



Research paper

Fruit and vegetable intake, physical activity, and depressive symptoms in the African American Health (AAH) study

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ARTICLE INFO

Keywords:

Fruit
Vegetable
Diet
Physical activity
Depressive symptoms
African American

ABSTRACT

Background: Healthy diet and physical activity (PA) have been associated with reduced depressive symptoms, but few studies have examined them simultaneously in African Americans.

Aims: To investigate fruit and vegetable intake (FVI) and PA as predictors of clinically-relevant levels of depressive symptoms (CRLDS) in African Americans.

Methods: African American Health (AAH) is a population-based longitudinal study of African Americans in St. Louis, MO, who were born in 1936–1950 (inclusive) and empaneled in 2000–01 (wave 1). At wave 8, participants self-reported fruit and vegetable intake (FVI) and completed the Yale Physical Activity Scale. At both waves 8 and 10, the CES-D 11-item scale was used to identify those who met criteria for CRLDS. Sequential logistic regression modeling was used to examine the associations of components of FVI/PA with CRLDS, both cross-sectionally ($n = 680$, including imputed values) and longitudinally ($n = 582$, including imputed values). Modeling employed gender, age, perceived income adequacy, and education as potential confounders.

Results: Cross-sectionally, vigorous PA, and leisurely walking PA, were independently associated with lower odds of CRLDS in all but the fifth model and green vegetables in all models. Longitudinally, green vegetables and interactions between the FVI summary score, the PA summary score, and other factors at wave 8 were most consistently associated with CRLDS at wave 10. In both cross-sectional and longitudinal models, the socioeconomic variables showed the strongest association as risk factors for CRLDS.

Limitations: Both FVI and PA were self-reported rather than observed, our cohort had limited geographic- and age-ranges, and confidence intervals for some results were broad.

Conclusions: Green vegetables, total FVI, and various aspects of PA showed protective effects regarding CRLDS. Therefore, the promotion of such lifestyles is likely to help prevent CRLDS in this population.

1. Introduction

Depressive morbidity represents a complex group of mental illnesses, including major depressive disorder, dysthymia, and clinically significant depressive symptoms (Castro-de-Araújo et al., 2013). Many studies have shown an important relationship between depressive symptoms and the risk of subsequently developing major depressive disorders (Blazer and Hybels, 2004; Steffens et al., 2006). Due to the association of depressive symptoms and major depressive disorder with multiple negative outcomes (Katon et al., 2005; Ravaglia et al., 2008), it is important to identify risk factors for precipitating or limiting these conditions, especially risk factors that are potentially modifiable.

The African American Health Study (AAH) is a population-based

panel study of 998 non-institutionalized African Americans empaneled in 2000–2001 (wave 1), when the cohort ranged in age from 49 to 65 years of age. We previously showed that this group at wave 1 evidenced a 21.1% prevalence of clinically relevant levels of depressive symptoms (CRLDS), which is higher than the American population in general (Miller et al., 2004). Thus, it appears as if strategies to prevent or ameliorate CRLDS in this population would be particularly valuable.

Among factors that may help prevent depressive morbidity, diet and physical activity (PA) have been studied (Lai et al., 2014; Lucas et al., 2011; Vallance et al., 2011). Chemical compounds related to antioxidants found in different types of food, especially in fruits and vegetables, show a direct action on or modify the expression of different brain molecules (Psaltopoulou et al., 2013; Shabbir et al., 2013;

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Willians and Spencer, 2012) related to depressive symptoms. Such findings have been observed in population data (in both cross-sectional and longitudinal studies) and in meta-analysis as well (Kingsbury et al., 2016; Liu et al., 2016; McMartin et al., 2013). Regarding PA, it has been hypothesized to have a positive effect on depressive symptoms via beneficial modulation of neuroinflammation and neurotrophin synthesis (Medina et al., 2015; Schuch et al., 2016). For example, in a 3-year longitudinal study in New York City, USA, a high level of physical activity was shown to be negatively associated with depressive morbidity (Joshi et al., 2016). In addition, a meta-analysis conducted by Cochrane group showed exercise as moderately more effective than a control intervention for reducing symptoms of depression (Cooney et al., 2013); however, results specifically for African Americans were not reported for either physical activity in general or intentional physical exercise.

Hence, a healthy diet and greater PA might protect against the development of depressive symptoms. However, epidemiological data have shown that the USA population has low levels of fruit and vegetable intake (FVI) and PA, and these deficits are more prevalent in African-Americans than in majority whites (Kieffer et al., 2006; Patterson et al., 1990). A previous study from AAH (Ribeiro et al., 2016), showed that only 36% of this population achieved the recommended intake of two or more fruits servings per day, and only 17% achieved the recommended intake of three or more vegetables daily (recommendations made by USDA, 2012). PA was also low in this cohort compared both to recommendations and to other study groups.

In all the prior studies examining the associations between FVI/PA and depressive symptoms that we were able to identify, African Americans were consistently underrepresented. The interest in this specific segment of population is its complexity. In general, African Americans are more exposed to low income, to low access to education, to unfavorable environment for physical activity practice, and to lower quality food sources and hence to higher nutritional risk. We therefore hypothesize that the effect of all these conditions on the risk of increased depressive symptoms and its associated consequences, will be particularly important in this population, which justifies the importance of doing this research. In this study, we used data from AAH to investigate the independent associations of components of FVI and PA (adjusted for other risk factors) with CRLDS in both cross-sectional and longitudinal analyses.

2. Methods

AAH has been described previously (Miller et al., 2004, 2005; Tabet et al., 2017). In brief, AAH is a population-based prospective cohort study of 998 urban-dwelling African Americans 49–65 years at baseline. Recruitment occurred between September 2000 and July 2001, with a baseline response rate of 76% (998 out of 1320). Participants either lived in a very poor area in the city of Saint Louis, Missouri, or in less impoverished suburban areas northwest of the city. Block groups with at least 10% African Americans based on the 1990 Census were identified using a geographic information system (GIS). A multistage cluster design was used to randomly select area segments within each block group and, subsequently, housing units within each area segment. If more than one household member met eligibility criteria, only one was selected (using random allocation tables) to be invited for study participation. Eligibility criteria included self-identification as Black or African American, birth date between January 1, 1936 and December 31, 1950 (inclusive), and willingness to complete written informed consent. Follow-up interviews occurred at 1, 2, 3, 4, 7 and 9 years after baseline. The present study used information from wave 8 (7 years after baseline) and from wave 10 (9 years after baseline). At wave 8, the number of interviewees was 680, and the number of participants who responded the variables related to the present study was 657. At wave 10, the number of interviewees completed was 582, but only 550 participants answered the questions and evaluations related to the

present study. Evaluations at waves 8 and 10 included the 11-item version of the Center for Epidemiological Studies- Depression (CES-D). A criterion score of 9 was used to indicate CRLDS, which is equivalent to the usual criterion of 16 or greater on the 20-item CES-D scale (Kohout et al., 1993). Using these data, participants were classified as having CRLDS or not at both waves 8 and 10.

Acquisition of the FVI and PA variables at wave 8 has been described previously (Ribeiro et al., 2016). In brief, participants were questioned about frequency of FVI (specifically whole fruits, fruits juices, green salads, carrots, and other non-potato vegetables). From this information, we also calculated total fruit and total vegetables intake. Those questions were obtained from the Behavioral Risk Factor Surveillance System (BRFSS) survey (Mokdad et al., 2003; Nelson et al., 2001). To measure PA, we used the Yale Physical Activity Survey (YPAS; Dipietro et al., 1993), which assesses several different components of PA: vigorous activity, leisure walking, moving, standing, and sitting. The YPAS also includes the Activity Dimensions Summary Index, which is calculated as the sum of the 5 individual weighted indexes, corrected by a factor related to the season of the year.

Other risk factors for CRLDS from wave 8 included the following items. Perceived income adequacy was measured using the following question from the National Opinion Research Center (NORC) at the University of Chicago: “When you consider your household income from all sources today, would you say that you are comfortable, have just enough to make ends meet, or do not have enough to make ends meet?” Age, gender, and years of formal schooling were obtained at wave 1 using standard questions, and age was adjusted for elapsed time since the wave 1 interview. All the interviews applied at wave 8 were performed in a time interval of four weeks.

2.1. Missing data

To deal with the missing data, we used imputed values, as follows: (a) for CES-D at wave 8 and wave 10, and for income adequacy at wave 8, we used last observation carried forward ($n = 23/680$, $n = 32/582$ and $n = 1/680$ respectively); (b) YPAS seasonally adjusted summary scale used the individual participant's summary scale and the total sample's item-mean for the seasonal adjustment value ($n = 4/680$); (c) imputation for fruits and vegetables was performed using the sample's item-means ($n = 2/680$ juices; $n = 2/680$ eat fruit; $n = 1/680$ greens; $n = 1/680$ carrots; $n = 3/680$ other). The YPAS scales and summary index scores were available for all of the analytic sample, and therefore, no imputation was needed.

2.2. Data analysis

Descriptive data were constructed using standard methods. To investigate associations of each component of FVI and PA plus other risk factors with the presence of CRLDS (the dependent variable) in both cross-sectional (dependent and independent variables at wave 8) and longitudinal analyses (dependent variable at wave 10, and predictors at wave 8) we performed five models of logistic regression. Considering that no previous research exists to test our hypothesis (different types of PA and different types of FVI), and because of the presence of some significant interactions, we decided to adopt stepwise regression. In addition, to avoid suppressor effect, we choose backward-stepwise binomial logistic regression with likelihood ratio statistics. We sequentially included in the models the potential predictive variables in the following order: Model 1 included only the FVI components individually (not the summations); Model 2 included only the PA components individually (not the adjusted summary); Model 3 included Models 1 and 2 together; Model 4 added demographic variables (age and gender) to the FVI and PA variables; finally, in Model 5, socio-economic variables (perceived income adequacy and years of formal education) were included in the model with the all the previous variables. The same five models were tested in longitudinal analyses.

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