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Social life characteristics in relation to adherence to the Mediterranean diet in older adults: findings from the Hellenic Longitudinal Investigation of Aging and Diet (HELIAD) study

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Abstract

Objective: The present study aimed to explore the associations between social life and adherence to a healthy dietary pattern, the Mediterranean diet (MD), in a population-representative cohort of older people.

Design: Cross-sectional study. Adherence to the MD was evaluated by an *a priori* score; tertiles of the score, indicating low, medium and high adherence, were used in the analyses. Social life was assessed by a questionnaire evaluating participation in leisure-time activities and the number of social contacts; primary occupation was also recorded and job characteristics were further explored.

Setting: Community-dwelling older adults.

Participants: Adults from the Hellenic Longitudinal Investigation of Aging and Diet (HELIAD) study (*n* 1933; age range 65–99 years).

Results: Each unit increase in the number of social contacts/month and in the frequency score of intellectual, social and physical activities was associated with a 1·6, 6·8, 4·8 and 13·7 % increase in the likelihood of a participant being in the high MD adherence group, respectively. The analysis by age group revealed that younger elderly participants had a 1·4, 8·4 and 11·3 % higher likelihood to be in the high adherence group for each unit increase in the number of social contacts/month and in the frequency score of engagement in intellectual and physical activities, respectively. Similar associations were found for older elderly participants with high compared with low MD adherence, except for the intellectual activities.

Conclusions: The present results suggest that high MD adherence is associated with good social life, suggesting a clustering of health-promoting lifestyle factors in older adults.

Keywords
Social life
Social contacts
Leisure time
Diet quality
Mediterranean diet
Older adults

People change their food choices as they get older[1]. Among other factors, this is attributed to the physiological changes accompanying the ageing process[2,3]. In particular, poor dentition, taste or chemosensory changes, age-related diseases, compromised mobility and functional limitations are major factors that affect dietary intake and, in turn, may alter the diet and nutritional status of older people[4,5]. Additionally, various socio-economic factors affect older people's food choices and diet quality[6–9]. Specifically, less frequent social contacts and low educational level, regardless of income, have been associated with low fruit, vegetable and fish consumption in people of older age[10–12]. When exploring dietary patterns as indices of total diet quality, few studies have examined their relationship to social parameters, and economic factors have been largely understudied. Existing evidence indicates that participation in leisure-time activities, social contacts and a higher educational level are associated with better diet quality in community-dwelling

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older adults[6,13]. Furthermore, diet quality is positively influenced by marital status and living arrangement[7], and loneliness, due to loss of spouse or friends, has been related to compromised nutritional status[14].

In relation to the Mediterranean diet (MD), a well-investigated dietary pattern in terms of health outcomes[15,16], very little is known about the social aspects associated with it. In the early work of Keys in the Severn Countries Studies, lifestyle behaviours, such as social support and sharing food, were underlined as important components of the Mediterranean way of living[17]. However, there is no other work on the relationship between adherence to this healthy eating pattern and social factors. The investigation of the aforementioned relationship is of special interest in older individuals, bearing in mind that social factors can be modified to some extent and thus they may be the target of interventions aiming to improve quality of life in this vulnerable age group. Hence, the purpose of the present study was to explore associations between adherence to the MD and social life characteristics in a population-representative cohort of older adults.

Materials and methods

Sample and procedures

The Hellenic Longitudinal Investigation of Aging and Diet (HELIAD) is a population-based, multidisciplinary, collaborative study. The study design and data collection have been described in detail elsewhere[18]. Community-dwelling older people (≥65 years old) from a suburb of Athens (Marousi) and an urban area in Greece, the city of Larissa (including its rural surroundings), were selected through random sampling from municipality registries. All study assessments took place in day-care centres for older people, the participants' homes or the municipal public health clinics.

Assessments were conducted by trained researchers, neurologists, neuropsychologists and registered dietitians. Among others, information on sociodemographic characteristics (sex, age (years), education level (years of education)) as well as medical and family history, lifestyle, diet, physical activity, memory and other cognitive problems was collected through structured questionnaires. In addition, participants were screened for neuropsychiatric conditions through a structured neurological evaluation and a battery of neuropsychological tests addressing all major cognitive domains: memory, attention/speed of information processing, language, executive functions and visuospatial skills. Diagnosis of dementia, Alzheimer's disease and mild cognitive impairment was set according to international criteria[19] during consensus meetings of all study investigators.

Dietary assessment

Habitual diet was assessed using a validated semi-quantitative FFQ developed at the Department of Nutrition and Dietetics of Harokopio University and designed to evaluate energy and macronutrient intakes of the Greek population[20]. The FFQ was administered by registered dietitians and the time frame used was the previous month. It comprises sixty-nine questions on the consumption of foods or combination of foods, including dairy products, cereals, fruits, vegetables, meat, fish, legumes, added fats, alcoholic beverages, stimulants and sweets. Using a 6-point scale ('never/rarely', '1–3 times/month', '1–2 times/week', '3–6 times/week', '1 time/d', '≥2 times/d'), participants were asked to indicate the absolute frequency of consuming a certain amount of food, expressed in grams, millilitres or in other common measures, such as a slice, tablespoon or cup, depending on the food. Responses to the FFQ were grouped into groups (expressed as servings/d) featuring the core foods of the Greek diet: refined and non-refined cereals, potatoes, fruits, vegetables, red meat and meat products, poultry, fish, eggs, legumes, full-fat and low-fat dairy (milk, yoghurt and cheese), sweets and sweeteners, alcoholic beverages and nuts.

Adherence to the Mediterranean dietary pattern was evaluated using the MedDietScore, an eleven-item composite score calculated for each participant from the FFQ-based food consumption[21]. The score is based on the weekly consumption of eleven food groups (non-refined cereals, fruits, vegetables, legumes, potatoes, fish, meat and meat products, poultry, full-fat dairy, olive oil use, alcohol). A score of 0–5 is given for each food group. Specifically, for food groups presumed to be healthful components of the MD (i.e. those with a recommended intake of ≥3 servings/week, such as non-refined cereals, fruits, vegetables, legumes, fish, potatoes and olive oil use), a score of 0 was assigned when the participants reported no consumption and scores of 1 to 5 for rare to daily consumption. For the unhealthy food components of the pattern, scoring was assigned on a reverse scale, i.e. from 5 when someone reported no consumption to 0 for daily consumption. For alcohol intake, a score of 5 was assigned for consumption of less than 300 ml wine/d, a score of 0 was assigned for no consumption or for consumption of 700 ml/d, and scores of 4 to 1 were assigned for consumption of 600–700, 500–600, 400–500 and 300–400 ml/d, respectively. All alcoholic beverages were converted into millilitres of wine, assuming that 12 g of ethanol correspond to 100 ml of wine. The potential range of MedDietScore is between 0 and 55, with higher values indicating greater adherence to the MD. For the analyses below, tertiles of MedDietScore were used: the first tertile (reference group) was defined as low adherence and the other two tertiles as medium and high adherence to the MD, respectively.

Leisure-time activities assessment

Participants were interviewed regarding their involvement in common leisure-time activities, using a self-reported

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questionnaire previously used in older adults[22]. They were asked to rate the frequency of engaging in twenty-three common leisure-time activities during the previous month, on a 5-point scale: 0 indicates participation in the activity once per year or less; 1, several times per year; 2, several times per month; 3, several times per week; 4, every day or almost every day. Total score ranged from 0 to 92, with higher scores indicating more frequent engagement in leisure-time activities. The activities were divided in four sub-categories[23] as follows.

1. Social activities: visiting friends or relatives, going out to a movie, theatre, restaurant or sporting event, going on day or overnight trips, going to day-care centres for older people, participating in groups and taking part in activities, offering unpaid community or volunteer work, maintaining paid employment, visiting museums and attending religious services. Social activities score ranged from 0 to 36, with higher values indicating more frequent participation in social activities.
2. Intellectual activities: reading newspapers, books, magazines, playing a musical instrument, knitting or spending time on any other hobbies, playing cards, chess, crossword puzzles and taking classes. Intellectual activities score ranged from 0 to 28, with higher values indicating more frequent participation in intellectual activities.
3. Recreational activities: shopping, gardening, preparing meals, watching television and listening to the radio. Recreational activities score ranged from 0 to 20, with higher values indicating more frequent participation in recreational activities.
4. Physical activities: walking and exercising. Physical activities score ranged from 0 to 8, with higher values indicating more frequent participation in physical activities.

Also, the number of social contacts with friends or relatives during the previous month was recorded and was expressed as number of social contacts/month. Finally, participants were asked to report the number of people they live with; a dichotomous variable was computed indicating whether the participant lived alone or with other people (0 *v.* 1, respectively).

Assessment of participants' job characteristics

Participants reported their primary lifetime occupation, i.e. the occupation that each participant was engaged in for the longest period of his/her life. Then, using the Dictionary of Occupational Titles (https://occupationalinfo.org/), we defined the duties of each occupation. Subsequently, based on the work of Stern *et al.*[24], we assigned to each duty one of the following dimensions (0 = no, 1 = yes, if the duty had one of the following dimensions): substantive complexity (general educational development, intelligence, complexity of functioning with data, verbal aptitude, numeric aptitude), physical demands (climbing, balancing, eye–hand–foot coordination, outside working conditions, kneeling, crawling, lifting, carrying, pulling, pushing), motor skills (finger dexterity, motor co-ordination, complexity of functioning with things, manual dexterity, form perception, seeing), management skills (talking, dealing with people, scientific, technical activities *v.* business contact, direction, control, planning, complexity of function in relation to people) and interpersonal skills (sensory or judgement criteria, influencing people, activities involving processes and machines *v.* social welfare). Then the scores of all dimensions for all duties of each occupation were summed, yielding a score for each dimension for each study participant based on his/her primary occupation.

Statistical analysis

Nominally significant α values were defined as $P < 0{\cdot}05$. Characteristics of the participants were expressed as mean values with SD or as percentages. Differences among groups were tested through ANOVA for continuous variables and Pearson's χ^2 test for categorical variables.

Logistic regression analyses were performed with adherence to the MD as the dependent variable and socio-demographic characteristics as the independent variables, namely age, sex and years of education, job characteristics (substantive complexity, physical demands, motor, management and interpersonal skills) and social variables (social contacts/month, frequency of participation in social, intellectual, recreational and physical activities). MedDietScore was entered into the models in categorical form as tertiles; the second and third tertiles (medium and high adherence) were compared with the first tertile (low adherence; reference group). We repeated all analyses after excluding participants with mild cognitive impairment or dementia. Furthermore, analyses were performed for men and women separately as well as for younger and older elderly participants (≤75 and >75 years old, respectively, as previously used[25,26]). Finally, regression analyses were performed with consumption of specific food groups, either characteristic of the MD or not, as the dependent variables and social life variables as the independent variables, as mentioned above. In the latter analyses, we corrected for multiple comparisons by setting the statistical significance level at $P < 0{\cdot}004$.

Results

The study population consisted of 1993 older adults with mean age of 73 (SD 6) years and a mean level of education 7·7 (SD 4·8) years. Fifty-nine per cent were women and 5 % were diagnosed with dementia. Mean vegetable consumption was 2·0 (SD 1·0) servings/d, mean fish consumption was 0·6 (SD 0·4) servings/d and mean MedDietScore was 33·3 (SD 4·6). Participants with low MD adherence were older, had less education years, had a higher frequency of dementia and less social contacts compared with participants with medium and high MD adherence (Table 1).

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Table 1 Demographic, job, social and dietary characteristics of the community-dwelling older adults (*n* 1993), in the total sample and by tertile of adherence to the Mediterranean diet (MD), Hellenic Longitudinal Investigation of Aging and Diet (HELIAD) study, January 2011–October 2015

	Total sample		Low MD adherence (0–31)		Medium MD adherence (32–35)		High MD adherence (35–55)		
	n or mean or %	SD	*n* or mean or %	SD	*n* or mean or %	SD	*n* or mean or %	SD	*P**
n	1933	–	657	–	668	–	608	–	–
Age (years)	73·1	5·9	73·8	6·0	72·8	5·8	72·3	5·8	**<0·001**
Education (years)	7·7	4·8	6·8	4·4	7·7	4·9	8·7	4·9	**<0·001**
Sex (% females)	59·2	–	71·3	–	58·5	–	48·6	–	**<0·001**
% Dementia	4·8	–	7·4	–	3·9	–	2·2	–	**<0·001**
% Mild cognitive impairment	12·0	–	13·7	–	11·5	–	10·7	–	**<0·001**
Dimensions of job									
Motor dimension of job	1·4	1·1	1·4	1·1	1·5	1·1	1·3	1·1	0·071
Physical dimension of job	1·1	1·4	1·4	1·4	1·1	1·3	0·9	1·3	**<0·001**
Management dimension of job	1·5	1·0	1·3	1·0	1·4	1·1	1·7	1·1	**<0·001**
Interpersonal dimension of job	0·7	0·9	0·6	0·8	0·7	0·9	0·8	0·9	**<0·001**
Substantive complexity dimension of job	0·01	0·1	0·01	0·1	0·02	0·2	0·01	0·1	0·534
Social factors									
Frequency of intellectual activities (0–28)	5·7	4·3	4·8	4·2	5·8	4·4	6·8	4·3	**<0·001**
Frequency of social activities (0–36)	7·3	4·3	6·2	4·2	7·6	4·3	8·1	4·1	**<0·001**
Frequency of recreational activities (0–20)	11·7	3·8	11·6	3·8	11·7	4·0	11·8	3·8	0·306
Frequency of physical activities (0–8)	2·2	2·2	1·6	1·9	2·2	2·1	2·6	2·2	**<0·001**
Number of social contacts (the last month)	15·1	18·2	12·6	17·9	15·2	14·7	17·5	21·3	**<0·001**
Living alone (% yes)	17·6	–	21·3	–	17·8	–	16·0	–	0·056
Dietary factors									
MedDietScore (0–55)	33·3	4·6	28·2	2·6	33·5	1·1	38·3	2·0	**<0·001**
Fruit consumption (servings/d)	2·0	1·3	1·5	1·1	2·1	1·2	2·6	1·3	**<0·001**
Vegetable consumption (servings/d)	2·0	1·0	1·6	0·9	2·0	1·2	2·4	1·0	**<0·001**
Non-refined cereal consumption (servings/d)	0·9	1·4	0·4	0·9	0·8	1·2	1·5	1·6	**<0·001**
Fish consumption (servings/d)	0·6	0·4	0·4	0·4	0·6	0·4	0·7	0·4	**<0·001**
Legume consumption (servings/d)	0·5	0·3	0·4	0·2	0·5	0·3	0·5	0·3	**<0·001**
Red meat consumption (servings/d)	0·8	0·5	0·9	0·5	0·8	0·5	0·7	0·5	**<0·001**
Poultry consumption (servings/d)	0·4	0·3	0·4	0·3	0·4	0·3	0·3	0·2	**<0·001**
Full-fat diary consumption (servings/d)	1·3	0·9	1·4	1·0	1·3	0·8	1·1	0·8	**<0·001**
Alcohol consumption (servings/d)	0·3	0·7	0·2	0·6	0·4	0·7	0·5	0·6	**<0·001**
Sweets consumption (servings/d)	0·4	0·5	0·4	0·5	0·4	0·5	0·4	0·4	0·950
Nut consumption (servings/d)	0·2	0·3	0·1	0·2	0·2	0·3	0·2	0·3	**<0·001**

Continuous variables are presented as mean and SD, categorical variables as relative frequencies (%).
Bold font indicates statistical significance ($P < 0·05$).
*Comparisons between tertiles of MD adherence.

The analyses of the associations between MD and social life characteristics showed that participants with high, compared with those with low, MD adherence had lower age, more social contacts as well as higher frequency of social, intellectual and physical activities (Table 2). Specifically, the likelihood for someone to be in the high adherence group increased by 1·6, 6·8, 4·8 and 13·7 % for each unit increase in the number of social contacts/month and in the frequency score of intellectual, social and physical activities, respectively. When participants with mild cognitive impairment and dementia were excluded, the results did not change (data not shown).

The analyses by sex did not reveal differences in the results for men and women. However, when the sample was split into those aged ≤75 years and >75 years, younger elderly individuals with high MD adherence had more social contacts and more frequent engagement in intellectual and physical activities compared with same-age participants with low MD adherence. Similar results were found for older participants, except for the engagement in intellectual activities which was not different between the two groups of MD adherence (Table 3). In contrary to the findings on the MD as a dietary pattern, no associations were found between specific food groups and social life characteristics (see online supplementary material, Supplemental Table S1).

Discussion

The results presented above indicate that older adults with high MD adherence reported better social life, i.e. greater number of social contacts and higher frequency of participating in intellectual, social and physical activities, compared with those reporting low adherence to this traditional dietary pattern. Interestingly, when specific food groups were evaluated, no similar associations were found.

The MD is a sustainable, plant-based eating pattern, with mounting evidence confirming its protective role in many chronic diseases such as cancer and CVD[15,16]. Our study further expands on the MD by indicating a particular social context associated it, at least in older adults in a

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Table 2 Results from logistic regression analyses evaluating the associatione between tertile of adherence to the Mediterranean diet (MD) and social life variables in the total sample of community-dwelling older adults (*n* 1993), Hellenic Longitudinal Investigation of Aging and Diet (HELIAD) study, January 2011–October 2015

	Low MD adherence (reference)	Medium MD adherence			High MD adherence			
	OR	OR	95 % CI	*P*	OR	95 % CI	*P*	*P* for trend
Age (/year)	1	0·966	0·942, 0·990	**0·006**	0·955	0·930, 0·981	**0·001**	**<0·001**
Sex (1 = males, 2 = females)	1	0·514	0·352, 0·751	**0·001**	0·320	0·214, 0·479	**<0·001**	**0·001**
Years of education (/year)	1	0·983	0·943, 1·025	0·427	0·981	0·940, 1·023	0·361	0·343
Motor dimension of job (/unit)	1	0·908	0·545, 1·512	0·711	1·138	0·679, 1·908	0·624	0·534
Physical dimension of job (/unit)	1	0·955	0·634, 1·437	0·824	1·176	0·774, 1·787	0·448	0·397
Management dimension of job (/unit)	1	0·878	0·584, 1·320	0·532	1·244	0·817, 1·895	0·309	0·246
Interpersonal dimension of job (/unit)	1	1·012	0·590, 1·735	0·966	1·219	0·704, 2·112	0·480	0·441
Substantive complexity dimension of job (/unit)	1	0·978	0·399, 2·397	0·961	0·645	0·174, 2·389	0·511	0·580
Social contacts (/number per month)	1	1·010	1·002, 1·022	**0·014**	1·016	1·009, 1·026	**0·001**	**<0·001**
Living alone (0 = alone, 1 = with others)	1	0·851	0·593, 1·222	0·381	0·777	0·522, 1·155	0·212	0·434
Intellectual activities (/unit)	1	1·025	0·986, 1·066	0·217	1·068	1·027, 1·110	**0·001**	**0·002**
Social activities (/unit)	1	1·047	1·008, 1·087	**0·018**	1·048	1·009, 1·090	**0·017**	**0·005**
Recreational activities (/unit)	1	0·992	0·950, 1·037	0·735	1·004	0·956, 1·053	0·887	0·966
Physical activities (/unit)	1	1·084	1·007, 1·167	0·031	1·137	1·053, 1·228	0·001	<0·001

Bold font indicates statistical significance ($P < 0·05$).

Table 3 Results from logistic regression analyses evaluating the associations between tertile of adherence to the Mediterranean diet (MD) and social life characteristics in participants aged ≤75 years (*n* 1301) and >75 years (*n* 630), Hellenic Longitudinal Investigation of Aging and Diet (HELIAD) study, January 2011–October 2015

	Low MD adherence (reference)	Medium MD adherence						High MD adherence					
		≤75 years old			>75 years old			≤75 years old			>75 years old		
	OR	OR	95 % CI	*P*	OR	95 % CI	*P*	OR	95 % CI	*P*	OR	95 % CI	*P*
Sex (1 = males, 2 = females)	1	0·721	0·451, 1·154	0·173	0·265	0·131, 0·538	**<0·001**	0·436	0·269, 0·709	**<0·001**	0·173	0·080, 0·373	**<0·001**
Years of education (/year)	1	1·006	0·952, 1·062	0·838	0·971	0·907, 1·041	0·408	1·021	0·968, 1·077	0·437	0·935	0·872, 1·003	0·060
Motor dimension of job (/unit)	1	0·999	0·532, 1·880	0·999	0·930	0·343, 2·521	0·503	1·101	0·579, 2·095	0·769	1·382	0·542, 3·525	0·498
Physical dimension of job (/unit)	1	0·892	0·541, 1·473	0·656	1·318	0·587, 2·955	0·503	1·019	0·612, 1·697	0·942	1·716	0·782, 3·766	0·178
Management dimension of job (/unit)	1	0·946	0·568, 1·576	0·830	0·830	0·386, 1·786	0·634	1·191	0·707, 2·005	0·511	1·395	0·653, 2·981	0·390
Interpersonal dimension of job (/unit)	1	0·927	0·478, 1·800	0·823	1·319	0·458, 3·796	0·608	0·958	0·490, 1·872	0·900	2·044	0·741, 5·634	0·167
Substantive complexity dimension of job (/unit)	1	0·816	0·258, 2·583	0·730	1·106	0·247, 4·955	0·895	0·001	000·1, 3·259	0·999	1·361	0·220, 8·428	0·740
Social contacts (/number per month)	1	1·011	1·000, 1·022	**0·049**	1·021	1·000, 1·042	**0·050**	1·014	1·003, 1·025	**0·012**	1·021	1·002, 1·042	**0·033**
Living alone (0 = alone, 1 = with others)	1	0·704	0·451, 1·099	0·122	1·457	0·743, 2·855	0·273	0·838	0·514, 1·366	0·478	0·730	0·363, 1·467	0·376
Intellectual activities (/unit)	1	1·058	1·006, 1·111	**0·027**	0·961	0·895, 1·031	0·268	1·084	1·033, 1·137	**0·001**	1·033	0·963, 1·107	0·365
Social activities (/unit)	1	1·047	0·999, 1·098	0·055	1·043	0·975, 1·116	0·216	1·043	0·994, 1·094	0·084	1·064	0·992, 1·141	0·080
Recreational activities (/unit)	1	0·977	0·922, 1·035	0·425	1·019	0·948, 1·095	0·617	0·984	0·927, 1·045	0·603	1·040	0·958, 1·130	0·349
Physical activities (/unit)	1	1·075	0·982, 1·176	0·119	1·054	0·915, 1·213	0·468	1·113	1·016, 1·218	**0·021**	1·200	1·036, 1·390	**0·015**

Bold font indicates statistical significance ($P < 0·05$).

Mediterranean country. Specifically, adherence to this healthy pattern is associated with good social life, suggesting a clustering of healthful lifestyle factors, and thus one may speculate that the health effects could be attributed not only to the healthy eating habits, but also to other aspects of life, such as physical activity, sleep habits and social factors, as previously proposed[17,27]. In relation to these social aspects, to the best of our knowledge, no study has previously investigated their relationship with MD adherence. Some research has investigated the association between MD and physical activity, as part of the social activity, in young adults[28,29], but we further explored this issue by focusing on a range of activities, including several leisure-time activities.

Interestingly, the relationships between adherence to the MD and occupational characteristics were not found to be significant among older adults in the fully adjusted models. This fact could be attributed to the nature of our sample: it consisted mainly of retired older adults, thus one expects that leisure-time activities play an important role in their lives compared with younger people, for whom occupation may be a more important determinant. Indeed, other studies in older adults suggested that leisure-time activities are associated with health outcomes, whereas occupational characteristics are not[30].

The analysis by age group revealed differences among the different age groups in people of older age. Apart from the number of social contacts and the frequency of participation in physical activities, which were common in both age groups, in younger elderly people (65–75 years) a positive association between MD adherence and intellectual activities was revealed, whereas in older elderly not. Thus, one notes that for older elderly adults the positive relationship between MD and leisure-time activities exists only when the latter involves active participation, such as walking or exercising; this is unlike the pattern found in younger elderly people, for whom a positive relationship was also observed for intellectual activities (such as reading books) that can be characterized as more passive and not requiring active participation.

Analyses regarding specific food groups did not reveal associations similar to those found for the Mediterranean dietary pattern. Thus, the combination of foods, incorporated in a dietary pattern, and not specific food groups, is significantly associated with social life characteristics. To the best of our knowledge, no study to date has investigated the relationship between consumption of specific food groups and social variables. However, the importance of dietary patterns, rather than specific food group consumption, on health and health outcomes has been previously underlined[31].

The results of the present study should be interpreted in the context of its strengths and limitations. Our study is the first to examine a variety of social life characteristics, including leisure-time activities and occupation characteristics, in relation to the adherence to a healthy and traditional dietary pattern, the MD, in older adults. Participants were selected through random sampling and thus selection bias was low; both rural and urban areas were included. MD adherence was evaluated through the MedDietScore[21]: an advantage of this index is that scoring depends on the frequency of consumption (thresholds are chosen based on *a priori* definition of the MD) and regardless of the consumption amounts of the sample studied[32]. Furthermore, a detailed clinical and neuropsychological evaluation was conducted by dementia experts, allowing for a fine-tuned classification of the participants' cognitive status and enabling us to exclude participants with dementia or mild cognitive impairment from the analyses. On the other hand, due to the cross-sectional design of the study, we cannot provide answers regarding the direction of the relationship found. Although we considered many confounders, the effect of other factors not assessed in the study (i.e. residual confounding) cannot be entirely excluded. Finally, concerns regarding recall bias could arise, as all the questionnaires used were self-reported; however, this is a common concern in all epidemiological investigations in older people[33].

Conclusion

In conclusion, adherence to the MD among older adults is positively associated with good social life characteristics, i.e. the number of social contacts and the frequency of participation in intellectual, social and physical activities. Although additional studies are needed in other Mediterranean but also non-Mediterranean population groups, this finding indicates a clustering of health-promoting lifestyle factors in older adults and suggests social factors as important aspects to be considered when evaluating diet quality, at least in this age group.

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participation: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Institutional Ethics Review Board of the University of Thessaly as well as the Institutional Ethics Review Board of the University of Athens. Written informed consent was obtained from all subjects.

Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/S1368980019002350.

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