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Original Article

Association Between Mediterranean Diet Adherence and Physical Activity in Elderly Men: A Comparative Study Between Iran and Spain

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Introduction: The elderly population is increasing worldwide, highlighting the importance of healthy lifestyle behaviors such as nutritious eating and regular physical activity (PA). The Mediterranean-style dietary pattern (MDP) is recognized for its health-promoting nutritional profile. This study examines the association between MDP adherence and PA levels in elderly men from Iran and Spain.

Methods: A cross-sectional study was conducted among elderly individuals aged 60 years and older in Iran and Spain (n = 1200). Adherence to the MDP was evaluated using a validated Mediterranean Diet Adherence Screener. PA levels were assessed using the Rapid Assessment of Physical Activity questionnaire. Additional demographic and anthropometric data—including age, sex, weight, and height—were also collected.

Results: Among Iranian elderly participants, vigorous PA showed a significant positive association with adherence to the MDP ($\beta = 0.143$, $p = 0.001$). No significant associations were observed for light ($\beta = 0.055$, $p = 0.178$) or moderate ($\beta = -0.003$, $p = 0.934$) physical activity. Among Spanish elderly participants, adherence to the MDP was significantly associated with both vigorous ($\beta = 0.241$, $p < 0.001$) and light ($\beta = 0.112$, $p = 0.004$) PA, while moderate activity showed no significant relationship ($\beta = 0.007$, $p = 0.987$).

Conclusion: Adherence to the MDP is positively associated with higher levels of vigorous PA in elderly men from both Iran and Spain, and with light PA among Spanish participants. These findings highlight the role of lifestyle behaviors—particularly diet and PA —in shaping health-related patterns in older adults, and emphasize the importance of promoting MDP alongside regular PA.

Keywords: Mediterranean Diet, Physical Activity, Elderly Men

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Introduction

The global population of adults aged 65 years and older is increasing rapidly, and it is projected to reach 1.6 billion by 2050, representing a 2.6-fold rise compared to 2015 (1). This demographic transition is accompanied by significant challenges for healthcare systems worldwide, including (2, 3) rising rates of chronic diseases (4, 5), functional decline (5, 6), and increased healthcare costs (1, 2). Greater adherence to

the Mediterranean diet was also associated with reduced frailty and physical health among community-dwelling older adults (7). Promoting healthy and active aging (8,9) has therefore become a central public health priority (10, 11) with lifestyle factors such as diet and physical activity (PA) identified as key modifiable determinants of health outcomes in older adults (12, 13). This has significant implications for the planning and delivery of health and social care (14).

Physiologically, aging is characterized by gradual declines in lean body mass, bone mineral density, and to a lesser extent, fat mass (15). The onset of sarcopenia contributes to frailty and reduces functional capacity, limiting older adults' ability to engage in physical activity (16–19). Additionally, age-related changes in metabolism, hormonal regulation, and nutrient absorption can negatively impact overall health, making diet and PA crucial for maintaining physiological function in this population.

The Mediterranean-style dietary pattern (MDP) is widely recognized as one of the healthiest dietary models, combining nutritional richness with cultural and lifestyle elements that promote adherence (15, 22–28). The MDP emphasizes high consumption of vegetables, fruits, legumes, whole grains, nuts, and olive oil as the main dietary fat source, moderate intake of fish and dairy products, low consumption of meat and processed foods, and moderate wine consumption during meals (25, 26). Strong adherence to the MDP has been associated with reduced cardiovascular risk, lower overall mortality, improved metabolic profiles, and enhanced physical and cognitive health in older adults (10, 24, 27, 28). In addition to its nutritional composition, the MDP is considered a lifestyle model, often accompanied by social and cultural practices and regular moderate PA, which further contribute to its health-promoting effects.

PA is another critical determinant of health in elderly populations. Regular PA helps maintain muscle mass, bone density, cardiovascular function, and metabolic health, while reducing the risk of chronic non-communicable diseases (14, 16–19). Engaging in at least 150 minutes per week of moderate-to-vigorous PA is generally recommended for health benefits, yet a substantial proportion of older adults remain physically inactive, particularly in urbanized and industrialized settings (17, 18, 20). PA contributes to increased prevalence of coronary heart disease, type 2 diabetes, certain cancers, and functional decline, thereby compounding the challenges posed by aging populations (14).

The interaction between diet and PA is particularly important, as these lifestyle behaviors may have synergistic effects on health outcomes. Observational and interventional studies suggest that adherence to a high-quality diet such as the MDP is often accompanied by higher levels of PA, supporting overall health and functional capacity in older adults (10, 24, 27). However, the strength and nature of this relationship may vary across cultural and environmental contexts, and cross-cultural comparisons are limited.

Globalization, industrialization, and the spread of Westernized dietary patterns have led to shifts away from traditional dietary models, including the MDP, particularly among younger populations but also affecting older adults (31). These dietary changes, coupled with increasingly sedentary lifestyles, are major contributors to the rising prevalence of non-communicable diseases worldwide. Understanding how older adults in different countries maintain adherence to the MDP and engage in PA is critical for informing public health interventions aimed at promoting healthy aging.

In this context, Iran and Spain provide contrasting cultural and dietary settings for examining these behaviors. Spain, historically part of the Mediterranean region, has experienced a decline in adherence to the traditional MDP, while Iran represents a non-Mediterranean population with emerging interest in healthy dietary patterns. Cross-cultural investigation can thus provide insights into the universality of lifestyle-health associations and the role of environmental, cultural, and social factors in shaping these behaviors.

Therefore, the present study aimed to examine adherence to the MDP and its association with physical activity levels among elderly men in Iran and Spain, providing evidence to support culturally appropriate strategies for promoting healthier lifestyle behaviors in older populations.

Methods

Study design and participants

A cross-sectional study was conducted from December 2022 to July 2023 in Iran and Spain. The minimum sample size was determined as 1,200 participants, based on a significance level of 0.05 and a two-sided confidence interval of 90%. Participants were aged 60 years and older and categorized into five age groups.

A total of 1,224 elderly participants were recruited from Iran (n = 612) and Spain (n = 612). To ensure representativeness and methodological consistency across the two countries, similar structured sampling procedures were applied. In Iran, a multi-stage cluster sampling method was used. First, four urban cities from different geographical regions of the country (north, south, east, and west) were randomly selected based on the national urban registry. Within each city, three neighborhoods representing low, middle, and high socioeconomic status were randomly chosen from municipal zone lists. Households within these neighborhoods were then approached using a systematic sampling method in which every fifth residential unit was invited to participate. Eligibility criteria included being 60 years of age or older, living independently in the community, being able to perform light-to-moderate physical activity, and having sufficient cognitive ability to respond to the survey. Individuals with severe cognitive impairment, debilitating illness, or inability to provide informed consent were excluded. Out of 700 approached individuals, 612 completed the study, yielding a response rate of 87%.

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In Spain, participants were selected using a stratified random sampling approach. The elderly population was stratified according to geographical regions (north, south, east, and west) and gender to ensure proportional representation. Recruitment lists were obtained from community centers, public health clinics, and registered senior associations, which collectively serve as the primary social, healthcare, and recreational points of contact for the elderly population and therefore provide a diverse sampling frame. Potential participants were contacted through phone calls, email invitations, and in-person announcements. Inclusion and exclusion criteria were identical to those used in Iran to maintain comparability between the two samples. Of the 680 individuals invited, 612 agreed to participate, resulting in a 90% response rate.

Overall, the sampling strategies in both countries were designed to ensure that the selected samples adequately reflected the diversity of the urban elderly populations, while maintaining comparable recruitment procedures and eligibility standards. This methodological alignment supports the validity of cross-national comparisons conducted in the study.

Mediterranean diet adherence

Adherence to the MDP was assessed using the validated 14-item Mediterranean Diet Adherence Questionnaire (44). In Spain, the original validated version of the questionnaire, including the wine consumption item, was used without modification. In Iran, the questionnaire was culturally adapted by removing the wine-related item due to religious and cultural restrictions. As this item reflects alcohol intake rather than a core nutritional component of the Mediterranean diet, its removal does not affect the conceptual validity of the instrument. The original scoring range (0–14) was retained to ensure comparability between samples. Content and face validity of the Persian version were confirmed by two nutrition experts. A pilot study yielded a Kuder–Richardson 20 reliability coefficient of 0.55, which is comparable to values reported for dichotomous dietary screeners in cross-sectional studies (45).

PA levels were measured using the International PA Questionnaire–Short Form (IPAQ-SF) (46). This tool assesses seven items related to vigorous, moderate, and walking activities, and classifies older adults into three categories: low, moderate, and high activity. The internal consistency of the questionnaire in the present study was 0.61 based on Cronbach's alpha. Although this value is modest, it aligns with the reliability levels commonly reported for IPAQ-SF in older adult populations, where alpha values typically range from 0.55 to 0.75 due to the multidimensional and heterogeneous nature of self-reported physical activity (46). The IPAQ-SF has been extensively validated across diverse cultural contexts—including studies conducted in Iran, Spain, and other Mediterranean countries—demonstrating acceptable reliability and strong construct validity for epidemiological and cross-sectional research. The use of this instrument therefore supports comparability with prior international studies and ensures adequate measurement accuracy for assessing physical activity in elderly populations.

Data collection procedure

In Iran, questionnaires were distributed to volunteers aged 60 years or older in the selected neighborhoods, regardless of gender. Out of 700 questionnaires collected, 104 were excluded due to incomplete responses. Data collection in Spain followed a stratified random sampling procedure in community centers and senior associations, ensuring consistency across sites.

Statistical analysis

Data were analyzed using SPSS version 26. Descriptive statistics were used to summarize demographic characteristics. The Kolmogorov-Smirnov test was applied to assess normality. Independent t-tests compared MD adherence and PA levels between Iranian and Spanish participants. Pearson correlation coefficients were calculated to examine the relationship between diet adherence and PA levels. Covariance analyses were also conducted to explore associations while controlling for potential confounders. A significance level of 0.05 was applied for all statistical tests.

Ethical considerations

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Mohaghegh Ardabili University (protocol code: (IR.UMA.REC.1401.073). All participants provided written informed consent prior to participation.

Results

Demographic characteristics

A total of 1,224 participants were included, with 612 from Iran and 612 from Spain. Among Iranian participants, 571 (93.3%) lived in urban areas and 41 (6.7%) in rural areas. In Spain, 580 participants (94.8%) resided in urban areas, and 50 (5.2%) in rural areas.

The age distribution is presented in Table 1 and 2. In Iran, 32% of participants were aged 60–65 years, 30% were 65–70 years, 14% were 70–75 years, 9% were 75–80 years, and 15% were over 80 years. In Spain, 30% were aged 60–65 years, 39% were 65–70 years, 10% were 70–75 years, 7% were 75–80 years, and 14% were over 80 years. The mean age was 68.48 ± 7.86 years for Iranian participants and 69.58 ± 8.48 years for Spanish participants. (Table 1)

Mediterranean diet adherence

Among Iranian participants, 22% demonstrated low adherence to the MDP, 51% had moderate adherence, and 27% had high adherence. In the Spanish cohort, 18% had low adherence, 47% moderate adherence, and 35% high adherence. (Overall, Spanish participants showed a slightly higher proportion of high adherence compared to Iranian participants.

Physical activity levels

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PA levels were classified as low, moderate, or high based on the IPAQ-SF scores. In Iran, 34% of participants reported low PA, 45% moderate PA, and 21% high PA. Among Spanish participants, 28% reported low PA, 42% moderate PA, and 30% high PA. These results indicate that a greater proportion of Spanish elderly engaged in higher levels of PA compared to the Iranian participants.

Association between mediterranean diet adherence and physical activity

Pearson correlation analyses revealed a significant positive association between vigorous PA and adherence to the Mediterranean diet among Iranian participants ($\beta = 0.143$, $p = 0.001$). No significant correlations were observed for light ($\beta = 0.055$, $p = 0.178$) or moderate PA ($\beta = -0.003$, $p = 0.934$). In the Spanish participants, both vigorous ($\beta = 0.241$, $p < 0.001$) and light PA ($\beta = 0.112$, $p = 0.004$) were positively associated with Mediterranean diet adherence, whereas moderate PA showed no significant association ($\beta = 0.007$, $p = 0.987$). (Table 2 and 3)

These findings suggest that higher levels of vigorous PA are consistently associated with greater adherence to the MDP across both populations, while light PA is positively associated only in the Spanish participants.

Discussion

This study aimed to compare PA levels and adherence to the MDP among elderly individuals. The results revealed a significant positive association between vigorous PA and adherence to the MD among Iranian older adults. No significant relationships were observed for moderate or light PA. Among Spanish elderly participants, significant positive correlations were found between both vigorous and light PA with MD adherence, whereas moderate activity showed no significant association. These findings are consistent with previous reports by Karimi et al., (29), who observed moderate adherence to the Mediterranean diet among Iranian populations. Similar trends have been reported in Italy (30), Greece (31), Nepal (32), and South Korea (33), indicating that elderly individuals generally exhibit moderate adherence to MDP. Furthermore, a multi-country study by García-Conesa et al., (34), conducted in Spain, Italy, Portugal, Cyprus, Greece, North Macedonia, and Bulgaria, confirmed that, despite cultural differences, MDP adherence levels remain moderate across populations.

Table 1. Descriptive statistics and independent t-test results for physical activity levels and Mediterranean diet scores in Iranian and Spanish elderly populations

Variable	Group	N	Mean	Standard deviation	Levene's Test		T-test	
					F	p	t	p
Vigorous physical activity	Iranian	612	1272.89	214.009	1.30	0.267	1	≥ 0.05*
	Spanish	612	1265.09	208.115				
Moderate physical activity	Iranian	612	445.50	932.464	0.76	0.762	1	≥ 0.05*
	Spanish	612	483.36	943.536				
Light physical activity	Iranian	612	382.00	716.753	2.15	0.160	1	≥ 0.05*
	Spanish	612	415.13	731.084				
Mediterranean diet score	Iranian	612	41.03	7.367	11.56	0.051	1	≥ 0.05*
	Spanish	612	41.78	7.469				

*Significant difference; F = Levene's test statistic for equality of variances; p = significance level; t = T-test statistic.

Table 2. Pearson Correlation between physical activity variables and Mediterranean diet score (Iranian elderly)

Variable	Mediterranean diet score	N	Significance (p)
Vigorous physical activity	0.143	612	0.001
Moderate physical activity	0.055	612	0.178
Light physical activity	-0.003	612	0.934

Table 3. Pearson correlation between physical activity variables and Mediterranean diet score (Spanish elderly)

Variable	Mediterranean diet score	N	Significance (p)
Vigorous physical activity	0.241	612	0.000
Moderate physical activity	0.007	612	0.987
Light physical activity	*0.112*	612	0.004

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Extensive evidence supports the beneficial effects of the MD in promoting healthy aging. Studies by Panagiotakos et al., (47) Fung et al., (48) and Roman et al., (4) reported associations between MDP adherence and reduced blood pressure, improved lipid profiles, and better glycemic control—even in individuals with diabetes or metabolic syndrome. Research from Cyprus further showed that elderly adults aged 65–100 adhering to the MD had lower cholesterol levels, even while on statin therapy (49). Observational studies such as GREECS and CARDIO2000 also reported lower incidences of acute coronary syndromes and reduced mortality among older adults following the MD (50) .

In addition, MDP has demonstrated protective effects against certain cancers and neurodegenerative disorders. It has been associated with better cognitive performance and a reduced risk of Alzheimer's disease, likely due to the synergistic effects of omega-3 fatty acids, B vitamins, and antioxidants. Data from the Washington Heights-Inwood Columbia Aging Project in a non-Mediterranean population further confirmed an inverse relationship between MDP adherence and cognitive decline (50).

Geographical and cultural factors may partly explain the observed differences in diet adherence. Spain, as a Mediterranean country, provides easier access to MDP components, whereas Iranian dietary habits differ, contributing to lower adherence rates in this population.

Our results also align with evidence from a 2021 meta-analysis showing that resistance training significantly improves body composition, agility, balance, walking speed, and muscular strength in older adults. Other studies indicate that physical activity mitigates sarcopenia, enhances strength, and delays disability (50). A randomized controlled trial reported that resistance training increased daily step counts and reduced frailty scores among elderly participants (50).

Conclusion

A healthy lifestyle that includes balanced nutrition and regular PA is essential for reducing the risk of disease and disability in older adults. The MDP is recognized as one of the healthiest dietary models due to its comprehensive nutrient profile and ease of adherence. Promoting MDP and encouraging regular physical activity among elderly populations, especially in non-Mediterranean countries, can serve as effective strategies for supporting healthy aging and maintaining functional independence.

Study limitations

Motivation of participants, lack of accurate assessment of physical activity and Mediterranean diet with measurement tools.

Conflict of interests

The authors declare no conflict if interests.

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Authors' contribution

All authors have contributed to the design, execution, and writing of all parts of the present research.

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