Factors Associated with Adherence to the Mediterranean Diet in the Adult Population

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ABSTRACT

Our aim was to analyze the variables associated with adherence to the Mediterranean diet in the adult population. We conducted a cross-sectional study in an established cohort of 1,553 healthy study participants (mean age=55±14 years; 60.3% women). Mediterranean diet adherence was evaluated based on a 14-item questionnaire and the Mediterranean diet adherence screener, which defines adequate adherence as a score of ≥9. Physical activity was evaluated using the 7-day physical activity record. Sociodemographic, biological, and anthropometric variables were also evaluated. The differences between Mediterranean diet compliers and noncompliers are defined by the consumption of fruit, red meats, carbonated beverages, wine, fish/shellfish, legumes, pasta, and rice ($P<0.01$). Adherence was lower among individuals younger than 49 years of age. In the first age tertile, adherence was greater in women and in nonobese individuals, and the triglyceride levels were lower among compliers. In the second age tertile, the compliers exercised more and had a lower body fat percentage. In the third age tertile, the compliers also possessed less body fat. The logistic regression analysis revealed the following factors associated with improved Mediterranean diet adherence: more physical exercise (odds ratio=1.588), older age (odds ratio=2.162), and moderate alcohol consumption (odds ratio=1.342). The factors associated with improved Mediterranean diet adherence included female sex, age older than 62 years, moderate alcohol consumption, and more than 17 metabolic equivalents (METs)/h/wk of physical exercise. Poorer adherence was associated with males and obesity.
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EATING HABITS PLAY A CRUCIAL ROLE IN MAINTAINING health at both an individual and a population level.[1] Adherence to the Mediterranean diet reduces global mortality[2,3] and mortality due to cardiovascular diseases and cancer.[4] In addition, it reduces the incidence of Parkinson's disease[5] and is associated with a reduced risk of weight gain[6,7] and metabolic syndrome.[8]

Progressive Mediterranean diet abandonment is observed in the developed parts of the world, including the Mediterranean countries, due to the influence of new and unhealthy eating habits.[9] Several factors contribute to these changes, including food-preservation techniques, increased female participation in the labor market, and increased economic incomes. These changes have promoted modifications in both food choice and in food-preparation methods,[10,11] particularly among the younger population.[12]

Studies analyzing the role of a person's sex in Mediterranean diet adherence revealed that the strongest predictors of successful dietary changes were a low baseline consumption of fruits and vegetables, a family history of cardiovascular disease among men, and marriage for women.[13] Other studies have explored different predictors of good Mediterranean diet adherence, such as sociodemographic characteristics, general health status, lifestyle, and psychological factors.[14,15]

At least four large studies have analyzed Mediterranean diet adherence in Spanish populations. Three studies investigated specific populations: the European Prospective Investigation into Cancer and Nutrition (EPIC) study[16] investigated healthy volunteers, the Seguimiento Universidad de Navarra (SUN) study[12,17] investigated university students, and the Prevención con Dieta Mediterránea (PREDIMED) survey[13] investigated study participants with a high cardiovascular risk. Conversely, the Estudio de Nutrición y Riesgo Cardiovascular en España (ENRICA) study[18] assessed the Spanish population with a greater focus on dietetic pattern prevalence than on factors that influence the adherence to healthy eating habits. The profiles of individuals most likely to adhere to the Mediterranean diet and how these factors are associated with exercise frequency and other lifestyle habits in the Spanish population have not been fully established.

The present study, therefore, aimed to identify the individual characteristics, physical exercise frequency, and other lifestyle parameters associated with Mediterranean diet adherence among Spanish adults.

METHODS

Design

A cross-sectional and a multicenter study were done with six participating groups distributed throughout Spain according to the previously published protocol for the EVIDENT (Estilos de vida y envecimiento arterial [Lifestyles and Arterial Aging]) study (NCT01083082).[19]

Study Participants

Study participants (1,553), age 20 to 80 years, were selected by randomly sampling the population from six Spanish health centers. Study participants were excluded based on the following characteristics: known coronary or cerebrovascular atherosclerotic disease; heart failure; moderate or severe chronic obstructive pulmonary disease (COPD); walking-limiting musculoskeletal disease; advanced respiratory, renal, or hepatic disease; severe mental diseases; treated oncological disease diagnosed in the past 5 years; terminally ill diagnosis; and pregnancy.

The sample size calculation indicated that the 1,553 patients included in the study was sufficient to detect a difference of 0.5 points in the global score of the Mediterranean Diet Adherence Screener (MEDAS) between the age tertiles in a two-sided test, assuming a common standard deviation (SD) of 2 points with a significance level of 95% and a power of 90%.

The study was approved by an independent ethics committee of Salamanca University Hospital (Spain), and all participants provided written informed consent according to the general recommendations of the Declaration of Helsinki.[20]

MEASUREMENTS

Lifestyles

Study participants were classified into smokers or nonsmokers, and their alcohol consumption was classified into one of three categories: Category 1, abstemious; Category 2, males 1 to 16.9 g/wk, females 1 to 10.9 g/wk; Category 3, males $\geq$17 g/wk, females $\geq$11 g/wk.

Mediterranean Diet Adherence Screener (MEDAS). Adherence to the Mediterranean diet was assessed using the validated 14-point MEDAS,[21] an adaptation of a previously validated 9-item index.[22] The MEDAS was developed within the PREDIMED study group.[22,23] The MEDAS can rapidly estimate Mediterranean diet adherence and may be useful in the clinic. The 14-item screener includes 12 questions about food consumption frequency and two questions about food intake habits characteristic of the Spanish Mediterranean diet (Table 1). Each question was scored as a 0 or 1. One point was given for using olive oil as the principal source of fat for cooking, for preferring white meat over red meat, or for consuming (a) 4 or more tablespoons (1 T=13.5 g) of olive oil/day; (b) 2 or more servings of vegetables/day; (c) 3 or more pieces of fruit/day; (d) fewer than 1 serving of red meat or sausage/day; (e) fewer than 1 serving of animal fat/day; (f) less than 1 cup (100 mL) of sugar-sweetened beverages/day; (g) 7 or more servings of red wine/week; (h) 3 or more servings of pulses (beans/legumes)/week; (i) 3 or more servings of fish/week; (j) fewer than 2 commercial pastries/week; (k) 3 or more servings of nuts/week; or (l) 2 or more servings/week of a dish with a traditional sauce of tomatoes, garlic, and onions. The final score ranged from 0 to 14. A total score of 9 or more points was indicative of adequate Mediterranean diet adherence.[21]

Physical Activity

Physical activity was estimated with the 7-day physical activity recall. The 7-day physical activity recall is a general measure of physical activity that has been recognized as a valid and reliable tool and is widely used in epidemiological, clinical, and behavioral studies. This measurement consists of a semistructured interview (10 to 15 minutes) in which participants estimate the number of hours they have dedicated to physical or occupational activities requiring at least a moderate effort in the previous 7 days. The measurement differentiates moderate, hard, and extremely hard physical activity. The physical exercise dose was estimated in metabolic equivalents (METs)/hour/week. Active study participants were defined as engaging in at least 30 minutes of moderate activity 5 days/wk or at least 20 minutes of heavy activity 3 days/wk. The study participants who did not attain this physical activity level were considered to be sedentary.[24]

Anthropometric Measurements

Patients (wearing light clothing and no shoes) were weighed on two occasions using a homologated electronic scale (Seca 770) after calibration (precision$\pm$0.1 kg). Height was measured with a portable system (Seca 222) by recording the average of two readings. Body mass index (BMI) was calculated by dividing the weight (kg) by the height squared (m^2). A value of more than 30 indicated obesity. The waist circumference was measured as follows: the upper margins of the iliac crests were located, and the tape was wrapped around the body above this point, parallel to the floor, without compressing the skin. A measurement of less than 102 cm in males and 88 cm in females was characterized as normal.[25] The body fat percentage was measured using a body fat monitor (OMRON, model BF306).

Six trained research nurses gathered all of the measurements. A detailed description of how clinical data were collected, how anthropometric measurements were performed, and how analytical parameters were obtained has been published elsewhere.[19]

Statistical Analysis

The continuous variables were expressed as the mean$\pm$SD for normally distributed continuous data, as the median (interquartile range, IQR) for asymmetrically distributed continuous data, and as the distribution frequency for categorical data. Statistical normality was tested using the Kolmogorov–Smirnov test. The mean difference between two category quantitative variables was analyzed using the independent samples Student's t test for normally distributed continuous data and the Mann-Whitney U-test for asymmetrically distributed continuous data. The χ^2 test was used to contrast categorical data.

Stepwise logistic regression analysis was used with the following parameters: compliance or noncompliance with the Mediterranean diet (1=compliant; 0=noncompliant) was considered a dependent variable, and the independent variables included the age tertiles (1st=youngest; 2nd=medium age; 3rd=oldest), sex (0=female; 1=male), the METs/hour/week