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Research report

Eating habits in relations to anxiety symptoms among apparently healthy adults. A pattern analysis from the ATTICA Study

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ABSTRACT

The effect of anxiety on dietary intake of humans has been investigated through a number of laboratory, clinical and cross-sectional studies; no prior study, however, has examined potential associations between anxiety and overall dietary patterns. Aim of the present work was to describe dietary patterns in relation to anxiety trait in a nationally representative sample of Greek adults from the ATTICA Study. A sample of 453 men and 400 women were randomly selected from various areas of Attica region, Greece. Anxiety levels were assessed through Spielberger State-Trait Anxiety Inventory. Dietary habits, socio-demographic and lifestyle characteristics were recorded for all participants. Principal component analysis was used for the extraction of dietary patterns. More anxious, compared to less anxious, men and women exhibited different dietary patterns. In particular, the "light" dietary patterns that were emerged in the less anxious men and women did not appear as distinct patterns among men and women in the upper anxiety tertile. In women, a "Western-type" diet explained two times greater variance of food intake of those in the upper-anxiety tertile, compared to their counterparts in the low tertile. A vegetarian pattern was found only among the less anxious women, who also exhibited the lowest consumption of red meat and sweets. Regression analysis supported and further elucidated previous results: after adjusting for potential confounders, sweets intake, as well as meat and products intake, were positively associated with anxiety score in females; in males a negative association was found with legumes/cereals intake. From a public health point of view, given the increased prevalence of anxiety and other mental disorders, these findings should be taken into account when designing and evaluating interventions for the general population.

Introduction

Food choice is a multidimensional behavior, influenced by a variety of factors, including psychological parameters. Despite the general interest in the relationship between psychology and nutrition, most of the literature so far refers to disordered eating behaviors, such as anorexia and bulimia nervosa, dietary restraint, binge eating, and it is mainly related to eating attitudes, hunger, appetite, satiety and control of eating. Little is known on the association between psychological parameters, such as anxiety, depression, perfectionism, impulsivity, and diet-related features, such as macro- and micro-nutrient intake, food choices and meal patterns.

Anxiety is one of the psychological factors that has received special attention during the last couple of decades due to, among others, its high prevalence rates and its association with chronic disorders, mainly coronary heart disease (Alonso et al., 2004; Kubzansky, Kawachi, Weiss, & Sparrow, 1998). Its effect on dietary intake of humans has been investigated through laboratory studies, where food intake was measured after provoking an acute stress to subjects (Goldfield & Legg, 2006; Grunberg & Straub, 1992; Oliver, Wardle, & Gibson, 2000; Polivy, Herman, & McFarlane, 1994; Ruderman, 1983; Zellner et al., 2006), in naturalistic studies, where changes in food intake were recorded in response to a naturally occurring period of stress (Bellisle et al., 1990; Cartwright et al., 2003; Hakkarainen et al., 2004; Oliver & Wardle, 1999; Pollard, Steptoe, Canaan, Davies, & Wardle, 1995;

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Wardle, Steptoe, Oliver, & Lipsey, 2000), as well as in cross-sectional studies, where measures of anxiety or stress were associated with subjects' current food intake (Liu et al., 2007).

Although one study reported no association between food preferences and anxiety (Bellisle et al., 1990), the rest of them have detected some significant results with regards to total energy intake, individual nutrients or foods. In specific, stress-perceived events, such as exam-stress, high workload or cognitive tasks, were found to induce increases in energy intake (Chaput & Tremblay, 2007; McCann, Warnick, & Knopp, 1990; Michaud et al., 1990; Pollard et al., 1995). Anxiety has also been associated with increased alcohol (Hakkarainen et al., 2004) and fat intake (Hakkarainen et al., 2004; Michaud et al., 1990; Pollard et al., 1995), including saturated fat and both omega-6 and omega-3 fatty acids, in the form of margarine. Pertaining to particular food items or food groups, stressed subjects tended to eat high-calorie sweet and salty snacks, whereas they were less likely to prefer fruits and vegetables, meat and fish (Cartwright et al., 2003; Oliver & Wardle, 1999; Zellner et al., 2006).

Sex, dietary restraint, emotional eating and obesity status have been reported to influence the association between anxiety and dietary patterns, although for obesity the evidence is conflicting and may be confounded by the previous factors (Greeno & Wing, 1994; Ruderman, 1983). Women, compared to men, may be more likely to increase food consumption, in particular sweet foods or fat consumption, in response to stress (Grunberg & Straub, 1992; Michaud et al., 1990; Zellner et al., 2006). Stress has also been found to induce hyperphagia in restrained eaters, with those perceiving the highest stress exhibiting the largest hyperphagic response, whereas unrestrained eaters demonstrated no change in food intake (Oliver & Wardle, 1999; Wardle et al., 2000). Consumption of sweet and fatty foods, in particular, was increased during stress by restrained, as well as by emotional eaters (Oliver et al., 2000; Wardle et al., 2000).

Moving from nutrients and foods to dietary patterns, no prior study has examined potential associations between anxiety and overall diet. Conceptually, dietary patterns represent a broader picture of food and nutrient consumption and dietary pattern analysis has emerged as an alternative and complementary approach to examine the relationship between diet and health (Hu, 2002). Therefore, aim of the present paper was to describe dietary patterns in relation to anxiety in a nationally representative sample of Greek adults from the ATTICA Study.

Methods

Sample of the study

The "ATTICA" Study (Pitsavos, Panagiotakos, Chrysohoou, & Stefanadis, 2003) was a health and nutrition survey conducted in the province of Attica, Greece. Seventy-eight percent of the participants lived in the city of Athens (urban), while 22% in the areas surrounding the city (rural). To select participants, a random, multistage sampling method was used, based on the age (five stages) and sex (two stages) distribution of the Attica province according to the 2001 Census of the National Statistical Service of Greece. A total of 4056 residents were randomly identified for potential inclusion in this project. Individuals that did not have a cold or flu, acute respiratory infection, dental problems or surgery of any kind during the week preceding the study were asked to participate. A total of 1514 men and 1528 women consented (75% participation rate); however, 5% of these men and 3% of these women were excluded from the present analyses due to clinical histories of cardiovascular disease. Psychological data were obtained from a sub-sample of 853 participants (453 men, age 41 ± 10 years; 400 women, age 37 ± 11 years) based on the study population according to the following algorithm: in each "block" (i.e., city–gender–age group) 1 in every four participants was randomly selected using a sequence of binary numbers (i.e., 1100101100). Therefore, this sub-sample was considered as representative of the study population, as well as the general population of Greece, with only minor, insignificant differences in the age–sex distributions between studied and target populations. The study was approved by the Medical Research Ethics Committee of the First Department of Cardiology, School of Medicine, University of Athens, Athens, Greece and it was carried out in accordance with the Declaration of Helsinki (1989) of the World Medical Association. For each subject all data were collected during a 3-day period, following standard procedures.

Socio-demographic, lifestyle and anthropometric characteristics

A standard demographic questionnaire was used to assess age, marital status, education levels, mean annual income over the last 3 years and occupation status. According to their reported smoking habits, participants were classified as current smokers (those who smoked at least one cigarette per day at the time of the study), former smokers (those who had stopped smoking, at least, 1 year before the study) and non-smokers (all other participants). Physical activity was defined as leisure-time activity of specified intensity (kcal/min expended) and duration (minutes per time), at least once per week during the past year. Participants who met this criterion were considered physically active, whereas the rest of them as physically inactive. Height and weight were measured and body mass index (BMI) was calculated. Obesity was defined as BMI > 29.9 kg/m^2. Dieting was also recorded for all participants (i.e., being on a specific diet for weight reduction or management of blood lipids, glucose and blood pressure levels, at least for the last year).

Dietary intake

Dietary assessment was based on the EPIC-Greek semi-quantitative food frequency questionnaire, which includes all major food groups [i.e., cereals, fruits, vegetables, nuts, legumes, potatoes, fish and seafood, red meat and its products, poultry, dairy products (low-fat and total dairy products), sweets, soft drinks, alcoholic beverages (including light soft drinks)] (Katsouyanni et al., 1997). In particular, consumption of 156 food items and their portion sizes as an average per week during the past year was recorded. The frequency of consumption was, then, approximately quantified in terms of the number of servings per month the food or food group was consumed. Alcohol consumption was measured in terms of daily ethanol intake (one 100 ml wine glass as 12% ethanol concentration) and coffee consumption as milliliters per day.

Psychological assessment of anxiety

The 20-item State-Trait Anxiety Inventory (STAI), state version, has been used for the assessment of current levels of anxiety symptomatology (Spielberger, Gorsuch, & Lushene, 1970). This self-reported short scale, which has been extensively applied in research and clinical practice, refers to the subjective and transitory feelings of tension, nervousness, worry and may be characterized by activation of the autonomous nervous system, at a given moment. The Greek translation of STAI was applied in this study (Fountoulakis et al., 2006). Cronbach's alpha was 0.93 and test–retest reliability was excellent, with Pearson coefficient being between 0.84 and 0.98 for individual items and equal to 0.96. For completing the scale, participants responded to each of the items with a frequency rating from 1 to 4 by describing the intensity of