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Short report

Adherence to Mediterranean diet and nutritional status in a sample of nonagenarians

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ABSTRACT

Objective: The aim is to describe the adherence to Mediterranean diet in a sample of nonagenarians and to analyse its cross-sectional association with anthropometric and bioelectrical parameters.
Design: A cross-sectional design was employed in this study. The adherence to the Mediterranean diet was measured through the Mediterranean Diet Score (MedDietScore).
Setting and participants: A representative sample of nonagenarian residents in the eight municipalities belonging to Mugello (Florence, Italy).
Measurements: The tools used to investigate the nutritional status and the body composition were: weight; ulna length to estimate the height; body mass index (BMI); mid-upper arm circumference (MUAC); calf circumference (CC); waist circumference (WC); hip circumference (HC); and *specific* bioelectrical impedance vector analysis (BIVA*sp*).
Results: All the measurements were carried out for 298 nonagenarians (70.8% of whom were females). The mean value of MedDietScore was 34.3 ± 3.6. The MedDietScore was significantly correlated with CC (r = 0.127), *specific* resistance (R*sp*, r = 0.152), and *specific* impedance (Z*sp*, r = 0.153) in the whole sample, as well as with height (r = − 0.222), R*sp* (r = 0.282), and Z*sp* (r = 0.282) in males. In the whole sample, R*sp* and Z*sp* mean values significantly increased by quartiles of MedDietScore; these results were confirmed by vector analysis.
Conclusions: The high level of adherence to Mediterranean diet could contribute to explaining the longevity of our sample. Studying the influence of dietary lifestyle in nonagenarians in depth could help to promote healthy ageing.

1. Introduction

Both the proportion and the absolute number of older people in populations around the world are increasing dramatically (World Health Organization, 2015). According to some published reports, people older than 85 years comprise the fastest growing population segment in all high-income countries (Moore, 2007; Rikkert and Melis, 2013). Nonagenarians represent a peculiar age group that is different from people of lower decades (Franceschi et al., 2007; Cevenini et al., 2014). Quite a few epidemiological studies have specifically focused on this age class, but only some of them have investigated body composition and dietary patterns.

Nutrition and eating habits play an important role in predicting mortality, mobility (physical impairment), and healthy ageing (Avery et al., 2014; Aiello et al., 2016). The Mediterranean Diet (MD) is one of the most studied healthy dietary patterns (Sofi et al., 2014). It is characterized by a high intake of fruit and nuts, vegetables, legumes, cereals, fish, and seafood; a low intake of dairy products, meat, and meat products; and a moderate ethanol intake, mainly in the form of wine during meals (Bach-Faig et al., 2011; Naska and Trichopoulou, 2014). From the 'nutrient' point of view, it is an alimentary regimen with low-glycaemic index and low animal-protein intake, which contains phytochemical compounds with anti-inflammatory and anti-oxidant effects (Davis et al., 2015). Studies conducted on the elderly population have confirmed its role in predicting mortality, preventing age-related diseases, and attaining longevity (Lasheras et al., 2000;

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Knoops et al., 2004; Vasto et al., 2012a, 2014; Trichopoulou et al., 2015).

Some studies have investigated the relationship between the adherence to MD and the nutritional status in children, adolescents, adults, and the elderly, with different results. While a strong adherence to the MD is inversely associated with overweight or obesity in children and adolescents (Santomauro et al., 2014; Tognon et al., 2014; Mistretta et al., 2017), in adults and elderly people the relationship between the nutritional status and this dietary pattern is a matter of discussion (Lasheras et al., 2000; Trichopoulou et al., 2005; Rossi et al., 2008; Grosso et al., 2014a, 2014b; Bertoli et al., 2015; Zaragoza Martí et al., 2015; Bonaccio et al., 2016).

The aim of this study is to describe the adherence to the MD in a sample of nonagenarians and to analyse its cross-sectional association with anthropometric and bioelectrical parameters.

2. Methods

In the area of Mugello (Florence, Italy), a representative sample of nonagenarians was enrolled in a survey aimed at investigating different health issues, including those related to nutritional status, body composition, and dietary pattern of consumption. The survey was conducted in 2010–2011. The study design and the general characteristics of the participants have been previously described (Molino-Lova et al., 2013).

In brief, all the nonagenarian residents in the eight municipalities belonging to Mugello, along with their general practitioners, were contacted by letter and then by telephone to ascertain their availability to participate in the study and to arrange a time for visit. The study protocol, which complied with the principles of the Declaration of Helsinki on clinical research involving human subjects, was approved by the Institutional Review Board. All participants, or proxies, signed the informed consent form to be included in the study.

In this paper, we have examined their adherence to the MD, their nutritional status, and their body composition. Specifically, the adherence to the MD was measured through the Mediterranean Diet Score (MedDietScore). Moreover, the following measures were used to investigate the nutritional status and the body composition: weight; ulna length to estimate the height; body mass index (BMI); mid-upper arm circumference (MUAC); calf circumference (CC); waist circumference (WC); hip circumference (HC); and bioelectrical impedance vector analysis (BIVA).

2.1. Mediterranean Diet Score (MedDietScore)

The MedDietScore was developed by Panagiotakos et al. (2006), following the rationale of the Mediterranean dietary pattern. It is a diet score that assesses the consumption of the following 11 food groups: non-refined cereals (whole bread, pasta, rice, other grain, biscuits, etc.), fruit, vegetables, legumes, potatoes, fish, meat and meat products, poultry, full-fat dairy products, olive oil, and alcohol. In our sample, data on food consumption frequency were collected by consulting the elderly and/or those who were involved in the preparation and/or administration of their meals. To get the score, individual rating (from 0 to 5 or reverse) was assigned to each food group. Based on the Mediterranean pyramid, for the consumption of the items presumed to be close to this pattern (i.e. non-refined cereals, fruits, vegetables, legumes, olive oil, fish, and potatoes), a score of 0 was assigned when someone reported no consumption, a score of 1 when they reported consumption of one to four servings/month, a score of 2 for five to eight servings/month, a score of 3 for nine to 12 servings/month, a score of 4 for 13 to 18 servings/month, and a score of 5 for > 18 servings/month. Furthermore, for the consumption of items presumed to be away from this pattern (i.e. meat and meat products, poultry, and full-fat dairy products), a score on a reverse scale was assigned. For alcoholic beverages, a score of 5, 4, 3, 2, 1, or 0 was assigned for consumption < 300 ml of alcohol/day, equal to 300 ml/day, 400 ml/day, 500 ml/day, 600 ml/day, or not < 700 ml/day, respectively. A score of 0 was assigned for no consumption of alcoholic beverages as well. The total score was calculated as the sum of the scores attributed to each item, and ranges from 0 to 55 (higher values indicate greater adherence to Mediterranean diet). Using the quartiles of the MedDietScore, the subjects were classified as with a score lower than the first, between the first and the second, between the second and the third, or higher than the third quartile.

Table 1
Descriptive analysis of the Mediterranean Diet Score (MedDietScore).

	Males (*N* = 87)	Females (*N* = 211)	Total (*N* = 298)
Mean	34.3	34.3	34.3
Standard deviation	3.4	3.7	3.6
Minimum	26	10	10
Maximum	41	42	42
First quartile	32	32	32
Second quartile	34	35	34.5
Third quartile	37	36	37
Kurtosis	− 0.05	8.50	6.5
Standard error of kurtosis	0.51	0.33	0.28
Skewness	− 0.38	− 1.57	− 1.27
Standard error of Skewness	0.26	0.17	0.14
Kolmogorov–Smirnov test (*p*)	0.200	< 0.001	< 0.001

Males vs females, Mann–Whitney U test: $p = 0.965$.

2.2. Anthropometric measurements

Weight, ulna length, MUAC, CC, WC, and HC were measured according to standard procedures (Lohman et al., 1992; British Association for Parenteral and Enteral Nutrition, 2003). Weight was measured using a portable scale, while ulna length, MUAC, CC, WC, and HC were measured using a non-stretchable fiberglass insertion tape. The MUAC was measured half-way between the acromion and the olecranon process. The ulna length was measured between the olecranon and the midpoint of the styloid process; the ulna length was used to estimate the height of the subjects (British Association for Parenteral and Enteral Nutrition, 2003; Lorini et al., 2014). Weight and estimated height were used to calculate the BMI. CC was measured by wrapping the tape around the widest part of the calf. WC was measured around the smallest circumference between the lowest rib and the iliac crest, or midway between the lowest rib and iliac crest for obese subjects with no natural waist. HC was measured horizontally at the level of the greatest lateral extension of the hips.

2.3. Bioelectrical impedance vector analysis (BIVA)

BIVA provides a semi-quantitative evaluation of body cell mass and body water, based on the analysis of the bioelectrical impedance (Z, ohm) in the human body. The components of bioelectrical impedance are the resistance (R, ohm) and the reactance (Xc, ohm). R and Xc were obtained by using a single-frequency impedance analyser with an operating frequency of 50 kHz at 800 mA (EFG, Akern S.r.l, Italy). R correlates negatively with body fluids, while Xc correlates positively with body cell mass. The accuracy was determined by using a calibration circuit of known impedance ($R = 380\ \Omega$, $Xc = 47\ \Omega$, 1% error).

Whole-body impedance measurements were taken using the standard positions of the outer and inner electrodes on the right hand and foot (tetrapolar technique). The phase angle (PA, degrees) was calculated as arctan (Xc/R), and Z as $(R^2 + Xc^2)^{0.5}$.

There are two different BIVA approaches that can be used—the classic method, which involves standardizing the R and Xc values based on the subjects' height to remove the conductor length effect, and the *specific* method, which involves standardizing the R and Xc values based