



Applied nutritional investigation

Diet and its relationship to sarcopenia in community dwelling Iranian elderly: A cross sectional study



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ABSTRACT

Objectives: Sarcopenia is associated with frailty and disability among the elderly and imposes significant costs on health care systems. We tested whether adherence to a particular dietary pattern was associated with sarcopenia among the elderly in a district of Tehran, Iran.

Methods: We used a semiquantitative Food Frequency Questionnaire to assess the dietary intake of 300 randomly-selected elderly men and women (at least 55 y old) living in the sixth district of Tehran; and the dietary patterns of the subjects were obtained using principal component analysis. We performed a logistic regression to measure the effect of adherence to each dietary pattern on the odds of sarcopenia.

Results: Subjects in the highest tertile of the Mediterranean dietary pattern, characterized by a higher consumption of olive oil, fruits, vegetables, fish, and nuts, had a lower odds ratio for sarcopenia than those in the lowest tertile (OR = 0.42; 95% CI = 0.18–0.97; *P* for trend = 0.04). In contrast, adherence to the Western dietary pattern, characterized by a high consumption of sugar, soy, and fast foods, was not associated with sarcopenia (OR = 0.51; 95% CI = 0.21–1.24; *P* for trend = 0.13). Similarly, adherence to the Mixed dietary pattern, characterized by a high consumption of animal proteins, potatoes, and refined grains, did not affect the odds of sarcopenia (OR = 1.45; 95% CI = 0.66–3.19; *P* for trend = 0.95).

Conclusions: This study suggests that adherence to the Mediterranean diet is associated with lower odds of sarcopenia among the Iranian elderly.

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Introduction

Aging is associated with changes in the composition of the human body [1] and a decline in bone mass and muscle mass [2]. The age-related decline in muscle mass was first coined as “sarcopenia” by Irwin Rosenberg [3] in 1998. More recently, the European Working Group on Sarcopenia (EWGSOP) developed a new clinical definition for it [4] as the presence of low muscle

mass combined with low muscle function (measured either by muscle strength or muscle performance). Sarcopenia is a multifactorial disorder. Possible causal factors include age-related changes in the secretion of trophic hormones, malnutrition and decline in dietary intake, changes in physical activity and a sedentary lifestyle, and decreases in muscle innervation and capillary density [5].

Sarcopenia imposes significant costs on health care systems. In the United States alone, sarcopenia-related costs were estimated to be more than \$18.5 billion in 2000 [6]. Sarcopenia is considered to be the underlying cause of frailty [7], which in turn the sixth cause of death among people over 65 y old [8]. Sarcopenia also increases the risk of falling and disability among

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the elderly [9]. Roth et al. [6] showed that the rate of physical disability and functional impairment is 2 to 3 times higher in the sarcopenic population. The modifiable behavioral factors such as physical activity level, androgen hormone level, smoking habits, and, particularly, the quality and quantity of dietary intake [10] can be important to delaying or even preventing sarcopenia.

Numerous studies have looked at the association between single nutrient intake such as protein [11–18], vitamins [17,19,20], minerals [21], and antioxidants [22], and sarcopenia. These studies have reported Mixed results regarding the existence of such association [23]. However, the linkage between dietary patterns and sarcopenia has yet to be studied. The most recent studies on dietary patterns have focused on the association between adherence to a particular dietary pattern and factors such as muscle strength, muscle performance [24,25], or frailty [26,27]. Nevertheless, none have examined the association with sarcopenia.

Dealing with sarcopenia is of greater relevance in countries with a large aging population. In Iran, the second largest country of the Middle East, the aging of population looms large on the horizon. The rather unusual age structure of this country, with two thirds of the population under the age of 30, has turned the aging-related issues, such as sarcopenia, into national priorities. However, to our knowledge, the issue of sarcopenia has never been studied in this region and particularly in Iran.

In this study, we first identified sarcopenic cases among the elderly in a community-dwelling population of Iran's capital, Tehran. Next, we identified the major dietary patterns in our sample using principal component analysis. Finally, we examined the association between adherence to each dietary pattern and sarcopenia and its components, which include muscle mass, muscle strength, and muscle performance.

Materials and methods

Data collection

Data for the present study were collected using a survey designed by the authors from May to October of 2011 (for a detailed report on the sampling method and data collection procedure, please refer to [28]). (The study was approved by the Ethics Committee of Endocrinology and Metabolism Research Center of the Tehran University of Medical Science, code: E-00148). In this survey, 300 elderly men and women (55 y old and older) who lived in the sixth district of Tehran were selected using cluster random sampling. The head of each cluster was selected based on a 10-digit postal code. General characteristics of study participants have been shown on Table 1. Following other epidemic sarcopenia studies in the literature [5,29] and to ensure the homogeneity of our sample, we did not invite people whose potential cause of sarcopenia could have been factors other than aging. These cases, which are referred to as secondary sarcopenia in the literature [4], included people with limited mobility and people with a history of debilitating disease (e.g., chronic heart disease). For the same reason, we did not invite people with artificial limbs or limb prostheses as their lower muscle mass make their population incomparable with the general population.

During the home interviews, the individuals were briefed about the project's objectives and, for those who agreed to participate, clinic appointments were scheduled. Except for the informed consent forms, which were completed personally by the participants, all of the questionnaires were completed by a trained dietitian. The first questionnaire pertained to the socio-economic characteristics of the individual, as well as her medical history and medication use, smoking habits, and alcohol consumption. Two other supplementary questionnaires were also completed including a questionnaire about the participant's food intake (the Food Frequency Questionnaire or FFQ) and a questionnaire about the physical activity information (the short form of the International Physical Activity Questionnaire or IPAQ) [30].

FFQ collected information about the participant's consumption frequency of 117 common Iranian food items by their standard serving size [31]. Although the questionnaire had been previously validated [32], we examined its relative validity and reliability in a small pilot study on 30 older adults (mean age of 65 y) before the data collection stage. We asked each participant of the pilot study to record his/her food consumption for 2 d of a sample week and compared those food records with the FFQ results that had been completed for the individual by a

trained dietitian. We repeated the same sequence after 2 mo and again compared the food record results with the FFQ results. These comparisons revealed reasonable correlations between the dietary intakes assessed by the FFQ and those from the self-reported food records. The correlation coefficients for animal protein, fruits, and vegetables were 0.43, 0.57, and 0.45, respectively.

The validity of the second supplementary questionnaire, IPAQ, for assessment of physical activity in Iranian adult population has been reported in prior studies [33]. Following IPAQ's guidelines [34], each participant's level of physical activity was calculated and reported in the form of a metabolic equivalent (MET-h/week).

Identifying major dietary patterns

We used principal component analysis to identify dietary patterns from the dietary data collected by FFQ. We categorized 117 food items in the FFQ into 30 general food groups based on the similarity of nutrients and following the general groupings of the National Nutrient Database for Standard Reference provided by the U.S. Department of Agriculture (USDA) [35]. Table 2 reports the list of groupings and the corresponding FFQ food items. We then calculated the total consumption (grams per day) of each individual from each food group [36]. We used principal component analysis to extract the common dietary patterns based on the 30 food groups. To ensure the independence of the identified dietary patterns we used the orthogonal varimax rotation method. This method maximizes the sum of the variances of the squared loadings and results in the extraction of independent factors. To determine which dietary pattern to retain we used the natural interpretation of the patterns along with eigenvalues > 1.4 and the Scree plot, which is a graphical display of eigenvalues of derived factors. We labeled the resulting dietary pattern based on our interpretation of the data and of other similar studies in the literature.

For every participant, a pattern score was calculated for each one of the identified dietary patterns representing his/her adherence to that particular dietary pattern. To calculate the score, we summed the intakes of 30 food groups weighted by their factor loadings [37]. Participants were then categorized based on the tertiles of these pattern scores.

Identifying sarcopenic cases

According to EWGSOP, sarcopenia is defined as a combination of relatively low appendicular muscle mass with either low muscle strength or low muscle performance. The muscle mass was calculated as the ratio of an individual's total lean mass of legs and arms (also called Appendicular Skeletal Muscle or ASM) [38] to their squared height ($ASM/height^2$). ASM was measured using a DXA

Table 1
General characteristics and dietary intakes of study participants

Variables	Mean ($\pm$ SD)
Age	66.8 $\pm$ 7.72
BMI (kg/m ²)	27.3 $\pm$ 4.2
Physical activity (MET-h/w)	21.5
Sex(female) %	50
Education %	
Under diploma	5.7
Diploma	27.7
Bachelor	66.7
Alcohol use %	13.3
Smoking %	12.6
Medical history	
Diabetes %	20.7
MI %	12
CVA %	2.7
Arthritis %	1.7
Asthma %	2
Drug history	
Sexual hormone use %	3
Statin use %	36.7
ACE inhibitor use %	7.7
Corticosteroid use %	3
Dietary intake	
Total energy (kcal/day)	2262 $\pm$ 929
Carbohydrate (g/day)	366 $\pm$ 176.3
Protein (g/day)	86 $\pm$ 32.5
Fat (g/day)	59 $\pm$ 28.6
Number of sarcopenic cases	54
Number of observation	300

BMI, body mass index

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