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RESEARCH ARTICLE



Adherence to the traditional Mediterranean diet in a population of South of Italy: factors involved and proposal of an educational field-based survey tool

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ABSTRACT

We developed and validated a tool assessing the adherence to the Mediterranean diet based on current nutritional recommendations for health promotion (MEDI-Quest). Four-hundred-and-eleven clinically healthy subjects completed both the MEDI-Quest-score and the validated MedDietScore (MDS). A good accordance between MEDI-Quest and MDS was observed ($R = 0.638$), as well as for the percentage of individuals having similar scores with both methods for each food group. Regarding socio-cultural-factors, higher adherence was observed in people with older-age ($OR = 1.030$, $p < .0001$), more qualifier-employment ($OR = 1.136$, $p < .005$), higher-income ($OR = 1.925$, $p < .0001$), interest in reading-food-labels ($OR = 2.057$, $p < .0001$), and having frequent physical activity ($OR = 1.608$, $p < .05$). In conclusion, our findings show that (1) the MEDI-Quest score well correlate with MDS, and (2) the adherence to the Mediterranean diet is not particularly high due to less cultural roots. It could be necessary to improve people's knowledge about food and nutrition, taking into consideration beliefs embedded in their family, tradition and religion.

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Introduction

A greater adherence to the Mediterranean dietary pattern is associated with a lower risk of non-communicable chronic diseases, as type 2 diabetes, cardiovascular diseases and cancer, as well as to a lower prevalence of major cardiometabolic risk factors, like overweight, hypertension, dyslipidemia and the metabolic syndrome. This dietary model is also associated with a reduction in overall mortality and a better quality of life (Trichopoulou et al. 1995; Trichopoulou et al. 2003; Muñoz et al. 2009; Rees et al. 2013; Georgoulis et al. 2014; Schwingshackl and Hoffmann 2014; Grosso et al. 2014b, 2014c; Salas-Salvadó et al. 2016; Whalen et al. 2017; Castelló et al. 2018; Mayr et al. 2018; Radd-Vagenas et al. 2018).

The traditional Mediterranean diet is characterised by the consumption of whole grains, legumes, fruits, vegetables, nuts, fish and olive oil, wine in moderation, and a moderate intake of meat, dairy products, processed foods and sweets. The Mediterranean dietary pattern is also an important source of vitamins, minerals, antioxidants, mono- and poly-unsaturated

fatty acids, and fibre, all of which provide a wide range of health benefits. As a result, a greater adherence to the traditional Mediterranean diet is consistently associated with a health promotion (Sofi et al. 2013; Carlos et al. 2018).

According to this evidence, several scientific societies in European and non-European countries have recommended a greater adherence to the Mediterranean diet as an appropriate nutritional model for the treatment and prevention of the major chronic diseases.

Despite the large convincing scientific evidence in support of the favourable health outcomes of the Mediterranean diet, the adherence to this dietary model is not satisfactory. In addition, it is noteworthy to underline the progressive disaffection observed in the areas from which the traditional Mediterranean diet originated, as Greece, Italy, Spain (Benhammou et al. 2016; Bonaccio et al. 2016).

Several factors have been identified as markers of a lower adherence to the Mediterranean diet. Among them, the socio-economic factors play a very

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📎 Supplemental data for this article can be accessed [here](#).

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important role (Cavaliere et al. 2018; Navarrete-Muñoz et al. 2018). However, these factors seem to impact with different strength in different population groups.

Over the past years, several attempts for estimating the adherence to the Mediterranean diet have been done, mainly through the creation of diet quality scores (Trichopoulou et al. 2005; Bach et al. 2006; Schröder et al. 2011; Martínez-González et al. 2012; Sofi et al. 2017). Some of these scores are often difficult to be utilised since require extensive dietary information; moreover, since they are based on population specific cut-off values for food consumption, they show a poor reproducibility when utilised in different population groups. Finally, many Mediterranean diet scores have been developed specifically for epidemiological purposes. However, they are not designed to be utilised in the context of educational interventions to promote healthier dietary habits.

Therefore, the aims of our study were (1) to develop and validate a tool assessing the degree of the adherence to the traditional Mediterranean dietary pattern which utilises cut-offs of food group consumption based on current nutritional recommendations for health promotion and, therefore, also useful for educational purposes and for an immediate user's self-evaluation, (2) and to evaluate the socio-cultural factors associated with a lower adherence to the Mediterranean dietary model. All analyses were performed in a population of southern Italy with strong Mediterranean diet traditions.

Methods

Subjects

Five hundred and twenty healthy subjects of both sex, age 18–85 years, were recruited on a voluntary basis between May and July 2014 from those attending two shopping centres of Naples area and among the employees of the “Federico II” University of Naples. After exclusion of pregnant or lactating women and subjects reporting a personal history of cancer, cardiovascular diseases, diabetes, dyslipidemia, hypertension, gastrointestinal, liver and kidney diseases, 411 healthy individuals with a body mass index (BMI) $<30 \text{ kg/m}^2$, participated in the study. All participants were asked to complete written questionnaires to obtain information on their demographic, socioeconomic and cultural characteristics, comorbidity, lifestyle, including tobacco smoking (not-smoker, former smoker, current smoker) and physical activity. Moreover, all participants were asked to answer questions related to their

adherence to the Mediterranean dietary model through the MEDI-Quest score. In addition, a subgroup of this cohort was asked to fill in a food frequency questionnaire in order to calculate the MDS score developed by Trichopoulou et al. (2003), and to use it as a reference score for the validation of the MEDI-Quest score, developed by us. This study was conducted according to the recommendations of the Declaration of Helsinki and was approved by the Institutional review board. Signed, written informed consent was obtained from each participant.

Measurements and general data

Body weight and height of the participants were measured by a calibrated scale and a wall-mounted stadiometer, respectively. BMI was calculated as the ratio between body weight (kg) and height squared (m^2).

Participants were asked to fill in an anonymous questionnaire containing information on sex (male or female), date of birth, age, country of origin, civil status (alone, married, married with sons), education level (none, primary or secondary school, upper secondary school, university), occupation (student, worker, farmer, professional, merchant, unemployed, employed, pensioner) and income (less than 12,000 €/year, between 12,000 and 24,000 €/year, more than 24,000 €/year). In addition, the questionnaire included five questions to assess the health status of the subject to evaluate the presence of diabetes, dyslipidemia, hypertension, cardiovascular diseases and cancer. Participants with any of these conditions were excluded from the analysis here reported.

The MEDI-quest score

The MEDI-Quest score has been developed using the same food groups employed for other questionnaires aiming to evaluate the adherence to a dietary model resembling the traditional Mediterranean diet (Sofi et al. 2017). The major specificities of MEDI-Quest are: (1) the consumption of wholegrain cereals, and not of refined cereals, was considered; this choice was based on the available literature on the beneficial effects of wholegrain consumption on human health, while the evidence on the health effects of refined grains is still controversial; (2) nuts consumption was included and grouped together with legumes; (3) for foods rich in animal fat, not only dairy products, but also other foods rich in saturated fat, as butter, cakes, pastries, were grouped together in our questionnaire; in addition, in this category, our questionnaire did not include milk and yogurt since they have been reported

to be associated with beneficial effects on human health (Drouin-Chartier et al. 2016); (4) finally, for evaluating the resemblance to the traditional Mediterranean diet for the consumption of the various food groups we utilised predefined cut-off values rather than values based on the frequency of consumption within the population. Cut-offs were based on current recommendations for dietary habits suitable for health promotion. This choice was justified by the intention to give this score a wider generalizability and to utilise it as an educational tool (more details in the [Supplementary materials](#)).

The MDS score

The MEDI-Quest proposed by us was validated against the MDS score, calculated following the same food categories reported by Trichopoulou et al. (2003). Nine food categories were considered: vegetables, legumes, fruit and nuts, dairy products, cereals, meat and meat products, fish, alcohol and the ratio of monounsaturated (MUFA) to saturated fat (SFA). A value of 0 or 1 was assigned to each of the nine categories with the use of the sex-specific median as the cut-off (more details in the [Supplementary Materials](#)).

Statistical analysis

Data were expressed as mean \pm standard deviation (SD) for quantitative variables and as percentage (%) for qualitative variables, as appropriated.

For the validity assessment of the MEDI-Quest versus the MDS score, the Spearman's correlation coefficient was used. In addition, the absolute agreement between the two scores was analysed by the interclass correlation coefficient (ICC) and the Bland-Altman method. The percentage of participants correctly categorised (same score) was also calculated.

For factors influencing adherence to the Mediterranean diet, a logistic regression analysis was used. High adherence (score 6–9) to the traditional Mediterranean diet as compared to low adherence (0–5) was considered the dependent variable; the independent variables included age, sex, smoking, BMI, educational level, occupation, income, marital status, meals (n/day), food label use, importance attributed to nutritional properties in food choice and physical activity.

Differences between men and women were tested by Test-T for independent sample.

A $p < .05$ (two-tails) was considered statistically significant. Data were analysed using SPSS for Windows version 21.0 (SPSS Inc., Chicago IL).

Results

MEDI-quest validation

The validity assessment of MEDI-Quest versus MDS was evaluated in a subgroup of the total cohort including a total of 62 men and 76 women, with a mean age of 42.4 ± 14.4 years and a BMI of 26.5 ± 9.0 kg/m².

On average, 74.7% of the individuals were assigned the same score with both methods, with congruence ranging from 55.8% for animal fat to 91.3% for legumes and olive oil. Spearman's correlation coefficient between the two total scores was 0.513 ($p < .05$), very similar to the ICC (0.638) utilised to obtain absolute agreement between the two scores. Spearman's correlation coefficients for each food category were also calculated ([Supplementary Table 1](#)). Food categories with the highest correlation coefficients were fish (0.569) and wine (0.543); the lowest correlation coefficients were obtained for animal fat (0.145) and cereals (0.110).

Factors associated with the adherence to the Mediterranean diet

[Table 1](#) shows the general characteristics of the total cohort. Of all participants, 222 (54.0%) were women and 189 (46.0%) were men; the mean age was 41.0 ± 14.8 years and the BMI was 25.3 ± 4.2 kg/m². No differences in age and BMI were observed between males and females.

The mean Mediterranean score and the frequency of the different classes of adherence to the Mediterranean diet were shown in [Table 2](#). The mean score was 5.1 ± 1.3 for the overall sample, without significant differences between males and females (5.0 ± 1.3 versus 5.2 ± 1.3 in males and females, respectively). A very high adherence score to the Mediterranean diet (score 8–9) was observed in 5.1% of overall population; 41.8% and 43.7% of the total cohort were distributed between high adherence (score 6–7) and unsatisfactory (score 4–5) adherence to the Mediterranean diet; a low adherence (score 0–3) was observed in 9.2% of overall sample. The distribution of male and female in the different degree of the adherence to the Mediterranean diet was the same to that observed in the total cohort, with no gender differences.

The degree of the adherence to each category of the MEDI-Quest score is reported in [Figure 1](#). Most people adhered to the recommended score for olive oil consumption (84.4% in the total cohort), followed by animal fat (65.2% in the total cohort), meat and

wholegrain cereals, with full adherence to the recommended intakes for 58.6 and 50.4% of the cohort, respectively. The adherence to the recommended intake was lower for vegetables (31.4% of the total cohort adhered to the recommended intake), legumes (28.5%), fruit (18.2%), fish (16.1%) and wine (6.8%).

The logistic regression analysis reported in Table 3 revealed which factors were linked to adherence to the Mediterranean diet. Compared to people with a lower adherence to the Mediterranean diet, a higher adherence was observed in people with older age (OR = 1.030, $p < .0001$), more qualified employment (OR = 1.136, $p < .005$), higher income (OR = 1.925, $p < .0001$), interest in reading food labels (OR = 2.057,

$p < .0001$) and frequent physical activity (OR = 1.608, $p < .05$). Gender, smoking status, BMI, marital status and number of meals per day, were not associated with the adherence to the Mediterranean diet.

Discussion

In this study, we evaluated potential factors associated with the adherence to the Mediterranean diet in a population of Southern Italy with strong Mediterranean traditions. To this aim, we developed a questionnaire useful not only for epidemiological purposes, but also able to facilitate immediate self-evaluation of the habitual diet in respect to recommended frequencies of consumption of specific food groups.

Studies examining adherence to the Mediterranean Diet among people living in Mediterranean countries are scarce. We studied population-based nutritional data from 411 individuals in Southern Italy and evaluated their adherence to the Mediterranean Diet.

Table 1. General characteristics of study participants.

	Total population (n = 411)	Men (n = 189)	Women (n = 222)
Age (years)	41.0 ± 14.8	42.6 ± 9.7	39.4 ± 13.1
Weight (kg)	69.7 ± 16.4	77.2 ± 12.6	62.1 ± 24.6*
Height (m)	1.66 ± 0.08	1.73 ± 0.06	1.58 ± 0.05*
BMI (kg/m ²)	25.3 ± 4.2	25.8 ± 3.7	24.8 ± 6.5

M ± SD.

* $p < .05$ versus men, Test-T for independent sample.

Table 2. Mean score and distribution of the total cohort in the different degree of the adherence to the Mediterranean diet in the study participants.

	Overall (n = 411)		Men (n = 189)		Women (n = 222)	
	n	%	n	%	n	%
Mean Score (M ± SD)	5.1 ± 1.3		5.0 ± 1.3		5.2 ± 1.3	
Very high (Score 8–9)	21	5.1	6	3.3	14	6.3
High (Score 6–7)	172	41.8	76	41.9	93	41.8
Unsatisfactory (Score 4–5)	180	43.7	79	43.6	98	44.1
Low (Score 0–3)	38	9.2	20	11.0	17	7.6

Table 3. Determinants of the compliance to the Mediterranean diet based on multiple stepwise logistic regression analysis.

	β	OR (95% CI)	p value
Age (years)	0.030	1.030 (1.016–1.044)	.000
Gender	-0.116	0.890 (0.601–1.320)	.563
Smoking	-0.038	0.963 (0.702–1.320)	.814
BMI	-0.034	0.967 (0.922–1.013)	.157
Educational level	0.184	1.202 (0.938–1.542)	.146
Employment	0.127	1.136 (1.043–1.237)	.003
Income	0.655	1.925 (1.467–2.526)	.000
Family composition	-0.005	0.996 (0.821–1.206)	.963
Marital status	0.169	1.184 (0.975–1.437)	.089
Meals (n/day)	0.110	1.117 (0.845–1.476)	.438
Food label use	0.721	2.057 (1.373–3.082)	.000
Physical activity	0.475	1.608 (1.075–2.406)	.021

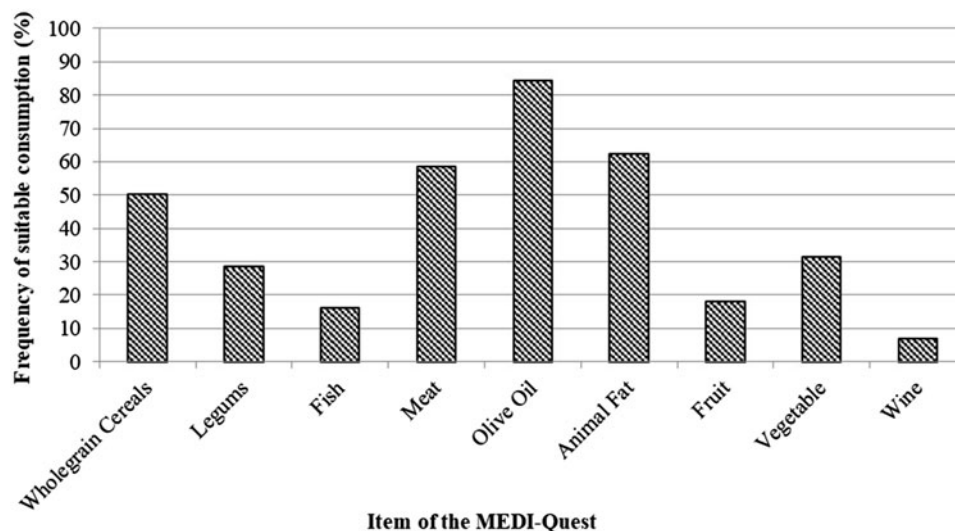


Figure 1. Degree of the adherence to each category of the MEDI-Quest score.

We assessed a relatively good adherence to the MD, with 46.9% of people reporting to follow the principles of the MD (very high and high adherence groups). Hence, our results agree with findings of previous studies assessing low to moderate adherence to the traditional dietary patterns among the inhabitants of Mediterranean countries (Tur et al. 2004; Tyrovolas et al. 2009; Katsarou et al. 2010; Grosso et al. 2014a; Marventano et al. 2018). It is remarkable, however, that in a region with a very strong cultural linkage with the traditional Mediterranean diet more than 50% of the people who were interviewed had a low or even a very low adherence to dietary recommendations based on the features of the Mediterranean diet. When analysing which factors could influence the adherence to the Mediterranean diet, our findings supported previous evidence of lower adherence to the Mediterranean diet among younger generations compared with older people (Moreno et al. 2002; di Giuseppe et al. 2008; Kontogianni et al. 2008); another relevant factor was a low socio-economic level as indicated by a low income and a less qualified job. This finding is in line with previous observations showing that people with disadvantaged socio-economic conditions are more likely to follow unhealthy behaviour due to economic and cultural constraints (Moreno et al. 2002; di Giuseppe et al. 2008; Kontogianni et al. 2008).

In line with previous studies documenting healthier dietary habits in people with higher motivation in health-related behaviours, a higher adherence to the Mediterranean diet was assessed in people who payed attention to nutritional food labels and in those performing regular physical activities (Pelucchi et al. 2010; Bibiloni et al. 2012; Bonaccio et al. 2012; Antonogeorgos et al. 2013).

In many studies the assessment of the adherence to the traditional Mediterranean dietary model was performed utilising questionnaires developed specifically for each study (Trichopoulou et al. 2005; Bach et al. 2006; Martínez-González et al. 2012; Schröder et al. 2011; Sofi et al. 2017). In any case, the validation of the MEDI-Quest shows a good concordance with MDS that represents a sort of gold standard for this type of evaluations.

The MEDI-Quest differs from other questionnaires so far employed, included the MDS of Trichopoulou, for its simplicity and because it takes into account only the frequency of food consumption while it does not consider the amount of food intake which is more difficult to assess.

A main strength of the MEDI-Quest is that the evaluation of the adherence to a Mediterranean type of food consumption is quickly available; moreover, it

is less expensive and requires less collaboration from the participants in comparison to the usual semiquantitative FFQ or other more sophisticated methods. The MEDI-Quest has also an educational purpose; in fact, participants receive simple advices on how to improve their eating habits when they diverge from the traditional Mediterranean dietary model. Therefore, the MEDI-Quest represents a valid and easy tool for a rapid assessment of the adherence to the traditional Mediterranean dietary pattern in different population groups and to identify dietary behaviours to modify in order to improve the healthiness of the habitual diet.

In conclusion, our study demonstrates that the adherence to the principles of the traditional Mediterranean diet is not particularly high, even in a population with strong cultural and gastronomic links with the traditional Mediterranean diet.

Poor adherence to the principles of a healthy diet involves mainly the more vulnerable groups (children and teenagers as well as the economically disadvantaged and poorly educated people) who have less cultural roots that a relevant to be able to resist to the widespread marketing of foods characterised by a low cost and poor nutritional value. Therefore, in order to prevent diseases linked with unhealthy lifestyles it is necessary to improve people's knowledge about food and nutrition, taking into consideration beliefs embedded in their family, tradition, religion (Vitale et al. 2018). This requires a widespread strategy that focuses on consensus and a shared approach rather than purely on draconian policies of deterrence. In order to be effective and appropriate this strategy has to be based on cultural sensitivity; this means that the design, the delivery and the evaluation of the intervention material has to take into consideration ethnic characteristics, scholarly, economic conditions and behaviours of the targeted population. In this context, the Mediterranean dietary model may be particularly appropriate to promote healthy dietary habits in people from the Mediterranean region. For its gastronomic and cultural strength, this model may also be utilised in other countries all over the world in view of its simplicity and efficacy.

Disclosure statement

No potential conflict of interest was reported by the authors.

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