22,23} Four-level response options ranged from "disagree a lot" to "agree a lot." A sample barrier item was: "It would be hard for me to eat more fruits and vegetables because I'm not in the habit of eating them."

Knowledge about recommended daily F&V consumption was measured with one question: "What is the minimum number of fruits and vegetables you should eat each day for good health?" Those who responded five or more were categorized as having "good knowledge;" others were categorized as having "poor knowledge."¹⁹

Perceived social support was measured using a 4-item scale: "If you tried to eat healthier foods, how much could you count on the people close to you²⁴: (1) to encourage you, (2) to tell you about healthier foods, (3) to tell you how to prepare healthier foods with or for you, and (4) to eat healthier foods with you?"

Data Analysis

Complete data were available on 289 participants. All analyses were conducted using SAS (Version 9.1; SAS Institute, Cary, NC). Descriptive analyses generated frequencies for categorical variables and means for continuous variables. Bivariate analyses between each sociodemographic, health, and psychosocial factors and F&V consumption were conducted with analysis of variance.

Multivariate analyses were conducted using linear regression techniques to identify sociodemographic, health, and psychosocial factors that were significantly associated with F&V consumption. A series of multiple regression analyses were performed to assess the unique variance explained by sociodemographic, health, and psychosocial factors. Model 1 (the sociodemographic factor model) included only the sociodemographic factors: age, race, gender, education, marital status, annual income, and employment. Model 2 (the health factor model) included only the health and health behavior-related variables: self-rated health, heart disease, diabetes, high blood pressure, high blood cholesterol, arthritis, obesity status, tobacco use, and substance abuse. Model 3 (the psychosocial factor model) included variables that measured self-efficacy, perceived benefits, perceived barriers, knowledge, and social support. The sociodemographic, health, and psychosocial factors that showed significant associations with F&V consumption in models 1, 2, and 3 were then entered into a fourth model (the combined model). These analytical methods have been described previously²⁵ and applied to health behaviors.²⁶ Collinearity diagnostics indicated no important violations among the variables in this study.²⁵ The significance level was set at $p < 0.05$.

RESULTS

Veterans were on average 58.4 (± 12) years old, and most were White (86%), male (90%), and had graduated from high school (93%) (Table I). More than half were married or living with a partner (58%), whereas less than half had an annual income $\geq \$30,000$ (45%). A third were employed either full- or part-time (35%). More than half of the participants (58%) reported their health as good. The most common health problems reported by veterans were having high blood pressure (47%), high blood cholesterol (39%), or arthritis (45%). All of the participants were overweight or obese.

On average, respondents reported eating four servings of F&V per day (Table I). Self-efficacy scores for eating five or more servings of F&Vs per day fell between somewhat sure and sure. Participants reported having social support, with the average response falling between some support and a lot of support. Participants also reported perceived benefits of eating F&Vs to their health, with an average response between agree a little and agree a lot. Perceived barriers were generally low, with an average response between disagree a little and disagree a lot. About half of the participants had correct knowledge of the recommended minimum daily amount of F&V consumption.

TABLE I. Sociodemographic, Health, and Psychosocial Factors of Overweight and Obese U.S. Veterans

| <i>N</i> = 289 | |
|-----------------------------------|-----------------------|
| Sociodemographic Factors | |
| Age in Years (SD) | 58.37 (± 11.96) |
| White | 86% |
| Male | 90% |
| \geq High School Degree | 93% |
| Currently Married | 58% |
| Income $\geq \$30,000$ | 45% |
| Employed Full- or Part-time | 35% |
| Health Factors (Yes) ^a | |
| Self-rated Health (Good) | 58% |
| Heart Disease | 19% |
| Diabetes | 25% |
| High Blood Pressure | 47% |
| High Blood Cholesterol | 39% |
| Arthritis | 45% |
| Overweight (BMI, 25.0–29.9) | 14% |
| Mild Obesity (BMI, 30.0–34.9) | 39% |
| Moderate Obesity (BMI, 35.0–39.9) | 25% |
| Extreme Obesity (BMI ≥ 40) | 22% |
| Tobacco Use | 11% |
| Substance Abuse | 5% |
| Psychosocial Factors (Mean, SD) | |
| Self-efficacy | 3.37 (± 1.16) |
| Perceived Benefits | 3.54 (± 0.85) |
| Perceived Barriers | 1.99 (± 0.68) |
| Social Support | 2.31 (± 0.60) |
| Knowledge (Good) | 49.5% |
| F&V Consumption ^b | |
| Daily (Mean, SD) | 4.12 (± 2.57) |
| Meeting "5-a-day" (Yes) | 50% |

^aParticipants could say 1 or more. ^bMeasures used = 35-item FFQ.

We conducted unadjusted bivariate analyses and found that, in general, older veterans reported eating more F&Vs compared to younger veterans ($p < 0.05$). Individuals who were 50 years and older ate on average 0.63 more servings of F&V compared to those less than 50 (4.26 vs. 3.63). Other sociodemographic characteristics, such as race, gender, education, marital status, income, and employment, were not significantly related to F&V consumption. Reported tobacco use, however, was inversely related to F&V consumption ($p < 0.05$).

Although health factors were not significantly related to F&V consumption in the unadjusted bivariate analyses, three of the five psychosocial factors were related to eating more F&Vs. Having greater self-efficacy ($B = 0.10$; $p < 0.001$), fewer perception of barriers to eating F&V ($B = -0.22$; $p < 0.001$), and knowledge of the minimum recommendations for daily F&V consumption were related to increased F&V consumption ($B = 0.23$; $p < 0.001$).

In multivariate analyses examining the relationship among sociodemographics, health and psychosocial factors, and F&V consumption, the sociodemographic model (Model 1) showed that age, race, and education were significantly related with F&V consumption (Table II). Older veterans reported eating more F&V compared to younger veterans ($B = 0.01$; $p < 0.001$).

TABLE II. Multiple Regression Results of the Relationship Between Sociodemographic, Health, and Psychological Factors and F&V Consumption

| Variable | Model 1 | Model 2 | Model 3 | Model 4 |
|---------------------------------|----------------|----------------|---------------|-----------------|
| | B (SE) | B (SE) | B (SE) | B (SE) |
| Sociodemographic Factors | | | | |
| Age | 0.01 (0.00)* | — | — | 0.01 (0.00)* |
| White | -0.25 (0.10)** | — | — | -0.18 (0.09)** |
| Male | 0.13 (0.11) | — | — | — |
| ≥High School Degree | 0.31 (0.13)** | — | — | 0.17 (0.15) |
| Currently Married | 0.09 (0.07) | — | — | — |
| Income ≥\$30,000 | -0.02 (0.07) | — | — | — |
| Employed Full- or Part-time | 0.04 (0.07) | — | — | — |
| Health Factors | | | | |
| Self-rated Health (Good) | — | 0.15 (0.07)** | — | 0.02 (0.06) |
| Heart Disease | — | -0.02 (0.09) | — | — |
| Diabetes | — | 0.14 (0.09) | — | — |
| High Blood Pressure | — | 0.05 (0.07) | — | — |
| High Blood Cholesterol | — | -0.09 (0.07) | — | — |
| Arthritis | — | -0.04 (0.07) | — | — |
| Obesity Status | — | 0.00 (0.03) | — | — |
| Tobacco Use | — | -0.30 (0.10)** | — | -0.30 (0.10)*** |
| Substance Abuse | — | -0.13 (0.16) | — | — |
| Psychosocial Factors | | | | |
| Self-efficacy | — | — | 0.07 (0.03)** | 0.07 (0.03)** |
| Perceived Benefits | — | — | -0.05 (0.04) | — |
| Perceived Barriers | — | — | -0.22 (0.06)* | -0.14 (0.05)*** |
| Knowledge (Good) | — | — | 0.12 (0.06)** | 0.12 (0.06)** |
| Social Support | — | — | -0.01 (0.06) | — |
| R ² | 0.11* | 0.10*** | 0.16* | 0.25* |

* $p < 0.001$; ** $p < 0.05$; *** $p < 0.01$.

Whites scored 0.25 units lower on servings of F&V consumption compared to Blacks ($B = -0.25$; $p < 0.05$). Veterans with a high school degree or more, however, reported more F&V intake compared to those who had not graduated from high school ($B = 0.13$; $p < 0.05$) after controlling for other sociodemographic factors. The sociodemographic model accounted for 11% ($p < 0.001$) of the variance in F&V consumption.

The health factor model (Model 2) showed that self-reported health and tobacco use were significantly related to F&V consumption. Veterans who reported being in good health scored 0.15 units higher on servings of F&V consumption compared to those who reported their health to be fair or poor ($B = 0.15$; $p < 0.05$). Reported tobacco use was inversely related to F&V consumption ($B = -0.30$; $p < 0.001$). The health factor model accounted for 10% ($p < 0.01$) of the variance in F&V consumption.

The psychosocial model (Model 3) showed that three of five psychosocial factors were related to eating more F&Vs among veterans. Individuals reporting greater self-efficacy scored 0.07 units higher on servings of F&V consumption ($B = 0.07$; $p < 0.05$). Greater perceived barriers were inversely associated with F&V consumption ($B = -0.22$; $p < 0.001$). Finally, participants reporting knowledge of the minimum daily F&V consumption recommendations ate more F&Vs ($B = 0.12$; $p = 0.05$). The psychosocial factor model accounted for 16% of the variance in F&V consumption.

The combined model (Model 4) indicated that higher F&V consumption was significantly associated with older age, being Black, not using tobacco, having greater self-efficacy for eating more F&V, fewer perceived barriers, and having correct knowledge of the minimum daily F&V consumption recommendation ($p < 0.05$). Having a high school degree or more and self-reported good health no longer contributed significantly in the combined model. The combined model accounted for 25% ($p < 0.001$) of the variance in F&V consumption.

DISCUSSION

This study surveyed overweight and obese U.S. veterans participating in the HSHM! study regarding dietary behaviors and associated factors. The veterans in this study reported eating an average of four servings of F&V per day, and about half were not meeting the national guideline of consuming five or more servings of F&V daily.

Sociodemographics, health, and psychosocial factors, i.e., perceived barriers, knowledge, and self-efficacy, were significantly associated with eating more F&Vs. Age was significantly associated with higher F&V consumption among veterans in this study. Similar results have been reported in the literature, where F&V consumption increases with age.^{12,27} This study also found that Blacks consumed more F&Vs compared to Whites. Similar results have been shown in the general population, where Blacks consume on average slightly

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more F&Vs than Whites, both using national data^{28,29} and population-based data.²² It is important to note that stratified analyses across age and race on our participants showed that older Blacks (defined as 50 years and older) also had higher BMI compared to older Whites. However, this difference was not statistically significant. Rather than formulating definitive conclusions about Blacks eating more F&V than Whites, future research may conduct more complete dietary assessments to construct a broader perspective of dietary behaviors and examine whether greater F&V consumption is a reflection of eating large portions or a balanced meal among overweight and obese U.S. veterans. Additionally, individuals with more education consistently have been shown to eat more F&V compared to less-educated counterparts.^{26,29} There was no relationship between income and F&V consumption, although education and income are often correlated.³⁰

This study did not find a significant relationship between employment status and F&V consumption. Although being employed may provide individuals with the financial means to purchase healthy food,³¹ research shows that it does not necessarily lead to more F&V consumption.²³ Working individuals may also experience time pressures related to preparing healthy meals that include F&Vs.²³ In fact, James et al²³ found that individuals who were not employed ate more F&Vs and engaged more frequently in other healthy activities. Most of their participants, however, were 65 and older and may have been retired and may have had more time to devote to healthy habits such as eating more F&Vs. In our study, almost half of our participants were retired (41%) and most of them (96%) were 50 and older. Military veterans may retire for very different reasons than the general population, and thus motivation to engage in healthy behaviors may also differ. The apparent scarcity of research on health behavior change postretirement, particularly among veterans, suggests that this area of research likely deserves consideration.

To our knowledge, our study is the first to document the relationship between psychosocial factors and F&V consumption among veterans who use VA facilities. Veterans in this study who reported high self-efficacy, knowledge about recommended daily F&V consumption, and low perceived barriers to eating F&Vs had increased F&V consumption. Other studies on nonveterans show similar findings.¹⁴ A review of 35 studies examining psychosocial predictors of F&V consumption among U.S. adults reported that self-efficacy and knowledge were strong predictors of F&V consumption in virtually all studies.¹⁴ More barriers to F&V consumption were also associated in many studies with low daily F&V consumption.¹⁴ These findings suggest that psychosocial factors should be considered when developing interventions to impact F&V consumption among veterans.

Social support was not significantly related to F&V consumption. This study, however, found that a great percentage of veterans had social support with 73% of participants reporting having some type of social support. The lack of association between this high level of perceived social support and

F&V consumption is difficult to interpret. High perceived social support may reflect a stronger social network or simply an increased awareness of available support but may not translate into actual support. It may be that the perception (rather than actual existence) of social support was higher among veterans or that the available social support was not helpful for facilitating health behavior. Although the literature suggests social support can be helpful for encouraging healthy behaviors, this may not always be the case.^{32,33} Although social support is usually intended by the giver to be helpful, negative aspects of support such as nagging, unhelpful advice, or a tendency to treat the person as ill or an invalid may exist.³² This study, however, did not measure negative aspects of support regarding F&V consumption among veterans.

Tobacco use emerged as a correlate of F&V consumption, both in a bivariate model and in the multivariate model. Our finding that tobacco use was related to eating fewer F&Vs among veterans is supported by results from studies in other parts of the world, including Great Britain, Italy, Sweden, and Japan.^{34,35} This pattern, found across different cultural groups, may be due to characteristic effects of tobacco use, such as diminished taste and smell, which may decrease an individual's desire for sweet-tasting foods such as fruit.³⁴

This study has several limitations. First, the study used self-reported measures, which may have introduced the possibility of over-reporting or under-reporting. A recent review of measures of F&V consumption, however, reported that studies using a measure with a greater number of items had greater validity than studies using shorter instruments.¹⁴ This study used 35 items to assess F&V consumption, which may have reduced the bias associated with self-report. These analyses examined only the baseline data; therefore, findings do not suggest causality, and replications with longitudinal data should be done to account for temporality between socio-demographics, health, psychosocial factors, and F&V consumption. This study also did not include a complete dietary assessment, but focused only on F&V consumption and therefore cannot assess whether participants were eating a balanced diet. Therefore, future studies among overweight and obese veterans may complete more comprehensive assessments of diets as well as other health behaviors that promote weight loss (i.e., physical activity) to identify factors that are associated independently to diet and physical activity as well as those that are related to both behaviors at the same time. Additionally, this study included veterans who voluntarily enrolled in the HSHM! study, a healthy diet and weight control study. Because researchers from this study did not have information about nonrespondents, it is not known how representative the participants were of the VA population. Finally, this study included only two sites with mostly male veterans. Results from this study are now being used to inform a larger intervention to promote healthy behaviors among male and female veterans.

CONCLUSION

U.S. veterans continue to disproportionately experience negative health conditions compared to the general population. Healthy diets that include F&Vs may play an important role in reducing their health risks. Findings from this study may help us understand important correlates of F&V consumption and may inform efforts to design dietary interventions for this vulnerable population.

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