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Original Study

Adherence to Mediterranean Diet and Frailty

Eva Ntanasi MSc^a, Mary Yannakoulia PhD^{a,*}, Mary-Helen Kosmidis PhD^b,
 Costas A. Anastasiou PhD^a, Efthimios Dardiotis MD, PhD^c, Giorgos Hadjigeorgiou MD^c,
 Paraskevi Sakka MD, PhD^d, Nikolaos Scarmeas MD, PhD^{e,f}

^aDepartment of Nutrition and Dietetics, Harokopio University, Athens, Greece

^bLab of Cognitive Neuroscience, School of Psychology, Aristotle University of Thessaloniki, Thessaloniki, Greece

^cSchool of Medicine, University of Thessaly, Larissa, Greece

^dAthens Association of Alzheimer's Disease and Related Disorders, Marousi, Greece

^eEginition Hospital, 1st Neurology Clinic, Department of Social Medicine, Psychiatry and Neurology, National and Kapodistrian University of Athens, Athens, Greece

^fTaub Institute for Research in Alzheimer's Disease and the Aging Brain, The Gertrude H. Sergievsky Center, Department of Neurology, Columbia University, New York, NY

A B S T R A C T

Keywords:

Mediterranean diet
 frailty
 older adults

Objective: To investigate associations between adherence to the Mediterranean diet and frailty in a Greek population of older adults.

Design: Cross-sectional study.

Setting: Data were drawn from the Hellenic longitudinal Investigation of Aging and Diet (HELIAD), a population-based, multidisciplinary study designed to estimate the prevalence and incidence of dementia in the Greek population.

Participants: Data from 1740 participants aged ≥ 65 years were included in the present analysis. Participants were selected through random sampling from the records of 2 Greek municipalities.

Measurements: Adherence to Mediterranean diet was evaluated through the MedDietScore, calculated from the information participants provided to a validated food frequency questionnaire. Frailty was assessed using 3 different definitions (the phenotypic approach proposed by Fried et al, the Frailty Index, and the Tilburg Frailty Indicator). Unadjusted and adjusted logistic and linear regression models were performed.

Results: Of our participants, 70 (4%), 325 (18.7%), and 442 (25.4%) were identified as frail according to the Fried et al definition, the Frailty Index, and the Tilburg Frailty Indicator, respectively. Adjusting for confounding factors, each additional unit in the MedDietScore was associated with a 5% ($P = .09$), 4% ($P = .005$), and 7% ($P < .001$) decrease in the odds for frailty according to the Fried definition, the Frailty Index, and the Tilburg Frailty Indicator, respectively.

Conclusions: According to study results, a higher adherence to the Mediterranean diet was associated with lower odds of frailty, irrespective of the definition used. This finding may be of relevance in the setting of population-based prevention efforts as well as in clinical practice.

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In recent decades, the observed rise in life expectancy has resulted in increases in the number of older people worldwide.¹ Although longevity is desirable, not everyone can achieve healthy ageing. Many

health problems may influence older people's quality of life and functionality. Among them is frailty, a geriatric condition that is estimated to affect 10% of people above the age of 65 years.² Given its detrimental effects (hospitalization, loss of autonomy, falls, and mortality),³ the identification of factors that could prevent frailty development is of great importance.

Nutrition has been consistently associated with the frailty syndrome in cross-sectional and prospective studies.⁴ The existing literature suggests that macro-^{5–7} and micro-nutrient^{8–10} intake may have a direct association with the frailty syndrome; low intake of energy and proteins,⁸ carotenoids,¹¹ vitamin D,^{12,13} vitamin C,⁸ vitamin E,^{8,14} n-3

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* Address correspondence to Mary Yannakoulia, PhD, Department of Nutrition and Dietetics, Harokopio University, Athens, Greece.

E-mail address: myiannak@hua.gr (M. Yannakoulia).

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fatty acids,¹⁵ and total polyphenols¹⁶ was found to be associated with frailty syndrome or frailty criteria.

Research has also focused on dietary patterns, such as the Mediterranean diet, to understand the relation between frailty and diet.^{17–20} The Mediterranean dietary pattern is characterized by abundance of plant foods: fruits, vegetables, bread, and other forms of cereals, legumes, nuts, and seeds; olive oil is the principal source of fat. Additionally, this dietary pattern also includes moderate amounts of dairy products (principally cheese and yogurt), small to moderate amounts of fish and poultry, small amounts of red meat, and wine, consumed modestly, normally with meals.²¹ One cross-sectional study has shown that older adults with the highest adherence to the Mediterranean diet had less possibilities to be identified as frail, compared with those in the lowest quartile of adherence.¹⁷ Moreover, the protective role of the Mediterranean diet against the development of frailty has been reported in some prospective studies,^{18,20,22} but it was not confirmed by others.¹⁹

The small number of studies on the Mediterranean diet and frailty and their incongruent results do not allow for firm conclusions to be established. The small sample in some^{17,18} is one important methodological issue. Another research limitation in the existing literature is related to the definition of frailty. Two main approaches have been used so far: (1) the biological or phenotypic approach, which focuses on the physical aspects of frailty, and (2) the multidomain approach, which is a broader perspective, including syndromes, diseases, impairments, and psychosocial factors. Within the latter, various definitions have been proposed. However, most studies examining the relation between Mediterranean diet and the frailty syndrome have used the Fried definition,²³ which belongs to the first approach, focusing on physical aspects of frailty. Thus, the multidomain approach of frailty and its relation with Mediterranean diet has been neglected.

Another limitation of the existing studies pertains to the cognitive evaluation of aged participants. Cognitive impairment is a feature that is included as a criterion in the multidomain definitions of frailty, and, thus, a comprehensive neuropsychological assessment is necessary in order to detect subtle cognitive changes. Even in the case of the phenotypic approaches to the study of frailty, including the Fried definition (which does not include cognitive function as a frailty criterion), cognitive performance still warrants in-depth evaluation, as it could be considered a mediator between diet and frailty. Existing studies have included only a brief cognitive assessment, probably resulting in a conceivably inaccurate identification of individuals with cognitive deficits.

The aim of the present study was to examine the relation between the Mediterranean diet and frailty status in a cohort of aged adults in Greece. Adherence to Mediterranean diet was defined by an a priori, non–population-specific index, and frailty was assessed by 3 different definitions, covering both definition approaches.

Methods

Participants

Participants were drawn from the Hellenic Longitudinal Investigation of Aging and Diet (HELIAD), which is described in detail elsewhere.²⁴ Briefly, HELIAD is a population-based, multidisciplinary study designed to estimate the prevalence and incidence of mild cognitive impairment, Alzheimer disease, and other types of dementia in the Greek population. Participants were at least 65 years old, and they were selected through random sampling from the records of 2 Greek municipalities, Larissa and Marousi, and they all gave their informed consent prior to study participation. The present analysis refers to the baseline assessment that took place from 2009 to 2015.

Clinical and Neuropsychological Evaluation

In the face-to-face interviews that were conducted by neurologists, participants provided information regarding medical problems, neurologic conditions, neuropsychiatric symptoms, current medications, hospitalizations, surgeries, and injuries. Information about the medical history of the participants' first-degree relatives was also gathered. Additionally, an extensive structured physical examination, evaluating neurologic signs and symptoms, was conducted for each participant.

Cognitive function was evaluated by trained neuropsychologists through a comprehensive neuropsychological assessment of all major cognitive domains: Orientation (Mini–Mental State Exam),²⁵ Non-verbal and Verbal Memory [Medical College of Georgia Complex Figure Test (MCG),²⁶ Greek Verbal Learning Test²⁷], Language (semantic and phonological verbal fluency²⁸; subtests of the Greek version of the Boston Diagnostic Aphasia Examination short form, namely, the Boston Naming Test—short form, and selected items from the Complex Ideational Material Subtest, to assess verbal comprehension and repetition of words and phrases²⁹), Visuoperceptual Ability (Judgment of Line Orientation^{30,31} abbreviated form; MCG Complex Figure Test copy condition, Clock Drawing Test³²), Attention and Information Processing Speed [Trail Making Test (TMT)³³], Executive Functioning (TMT-Part B, verbal fluency, Anomalous Sentence Repetition, Graphical Sequence Test, Motor Programming,²⁶ months forwards and backwards), and a gross estimate of intellectual level (a Greek multiple-choice vocabulary test).³⁴

Researchers and main investigators, that is, neurologists and neuropsychologists involved in the project, arranged regular diagnostic consensus meetings in order to decide on participants' diagnoses.

Dietary Assessment

Dietary intake was evaluated by registered dietitians with the use of a semiquantitative food frequency questionnaire (FFQ) that has been validated for the Greek population³⁵ and has been used to estimate dietary intake on numerous occasions.^{36,37} Briefly, the FFQ included information on all main food groups consumed during the last month (ie, 69 questions regarding consumption of dairy products, cereals, fruits, vegetables, meat, fish, legumes, added fats, alcoholic beverages, stimulants, and sweets), as well as on selected eating behaviors (ie, consumption of breakfast, number of meals consumed on a daily basis, and consumption of organic products or dietary supplements). A 6-grade scale, regarding frequency of consumption, was used ranging: “never/rarely”, “1–3 times/month, 1–2 times/week, 3–6 times/week, 1 times/day,” to “≥2 times/day.” The questionnaire was completed by each participant with the aid of an experienced investigator. Responses were converted to daily intakes of specific food items and were extrapolated into macronutrient intakes.

Adherence to the Mediterranean diet pattern was assessed through the Mediterranean Dietary Score (MedDietScore), proposed by Panagiotakos et al,³⁸ a score that incorporates the most important characteristics of the Mediterranean diet pattern. Its major advantage stems from the fact that is based on the weighting of selected food groups according to the frequency of consumption: the thresholds were chosen according to a priori hypotheses and regardless of the consumption by the sample studied, thus allowing comparisons with other population samples.³⁹

Specifically, the scoring is based on the weekly consumption of 11 food groups, and an individual score for each component is calculated, ranging from 0 to 5. For the consumption of items that are presumed to closely characterize the Mediterranean pattern, individuals who reported no consumption were assigned a score of 0, and scores of 1 to 5 were assigned for rare to daily consumption. For the consumption of

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