Journal of Psychosomatic Research 74 (2013) 142–148

Contents lists available at SciVerse ScienceDirect

Journal of Psychosomatic Research

Intake of Mediterranean foods associated with positive affect and low negative affect

Patricia A. Ford [a,*], Karen Jaceldo-Siegl [b], Jerry W. Lee [c], Wes Youngberg [d], Serena Tonstad [a]

[a] Loma Linda University, School of Public Health, Department of Preventive Care, United States
[b] Loma Linda University, School of Public Health, Department of Nutrition, United States
[c] Loma Linda University, School of Public Health, Department of Health Promotion and Education, United States
[d] Youngberg Lifestyle & Nurtitional Medicine Clinic, United States

ARTICLE INFO

Article history:
Received 27 June 2012
Received in revised form 2 November 2012
Accepted 5 November 2012

Keywords:
Affect
Dietary behaviors
Mediterranean
Mental health
Western

ABSTRACT

Objective: To examine associations between consumption of foods typical of Mediterranean versus Western diets with positive and negative affect. Nutrients influence mental states yet few studies have examined whether foods protective or deleterious for cardiovascular disease affect mood.
Methods: Participants were 9255 Adventist church attendees in North America who completed a validated food frequency questionnaire in 2002–6. Scores for affect were obtained from the Positive and Negative Affect Schedule questionnaire in 2006–7. Multiple linear regression models controlled for age, gender, ethnicity, BMI, education, sleep, sleep squared (to account for high or low amounts), exercise, total caloric intake, alcohol and time between the questionnaires.
Results: Intake of vegetables (β = 0.124 [95% CI 0.101, 0.147]), fruit (β = 0.066 [95% CI 0.046, 0.085]), olive oil (β = 0.070 [95% CI 0.029, 0.111]), nuts (β = 0.054 [95% CI 0.026, 0.082]), and legumes (β = 0.055 [95% CI 0.032, 0.077]) were associated with positive affect while sweets/desserts (β = −0.066 [95% CI −0.086, −0.046]), soda (β = −0.025 [95% CI −0.037, −0.013]) and fast food frequency (β = −0.046 [95% CI −0.062, −0.030]) were inversely associated with positive affect. Intake of sweets/desserts (β = 0.058 [95% CI 0.037, 0.078]) and fast food frequency (β = 0.052 [95% CI 0.036, 0.068]) were associated with negative affect while intake of vegetables (β = −0.076 [95% CI −0.099, −0.052]), fruit (β = −0.033 [95% CI −0.053, −0.014]) and nuts (β = −0.088 [95% CI −0.116, −0.060]) were inversely associated with negative affect. Gender interacted with red meat intake ($P<.001$) and fast food frequency ($P<.001$) such that these foods were associated with negative affect in females only.
Conclusions: Foods typical of Mediterranean diets were associated with positive affect as well as lower negative affect while Western foods were associated with low positive affect in general and negative affect in women.

Introduction

One in 17 Americans experience a serious mental illness in their lifetime while currently, only about 17% of United States adults are reported to be in an optimal state of mental health [1]. Associations between diet and mental illness have been reported, particularly with depression and anxiety [2–5]. However, little is known about the associations of dietary patterns and mental well-being [6,7].

Affect describes both the positive and negative facets of subjective well-being and has been shown to be independent of mental illness [8]. Positive affect has been associated with health outcomes including reduced cardiovascular disease risk [6]. Many of the dietary patterns associated with protection against cardiovascular disease may also be associated with mental health. Examples include prudent and Mediterranean dietary patterns characterized by a variety of fresh fruit and vegetables, certain dairy products, olive oil, fish and whole grains as well as vegetarian diets [4,9–12]. These dietary patterns are associated with improved mood states, improved self-reported functional health and quality of life and less depression in some studies [13–16]. Western dietary patterns characterized by intake of such foods as solid fats and refined sugars [3,17] and lack of omega-3 fatty acids have in contrast been associated with increased depression and negative mood states [18,19]. Recent research has increasingly focused on the role played by positive affect in health, not solely the detrimental effects of negative affect [6]. While the notion that foods reduce the risk of developing mental disease has been suggested [20], few studies have examined the relation between foods that may be protective against mental disease and promote positive affect.

In the current paper, we examined associations of consumption of foods typical of the Mediterranean diet and of Western diets with positive and negative affect. This was an observational analysis of a largely healthy cohort of Seventh-day Adventist church goers. This

* Corresponding author at: Loma Linda University, Department of Preventive Care School of Public Health, Loma Linda, CA 92354, United States. Tel.: +1 240 277 6826; fax: +1 909 558 0471.
E-mail addresses: paford@llu.edu (P.A. Ford), kjaceldo@llu.edu (K. Jaceldo-Siegl), jlee@llu.edu (J.W. Lee), dryoungberginfo@gmail.com (W. Youngberg), stonstad@llu.edu (S. Tonstad).

0022-3999/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jpsychores.2012.11.002

population spans a wide range of geographical locations and educational levels, has limited alcohol intake and is largely non-smoking [21], both potential confounders of associations of food and affect. Most importantly, this population follows a range of dietary patterns from vegan to non-vegetarian, as vegetarian diets have been historically encouraged by the church [22], providing ample opportunity to study diets and health outcomes.

Methods

Participants and design

Two sets of archival data were examined using an observational study design. The predictor (dietary) variables were assessed in 2002–6 among participants in the Adventist Health Study-2 (AHS-2) cohort. In brief, the AHS-2 cohort included approximately 96,000 subjects over 30 years of age who filled out a 50 page mailed questionnaire regarding their medical histories, lifestyle and dietary intakes. In 2006–7, the outcome variable (affect) was assessed in the Psychosocial Manifestations of Religion Sub-Study (PsyMRS), a sub-population of the AHS-2 study [21,23], which aimed to study connections between religion and health. Of 20,000 randomly sampled AHS-2 participants 10,988 responded to the 20-page PsyMRS questionnaire. The PsyMRS questionnaire included questions on mental health and religion [23]. Recruitment methodologies of subjects in both studies are described in previous literature [21,23].

All respondents that completed both AHS-2 and PsyMRS surveys were eligible for the present analyses (N = 10,988). Excluded in this study were subjects not well represented including those less than 35 years of age (N = 132), ethnicities other than Black or White (N = 700), non-Seventh Day Adventists (N = 363), and current smokers (N = 87), and subjects with an estimated energy intake <500 kcal/day or >4500 kcal/day or incomplete dietary data (N = 451) leaving 9255.

Dietary assessments

Dietary intake was assessed by a self-administered food frequency questionnaire (FFQ), which contains a list of over 200 food items including fruit, vegetables, legumes, grains, oils, dairy, fish, eggs and beverages, and commercially prepared products. This FFQ was designed to specifically assess dietary intake among a population where a large proportion is vegetarian. Respondents were asked about their intake of foods during the past year. Frequency categories range from *never or rarely*, 1–3 *times per month*, X *times per week* (where X was 1, 2 to 4, or 5 to 6) or Y *time per day* (where Y was 1, 2 to 3, or 4+). Portion sizes include *standard* (amount was dependent upon food item), 1/2 *or less* or 1 1/2 *or more*. The FFQ was previously validated against six 24-hour dietary recalls for intake of nutrients [24] and selected foods/food groups [25]. These studies showed that de-attenuated validity correlations in Whites for vegetables, fruits, dairy, all legumes and nuts, fish, red meats and soda were 0.66, 0.68, 0.86, 0.58, 0.53, 0.76, and 0.58, respectively. In Blacks, these were 0.41, 0.52, 0.82, 0.47, 0.57, 0.72 and 0.48, respectively.

The consumption of foods typical of Mediterranean or Western diets was assessed a priori based on hypothesized associations between foods and mental state. Mediterranean foods included non-starchy fresh vegetables, fresh fruit, certain dairy products, olive oil, nuts, fish, and legumes (excluding soy). Soy was excluded due to the wide range of processed and unprocessed foods that may include soy among people following vegetarian diets. Western foods included red meats, processed meats, sweets/desserts, soda, and fast foods. Associations between grain intakes and disease may depend on whether the grains are refined or whole, and also on the type of grain protein [26], and, thus, we did not aim to study these relationships and did not include grains. Furthermore, butter was not considered as butter may have positive or negative health effects [27] while fatty acid patterns were considered separately (submitted). Because the Mediterranean diet may include whole fat milk and yogurt, fatty dairy products were not separated from low fat products. Poultry was not analyzed because it may be part of both Mediterranean and Western diets.

Each food group was a composite of individual food items in the FFQ. Table 1 describes the food items used to classify the dietary food groups. Food intakes with the exception of fast foods were calculated using the product-sum method [28]. Thus, $I = \Sigma\ (F \times A \times S)$ where I = intake, F = weighted frequency, A = weighted amount and S = standard weight of a standard serving size in grams. Amount of food was coded into three options including standard serving size, 50% of the standard serving size and 150% of the standard serving size for each individual dietary variable. Missing values for amount of foods were coded as the standard serving size only if frequency was marked and amount was missing. If frequency was missing and amount of diet variable was missing, this diet variable was coded as zero. If frequency was missing and amount was marked, the diet variable was still coded as zero. Total energy intake was calculated using nutrient composition based from the NDS-R 2008 database (The Nutrition Coordinating Center), information from manufacturers, and the Caribbean Food and Nutrition Institute. Food intake was energy-adjusted using the residual method [28].

Table 1
Sixty-nine items from the FFQ used for classification of food types in Mediterranean and Western diet patterns

Mediterranean			
Fresh vegetables (13)	Dark green lettuce	Onions	
	Iceberg lettuce	Avocados	
	Tomatoes	Broccoli	
	Peppers, carrots	Cauliflower	
	Cabbage, brussels sprouts	Spinach	
	Kale, collards, mustard greens	Peas	
Fresh fruits (19)	Grapes in season and out of season	Persimmons in season	
	Plum in season and out of season	Apples	
	Apricot in season	Oranges	
	Cantaloupe in season and out of season	Grapefruits	
	Strawberry in season and out of season	Bananas	
	Blueberry in season and out of season	Fruit salad, fresh	
	Cherry in season and out of season		
Dairy (6)	Milk, whole or 2%	Low fat yogurt	
	Low fat milk, 1% or skim	Regular yogurt	
	Low fat cheese (mozzarella, ricotta)	Cottage cheese	
Olive oil (2)	Salad dressings		
	Added to breads, foods (aside from salads)		
Nuts (6)	Seeds (sunflower, pumpkin, sesame)	Walnuts	
	Mixed nuts	Almonds	
	Peanuts	Cashews	
Fish (5)	White fish (cod, salt-fish, sole, haddock or halibut, snapper, catfish)		
	Salmon	Tuna salad	
	Canned tuna	Tuna casserole	
Legumes (5)	Navy, red kidney, other red beans	Pinto, black	
	Lentils, split peas	Lima, white	
	Chick peas (garbanzos), black-eyed		
Western			
Red meat (2)	Hamburger, ground beef (in casserole, meatballs)		
	Beef or lamb as main dish (steak, roast, stew, pot pies)		
Processed meats (3)	Processed beef, lamb (sausage, salami, bologna)		
	Processed chicken or turkey (turkey bologna, turkey, ham)		
	Pork (bacon, sausage, ham, chops, ribs, lunch-meat)		
Fast food (1)	How often do you eat out: fast food/takeout		
Sweets and desserts (11)	Doughnuts, cake cookies, store-bought	Pastries cookies, homemade	Sweet pies ice cream, ice milk
		Cinnamon rolls	Milkshakes
		Frozen yogurt	
Soda (4)	Regular coke, Pepsi or other, caffeine free		
	Regular coke, Pepsi or other, with caffeine		
	Diet coke, Pepsi or other, caffeine free		
	Diet coke, Pepsi or other, with caffeine		