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Dietary patterns, Mediterranean diet and obesity in postmenopausal women

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ABSTRACT

Objective: The aim of this work was to explore associations between *a priori* and *a posteriori* dietary patterns and obesity indices in a sample of postmenopausal women.

Study design and methods: The present cross-sectional study involved 481 postmenopausal women, aged 57.7 ± 7.4 years (range 32–77 years), recruited consecutively from the Menopause Clinic of a major public hospital. Basic demographic information, medical history and lifestyle data including physical activity were collected from study participants. Dietary intake was assessed through a validated food frequency questionnaire. *A posteriori* dietary patterns were identified using Principal Component Analysis. Adherence to an *a priori* dietary pattern, the Mediterranean dietary pattern, was evaluated through the Mediterranean Dietary Score (MedDietScore).

Main outcome measures: BMI, waist circumference, waist-to-height ratio.

Results: Overweight and obese women constituted 39.5% and 29.1% of the sample respectively. Multiple linear regression analysis showed that the Dietary Component 2 (characterized by high consumption of unrefined cereals and legumes and low consumption of refined cereals) was negatively associated with BMI (beta = −0.104, p = 0.057), waist circumference (beta = −0.120, p = 0.019) and waist-to-height ratio (beta = −0.105, p = 0.038). Another dietary pattern, characterized by high consumption of red meat and potatoes and low consumption of nuts and coffee/tea, was positively associated with BMI (beta = 0.191, p < 0.001), waist circumference (beta = 0.225, p < 0.001) and waist-to-height ratio (beta = −0.237, p < 0.001). The associations were independent of age, years since menopause, energy intake and physical exercise. Negative associations were also found between the MedDietScore and the obesity indices, which became, however, non-significant when implausible energy reports were excluded from the analyses.

Conclusions: Our results indicate that different dietary patterns are positively or negatively associated with obesity in postmenopausal women. Early interventions targeting dietary habits are of major importance for promoting health in this age group.

1. Introduction

Obesity and central adiposity are major health problems during the postmenopausal years. The menopausal transition is associated with hormonal changes, which contribute significantly to the increase in visceral fat mass and the development of abdominal obesity [1,2]. Along with the increasing age and the concomitant lifestyle changes, menopause predisposes to weight gain and obesity – related diseases. The postmenopausal period is characterized by a decrease in energy expenditure [3], mainly as a result of the reduction in physical activity [4]. Concomitant decrease in energy intake has also been observed, along with decreases in protein, carbohydrate, and fiber intake [4–6].

Little is known about the dietary patterns in postmenopausal women and their potential associations with obesity indices. Dietary patterns provide a wider picture of the diet and a more holistic approach compared to individual nutrient and food groups analysis [7]. Studying dietary patterns could have important public health and clinical implications: they are easily interpreted and provide guidance for nutrition intervention and education. In the dietary pattern research, both *a priori* and *a posteriori* approaches have been used. In postmenopausal women, for example, it has been found that two well-known a priori dietary patterns, the Mediterranean diet and the Dietary

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Approach to Stop Hypertension (DASH) were both protective against obesity [8]. In the community setting, however, there are wide variations in the dietary habits; adherence, therefore, to the DASH or to the Mediterranean diet may not always be feasible and women may follow a variety of patterns, not clearly depicted so far. In this context, the identification of *a posteriori* dietary patterns and their potential association with adiposity in postmenopausal women is important from a clinical point of view and it is lacking from current literature.

The aim of the present cross-sectional study was to explore the dietary intake and patterns in a large sample of Greek postmenopausal women, using *a priori* and *a posteriori* approaches, and to evaluate potential associations with Body Mass index (BMI), waist circumference and waist-to-height ratio.

2. Methods

2.1. Study population

The study sample consisted of 481 postmenopausal women (aged 57.7 ± 7.4 years, from 32 to 77 years). Participants were consecutively recruited from the Menopause Clinic of Aretaieio Hospital from September 2014 to December 2015. All women, who visited the clinic and had follicle stimulating hormone > 25 mIU/mL and estradiol < 50 pg/mL, after 12 consecutive months without menses, were eligible for the study. Eligible volunteers were informed about the aim and the procedures of the study and they were asked to sign an informed consent. Most of them (~90%) accepted to participate in the study. The study protocol was approved by the Ethics Committee of Aretaieio Hospital (approval number B – 22/19-12-2013).

2.2. Assessments

Qualified medical doctors and trained dieticians administered all questionnaires, took the measurements and conducted the interviews.

2.2.1. Demographic and anthropometric characteristics

Demographic data (including age, level of education and smoking), clinical and anthropometric information were collected all participants. Systolic and diastolic blood pressure and heart rate were obtained with the participants in the sitting position. Blood pressure was measured in the right arm with the participant seated, who had not smoked or consumed any caffeinated beverages within 30 min of blood pressure measurement. A standard mercury sphygmomanometer was used to record systolic and diastolic pressures at the first and fifth Korotkoff sounds. Three consecutive blood pressure measurements were obtained with a 2 min minimum rest. Weight and height were measured on a levelled platform scale and a wall-mounted stadiometer, to the nearest 0.5 kg and 0.5 cm, respectively. Body mass index (BMI) was calculated as weight divided by height (kg/m^2). Obesity status of the participants was evaluated based on the World Health Organization's BMI cut-off points [9]: 18.5–24.9 kg/m^2 as normal-weight; 25.0–29.9 kg/m^2 as overweight and ≥30.0 kg/m^2 as obese. Waist circumference (cm) was measured in the middle between the 12th rib and the iliac crest and based on World Health Organization waist circumference cut-off points, i.e. women with > 80 cm waist circumference were in increased risk of metabolic complications [10]. Waist-to-height ratio index, as a measure for discriminating obesity-related cardiometabolic risk [11], was calculated as waist circumference divided by height.

2.2.2. Medical history

A brief medical history was recorded in all participants. Type 2 Diabetes mellitus was identified by fasting glucose levels higher than 126 mg/dl or intake of glucose-lowering medications. Participants whose average of the three consecutive measurements of blood pressure levels were higher or equal to 140 and/or 90 mmHg or reported use of antihypertensive medication were classified as having hypertension. Dyslipidemia was identified as total cholesterol levels higher than 200 mg/dl or triglycerides levels greater than 200 mg/dl or the use of lipid-lowering agents. Obstetric and gynecological history was also recorded, including age at menarche, age at menopause, parity and duration of breastfeeding.

2.2.3. Physical activity

Physical activity levels were assessed using the short version of the International Physical Activity Questionnaire – IPAQ [12], translated and validated in the Greek population [13], which provides information on time spent walking, in vigorous- and moderate-intensity activities and in sedentary activities (expressed in MET-minutes per week). Participants were instructed to recall the last seven days and refer to all domains of physical activity.

2.2.4. Dietary intake

Dietary intake was evaluated with a 65-item semi-quantitative food frequency questionnaire developed and validated for the Greek population [14]. The questionnaire was completed by each participant with the aid of an experienced investigator (AE). Responses were converted to daily food intakes and then extrapolated into macronutrient intakes. Energy intake was calculated by summing energy intake from macronutrients, assuming 4 kcal/g for carbohydrates and proteins and 9 kcal/g for lipids. Dietary intake was also grouped into 19 food groups featuring the core foods of the Greek diet [15], namely unrefined cereals, refined cereals, potatoes, fruits, juices, vegetables, legumes, fish, red meat, cold cuts, poultry, full fat dairy, low fat dairy, sugar/honey/jam, sweets, nuts, alcohol, coffee/tea and beverages. Adherence to an a priori dietary pattern, the Mediterranean dietary pattern, was evaluated through the Mediterranean Dietary Score (MedDietScore), ranging from 0 to 55, with higher values indicating greater adherence to the Mediterranean dietary pattern, as proposed by Panagiotakos et al. [16]. Finally, reports of energy intakes < 500 kcal/day or ≥3500 kcal/day were classified as implausible, based on the recommended method [17].

2.3. Statistical analysis

Normally distributed continuous variables are presented as mean values ± standard deviation, whereas non-normally distributed variables are presented using the median value and the 25th and 75th percentiles. For continuous variables, One Way Anova criterion was used to examine possible associations between BMI groups.

Dietary patterns were identified using Principal Component Analysis (PCA) with varimax rotation [18], applied for the whole sample using as variables the 19 food groups. Generated principal components are non-correlated variables; their optimal number was chosen based on the Kaiser criterion of unit eigenvalue. A food group was assigned to a certain component if the corresponding component score was greater (by absolute value) than 0.3. The relationships between dietary patterns (explanatory variables) and BMI, waist circumference and waist-to-height ratio (dependent variables) were examined using multiple lineal regression analysis. Results are presented as standardised beta coefficients, after controlling for potential confounders, i.e. age, years of menopause, physical activity and energy intake. The assumptions of linearity for the continuous independent variables and constant variance of the standardised residuals were assessed through plotting the residuals against the fitted values. For all analyses the significance level was set at 0.05.

3. Results

The mean age of our sample was 57.7 ± 7.4 years (range 32–77 years). Overweight and obese women constituted the majority of our sample (39.5% and 29.1% respectively). Demographic and clinical characteristics were evaluated by BMI group (Table 1). Compared to