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Vegetarian diet is inversely associated with prevalence of depression in middle-older aged South Asians in the United States

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Abstract

Objective: To investigate associations between a vegetarian diet and depression among South Asians in the United States.

Design: Data from 892 South Asians (age range 40–83 y, 47% women) enrolled in the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study were included. A vegetarian diet was defined as no intake of meat, poultry or fish in the previous year as reported on a validated food frequency questionnaire. Depressive symptomology was assessed using the Center for Epidemiologic Studies-Depression Scale (CES-D) and depression was classified as CES-D score≥16. Multivariable logistic regression was used and covariates included age, sex, study site, education, smoking, body mass index, acculturation, intentional exercise, alcohol and energy intake, and antidepressant medication use.

Results: Our study demonstrated 43% lower odds of depression among vegetarians (p=0.023).

Conclusions: Vegetarian diet was found to be inversely associated with prevalence of depression. Longitudinal examinations confirming these findings are needed.

Keywords

vegetarian; diet; depression; South Asians

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Disclosure statement

No potential conflict of interest was reported by the authors.

Introduction

Depression is a serious and common mood disorder affecting over 350 million people worldwide (Smith 2014). It is also a major contributor to Disability Affected Life Years, the overall global burden of disease, and is projected to be the leading cause of disease burden by 2030 (Smith 2014; Mathers 2008). Dietary behaviors and patterns are thought to play a role in depression. A recent review of the longitudinal associations between diet quality and depressive symptoms indicated that better diet quality examined using dietary indices and scores such as the Alternative Healthy Eating Index (AHEI), Mediterranean or Tuscan diet, among others, was associated with a lower risk. (Molendijk et al. 2018). Additionally, consumption of foods such as fish and vegetables were also related to lower depression risk.

A vegetarian diet has been considered to be healthy and reported to be associated with lower risk of some chronic diseases including diabetes, hypertension and subclinical atherosclerosis as well as lower body mass index (Fraser 2009; Acosta-Navarro et al. 2017; Baines, Powers, and Brown 2007). In our previous analyses, we showed inverse associations between a vegetarian diet and visceral fat, total and LDL cholesterol, fasting glucose, insulin resistance and odds of fatty liver and any coronary artery calcium (Jin et al. 2018). However, observational research conducted to date has demonstrated inconsistent findings on the associations of a vegetarian diet with depression with the majority of studies demonstrating higher risk of depression among vegetarians. For example, using cross-sectional data from the Avon Longitudinal Study of Parents and Children, Hibbeln et al. found that the risk of depression was 1.67 times higher for vegetarian compared to non-vegetarian men (Hibbeln et al. 2018). In a cohort of American college students, vegetarians and semi-vegetarians were more likely to report being depressed than non-vegetarians (Forestell and Nezlek 2018). Also, using data from the German Health Interview and Examination Survey and its Mental Health Supplement, the prevalence of mental disorders including depression was higher among both completely and predominantly vegetarians (Michalak, Zhang, and Jacobi 2012). In contrast to these studies, a longitudinal Spanish cohort study reported that higher adherence to a pro-vegetarian dietary pattern (operationalized to quantify the habit of consuming preferentially plant-derived foods instead of animal-derived foods but without the need to follow a strict vegetarian diet) was associated with a lower risk of depression and use of antidepressant drugs (Sánchez-Villegas et al. 2015), and using data from volunteers of Seventh Day Adventist communities, researchers found that vegetarians reported less negative emotions as assessed by Depression Anxiety Stress Scale and Profile of Mood States questionnaires (Beezhold, Johnston, and Daigle 2010).

Immigrants may be vulnerable to depressive symptoms because of additional stress from cultural barriers, lack of social support (Zisberg 2017), and social companionship such as eating together which is beneficial for psychological wellbeing (Wong, Yoo, and Stewart 2007). South Asians are individuals from countries of the Indian subcontinent including Bangladesh, Bhutan, India, Maldives, Pakistan, Nepal and Sri Lanka and are one of the fastest growing minority population in the United States (US) (Hoeffel et al. 2012). A high proportion of South Asians follow a vegetarian diet due to cultural traditions and religious reasons (Singh et al. 2014). The overall objective of this study was to examine the

associations between following a vegetarian diet and depression in a cohort of South Asian immigrants in the US.

Materials and methods

Participants and data collection

We used data from the baseline exam of the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study, a community-based cohort of South Asians from the San Francisco Bay and the greater Chicago areas. A total of 906 men and women, without known cardiovascular disease were recruited between 2010 and 2013 using surname-based recruitment methods; 14 participants with incomplete food frequency questionnaires or implausible energy intakes were excluded, leaving the analytic sample of 892 participants for these analyses. Detailed information on the MASALA study has been provided elsewhere (Kanaya et al. 2013). The study protocol was approved by the institutional review boards of University of California, San Francisco and Northwestern University. All participants signed informed consent prior to undergoing study procedures.

Measures

Depression was assessed using the Center for Epidemiologic Studies - Depression Scale (CES-D), which measured depressive symptoms in the previous week with a 20-item scale such as “I am quick tempered” (Radloff 1977). Participants responded “almost never”, “sometimes”, “often”, and “almost always” on the 20-item and received 0, 1, 2, and 3 points, respectively, so the overall score ranges 0–60. Participants with a score 16 or above were considered to have depression (Roux et al. 2006).

Dietary data were assessed using the validated Study of Health Assessment and Risk in Ethnic Groups food frequency questionnaire (FFQ). A participant was classified as being vegetarian, if they reported no consumption of meat, poultry, or fish in the previous year on the FFQ.

Covariates were selected based on previous literature and univariate analysis, and included age, sex, study site, education, income, smoking status, body mass index (BMI), acculturation, intentional exercise, alcohol and energy intakes, and antidepressant medication use. Acculturation was captured using the Traditional Cultural Beliefs scale which assessed how strongly participants believed that South Asian cultural practices should be maintained in the US and was categorized into strong, moderate and week based on established cut points (Kanaya et al. 2014). We used the Typical Week’s Physical Activity Questionnaire to assess intentional exercise (walking for exercise, dance, conditional activities, and sports), and the total metabolic equivalent minutes/week were used. Alcohol and energy intakes were estimated from the FFQ and used as grams of ethanol/day and kcal/day for analysis. The detailed measurements of covariates is available elsewhere (Kanaya et al. 2013).

Statistical analysis

Socio-demographic characteristics were compared between vegetarians and non-vegetarians with t-test or Mann-Whitney U test and Chi-square test for continuous and categorical variables, and mean (standard deviation), median (interquartile range) or percentages were reported, respectively. Multivariable logistic regression was used to examine the associations between depression and vegetarian status adjusting for covariates. In order to account for overall diet quality, a sensitivity analysis was conducted by additional adjusting for the AHEI score (Chiuve et al. 2012). The AHEI includes 11 food components with a total score ranged from 0 to 110, with higher AHEI scores indicating better diet quality. SAS 9.4 (SAS Institute, 2013) was used for all analyses with $p<0.05$ considered to be statistically significant.

Results

Table 1 shows socio-demographic characteristics by vegetarian status. About 38% of South Asians were vegetarian. Women, non-smokers, those with strong traditional South Asian beliefs and lower BMI tended to consume a vegetarian diet ($p<0.05$ for all). About thirteen percent of South Asians in this cohort had depression, and the prevalence of depression was higher among non-vegetarians (9.9% for vegetarians vs. 14.4% for non-vegetarians, $p=0.049$).

In the adjusted model, vegetarians had 43% lower odds of depression than non-vegetarians (odds ratio [OR] 0.57, 95% confidence interval [CI]: 0.35–0.92, $p=0.023$) (Table 2). Among the covariates, education, income and smoking status were also independently associated with depression, wherein a bachelor's degree or higher (OR=0.53, 95% CI: 0.30–0.93, $p=0.028$) and family income greater than or equal to $75000 (OR=0.46, 95% CI: 0.28–0.75, $p=0.002$) were associated with lower odds of depression, while being a current smoker (OR=3.25, 95% CI: 1.24–8.50, $p=0.016$) was associated with higher odds of depression. The significant results remained after additional adjusting for AHEI score, and the odds of depression was reduced by 4% per 1 point increase of AHEI score (OR=0.96, 95% CI: 0.92–0.99, $p=0.009$, data not shown).

Discussion

In our investigation of the relationship between following a vegetarian diet and depression, we found that the prevalence of depression in the MASALA cohort at baseline was 13%. And that following a vegetarian diet was associated with significantly lower odds of depression, independent of overall diet quality. Higher educational attainment and family income were also associated with lower odds of depression.

Compared to other ethnic groups, the prevalence of depression among South Asians (men: 11%, women: 15%) was higher compared to other US race/ethnic groups. In the Multi-Ethnic Study of Atherosclerosis, the prevalence of reported depression (CES-D≥16) were 7%, 8%, 13%, and 5% among non-Hispanic white, African American, Hispanic, and Chinese men, and were 12%, 15%, 28%, and 11% among non-Hispanic white, African American, Hispanic, and Chinese women, respectively (Peplinski, McClelland, and Szklo

2018). Reasons for the relatively higher prevalence of depression among South Asians could be manifold including the presence of stress due to adapting to a new culture and environment (Zisberg 2017) and as our study showed, maintenance of traditional cultural beliefs.

Previous literature has shown the protective associations of a pro-vegetarian dietary pattern with depression in a Spanish cohort with majority of middle-aged men and women over a median follow-up of 8.5 years (Sánchez-Villegas et al. 2015). While other studies have reported that a vegetarian diet is associated with higher risk of depression (Hibbeln et al. 2018; Michalak, Zhang, and Jacobi 2012) due to a lower intake of polyunsaturated fatty acids such as omega-3 fatty acids which are critical for brain functioning and decrease proinflammatory cytokines production during depression (Grosso et al. 2014). However, a vegetarian diet is generally characterized by higher intakes of grains, vegetables, nuts, beans and legumes, and therefore can be rich in antioxidant nutrients, folate, phytochemicals and fiber (Gangwisch et al. 2015).

For example, using data from the Women's Health Initiative Observational Study, higher intakes of dietary fiber were associated with lower incident depression after 3 years of follow-up (Gangwisch et al. 2015). Foods with high glycemic index tend to be low in fiber and may lead to may lead to hyperglycemia causing secretion of counter-regulatory hormones leading to anxiety and mood change (Gangwisch et al. 2015). Nutrients such as folate have also been shown to be correlated with brain function. A meta-analysis of studies examining the role of serum and dietary folate found that individuals with depression had significant less folate intake, and folate metabolism produces S-adenosylmethionine affecting neurotransmitters that are associated with depression (Bender, Hagan, and Kingston 2017). In previous analysis of the MASALA cohort, while omega-3 fatty acid intake was lower among vegetarians, no difference was observed in consumption of polyunsaturated fatty acids between vegetarians and non-vegetarians, and vegetarians reported higher intakes of fiber, folate and antioxidants such as vitamin C, which may partially explain the protective role of vegetarian diet on depression in the cohort at baseline (Jin et al. 2018).

Another reason for the inverse association between a vegetarian diet and depression in this cohort could be that following a vegetarian diet is a norm related to South Asian traditions, culture and religious affiliation which may result in no bias towards this practice. In the MASALA cohort, 38% of participants were vegetarians, while in the US, only 2.4% of the population were vegetarians according to the National Health and Nutrition Examination Survey 2003–2006 (Jaacks et al. 2016). Vegetarianism in the western society may be a target of bias because it challenges the social norm of western culture (MacInnis and Hodson 2017), and this may be a contributor to the presence of depression among vegetarians in the western countries shown in the previous studies. Our analysis showed that almost half of vegetarians had strong traditional beliefs. Since religion may be an important reason for following a vegetarian diet, this may lead to a better social support among those with similar religion, resulting in protection from depression (Park and Roh 2013).

The strengths of our study include the large community-based sample of South Asians and dietary assessment which incorporated cultural factors with South Asian specific dishes that has been previously validated among South Asians in Canada. The limitations include the cross-sectional design of the study, so no causal relationships can be concluded. There may be a likelihood for social bias for the assessment of depressive symptoms, since CES-D has not been validated in a South Asian population. And while the MASALA cohort is generally representative of South Asian immigrants in the US, its participants are middle aged and older with high education levels, and therefore our findings may not generalize to populations with younger South Asians or those with lower educational levels.

In conclusion, vegetarian diet is considered to be a healthy dietary pattern and has been shown to be associated with a lower risk of chronic diseases. Mental health is an important and growing public health concern. Our cross-sectional analyses showed that a vegetarian diet was associated with lower odds of depression among South Asians living in the US. Further investigations on longitudinal associations and mechanistic relationships of a vegetarian diet on depression are needed.

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Table 1.

Socio-demographic and health characteristics by vegetarian status in the MASALA cohort, 2010–2013

	Total N=892	Vegetarian N=335	Non-Vegetarian N=557	P value
Age (y)	55.3 (9.4)	55.6 (9.2)	55.2 (9.5)	0.558
Women, %	47.1	57.6	40.8	<0.001
Current smoker, %	3.1	1.5	4.1	0.029
Education ≥Bachelor's Degree, %	87.8	88.1	87.6	0.843
Income ≥ $75K, % (n=866)	73.6	70.8	75.2	0.158
Traditional cultural beliefs, %				<0.001
-Strong	33.4	44.7	26.4	
-Intermediate	29.9	29.0	30.4	
-Weak	36.7	26.1	43.2	
Intentional exercise (MET min/week)	945 (315–1856)	945 (420–1755)	960 (315–1890)	0.99
Body Mass Index (kg/m^2)	26.0 (4.1)	25.6 (4.1)	26.2 (4.1)	0.027
Alcohol intake (grams of ethanol/day)	2.8 (5.9)	1.0 (4.3)	3.8 (6.5)	<0.001
Energy intake (kcal/day)	1682 (504)	1597 (459)	1734 (523)	<0.001
Depression[a], %	12.7	9.9	14.4	0.049
Antidepressant use, %	3.7	3.3	4.0	0.610

Note: Data are mean (SD), median (interquartile range) or percentage.

[a]Depression defined as Center for Epidemiologic Studies - Depression Scale (CES-D) score ≥ 16.

Table 2.

Odds ratio (OR) for cross-sectional associations between vegetarian status and depression in MASALA cohort, 2010–2013

	OR (95% CI)	P value
Vegetarian vs. non-vegetarian	0.57 (0.35–0.92)	0.023
Covariates		
Age, y	1.00 (0.98–1.02)	0.940
Women vs. men	1.49 (0.93–2.37)	0.095
Study site, NWU vs. UCSF	1.09 (0.70–1.69)	0.712
Bachelor's Degree and above vs. below	0.53 (0.30–0.93)	0.028
Income ≥ $75K vs. < $75K	0.46 (0.28–0.75)	0.002
Current smoker vs. never/former smoker	3.25 (1.24–8.50)	0.016
Body mass index, kg/m^2	0.98 (0.93–1.03)	0.434
Traditional cultural beliefs		
-Intermediate vs. strong	0.81 (0.48–1.38)	0.443
-Weak vs. strong	0.70 (0.40–1.23)	0.211
Intentional exercise, MET min/week	1.00 (1.00–1.00)	0.135
Alcohol intake, grams of ethanol/day	0.98 (0.94–1.02)	0.332
Energy intake, kcal/day	1.00 (1.00–1.00)	0.613
Antidepressant use vs. no use	5.31 (2.39–11.78)	<.0001

Note: NWU= Northwestern University; UCSF=University of California San Francisco; MET=Metabolic equivalent