

Investigating the Relationship Between Mediterranean Dietary Pattern and Self-Care Components in Iranian Adults with Type 2 Diabetes Based on Demographic Data Analysis

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Abstract

Introduction: Type 2 diabetes, with its increasing prevalence in Iran, requires multifaceted management including self-care behaviors. This study aimed to examine the relationship between adherence to the Mediterranean diet and self-care components among Iranian adults with type 2 diabetes

Methods: This descriptive-analytical study was conducted on adults diagnosed with type 2 diabetes for at least one year. Data were collected using the validated DSMQ questionnaire and a 16-item Mediterranean diet adherence tool. Self-care behaviors and dietary adherence were categorized into three levels. Data analysis was performed using SPSS version 22, including descriptive statistics, normality testing, ANOVA, and Pearson correlation. A significance level of $p < 0.05$ was considered.

Results: The results indicated a positive but non-significant correlation between adherence to the Mediterranean diet and diabetes self-care indicators ($r = 0.07$; $p = 0.30$). Although individuals with higher dietary scores showed slight tendencies toward self-care behaviors, the association was statistically weak and not generalizable. These findings suggest that a healthy diet alone may not sufficiently enhance diabetes self-care levels.

Conclusion: Improving self-care behaviors in diabetic patients requires a multidimensional approach beyond dietary modification. Effective interventions should also address psychological, educational, and environmental factors to achieve sustainable health outcomes. Sole focus on healthy eating, without considering other behavioral components, may not adequately meet the care needs of this patient population.

Keywords: Type 2 diabetes, self-care, Mediterranean diet, demographic analysis

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1. Introduction.

Type 2 diabetes, as a controllable metabolic risk, has been increasing worldwide, especially in developing countries(1). According to the International Diabetes Federation (IDF), by 2021, more than 537 million people in the world will have diabetes, and this figure is expected to reach more than 783 million by 2045(2). In Iran, the prevalence of type 2 diabetes, especially among the adult population, is also alarming; according to statistics from the Ministry of Health of Iran, about 11% of the country's adult population is affected by this disease (Larestan University of Medical Sciences Report, 2010), and thousands of new cases are identified annually. This disease is more than a metabolic disorder, but it is associated with widespread consequences in the cardiovascular, renal, neurological, and psychological fields(3). However, controlling this disease requires multifaceted management. Given the increasing prevalence of type 2 diabetes and its widespread consequences, this disease has become one of the main priorities of health systems at the global and national levels. Direct and indirect costs resulting from treatment, disability, and reduced productivity impose a heavy economic burden on families and society. Therefore, identifying factors affecting better disease control, especially self-care behaviors, is of great importance.

Self-care in diabetes includes a set of purposeful behaviors that an individual performs to control the disease, prevent complications, and improve their quality of life(4). These behaviors include adherence to the principles of a proper diet, regular medication intake, blood sugar control, regular physical activity, foot care, stress management, and follow-up medical care(5). Despite the prominent role of self-care in diabetes control, many diabetic patients, especially in developing countries, face serious challenges in implementing self-care components. Factors such as education level, economic status, cultural beliefs, social support, personal motivation, and type of diet are among the variables affecting self-care behaviors(6). Among these, diet, as one of the most effective and modifiable factors, plays an important role in promoting or weakening self-care behaviors. The Mediterranean diet, which has its roots in Mediterranean countries, is known as one of the healthiest nutritional patterns(7). This diet

includes a higher intake of fruits, vegetables, whole grains, legumes, olive oil, fish, and nuts, and a limited intake of red meat, processed foods, and simple sugars(8). Several studies have reported that following the Mediterranean diet is associated with a reduced risk of cardiovascular disease, cancer, Alzheimer's disease, and type 2 diabetes(9). It has also been reported that this diet has been associated with improved insulin sensitivity, reduced systemic inflammation, and better blood sugar control in diabetic patients. The mechanisms of the Mediterranean diet's effect on improving type 2 diabetes control are multifaceted and scientific. By emphasizing the consumption of unsaturated fats (such as olive oil), high fiber, antioxidants, and a low glycemic index, this diet improves insulin sensitivity, reduces systemic inflammation, and better blood sugar control. In addition, regular consumption of fish and nuts is associated with improved blood lipid profiles and reduced insulin resistance. The combination of these factors has made the Mediterranean diet an effective dietary pattern in the prevention and management of type 2 diabetes. In addition, the flexible and culturally acceptable structure of this diet also allows it to be adapted to local dietary patterns(10).

In recent years, international studies have investigated the relationship between the Mediterranean diet and self-care behaviors in diabetic patients. For example, a study in Spain showed that diabetic patients who adhered to the Mediterranean diet had higher levels of self-care behaviors such as regular blood sugar control and physical activity (11). Also, studies in the United States and Italy have pointed to a positive relationship between healthy eating and motivation in self-care (12, 13).

Limited studies in Iran have comprehensively examined the relationship between the Mediterranean dietary pattern and self-care components in diabetic patients. Most domestic studies have either been limited to examining the effect of the Mediterranean diet on biochemical indicators such as HbA1c and blood lipids, or have examined self-care behaviors in general, regardless of the type of diet. This research gap necessitates studies that can analyze the relationship between healthy eating and self-care behaviors in the cultural and demographic context of Iran with a multidimensional approach. On the other hand, Iranian food

culture, despite similarities to the Mediterranean diet, also has significant differences. High consumption of white bread, rice, red meat, fried foods, and sweets in the daily diet of Iranians can be an obstacle to following the Mediterranean pattern.

Therefore, examining the level of adherence of Iranian diabetic patients to this diet and its effect on self-care behaviors can provide valuable information for designing nutrition-based interventions and health education. The present study aims to investigate the relationship between the Mediterranean dietary pattern and self-care components in Iranian adults with type 2 diabetes, and attempts to achieve a deeper understanding of the role of nutrition in diabetes management by analyzing population data. This study can not only fill the gaps in the domestic research literature, but also provide scientific evidence to lay the groundwork for the development of national strategies in the field of health education, nutrition, and prevention of diabetes complications. Finally, given the heavy economic and social burden of type 2 diabetes in Iran, and the key role of self-care behaviors in controlling this disease, studies that examine the factors affecting these behaviors are of great importance. The Mediterranean diet, as a nutritional pattern that can be adapted to Iranian culture, can be one of the effective tools in promoting self-care and improving the quality of life of diabetic patients.

2. Methods

2.1. Participants

The statistical population of this study included Iranian adults who had been diagnosed with type 2 diabetes for at least one year, estimated by the Iranian Ministry of Health to be at least 7 million people in Iran by the end of 1403. Inclusion criteria included age 30 years and older (to ensure behavioral maturity in self-care responsibilities and reduce behavioral variability resulting from adolescence or early adulthood), definitive diagnosis of type 2 diabetes by a specialist physician, ability to read and write, and willingness to participate in the study along with providing informed consent. In contrast, exclusion criteria included the following: having other types of diabetes except type 2 diabetes in order to maintain sample homogeneity; inability to perform physical

activity due to physical problems such as paralysis, recent orthopedic surgery, or advanced osteoarthritis that could significantly affect lifestyle and physical activity; Having diagnosed cognitive impairments such as dementia or severe psychiatric illnesses such as schizophrenia and bipolar disorder (formative screening by a psychologist with which it may have impaired comprehension or completion of the questionnaires); being hospitalized or having an acute illness such as infection, surgery, or cardiac event in the past month to avoid temporary disruptions in self-care patterns or activity; participating in structured lifestyle, exercise, or time management programs to avoid confounding effects; not completing more than 20% of the questionnaire items or providing inconsistent and unreliable responses (choosing a duplicate option in the questionnaire (number = 5)) which led to exclusion from the final analysis; and also pregnancy or breastfeeding in women due to physiological changes affecting physical activity and self-care behaviors. Participation in the study was completely voluntary and all personal information of the participants was kept confidential in accordance with ethical principles and individual rights. Based on the distribution of DSMQ total scores (30), patients were classified into three groups: poor self-care (1–15), moderate self-care (15–25), and excellent self-care (25–35). This classification allowed for comparative analysis of self-care behaviors across different populations.

2.2. Study design

This study was conducted with a descriptive-analytical and cross-sectional design to investigate the relationship between adherence to the Mediterranean diet and self-care behaviors in patients with type 2 diabetes. This study was conducted between 1401 and 1404 in different cities of Iran. Research ethics permission was obtained from the Ethics Committee of Mohaghegh Ardabili University (IR.UMA.REC.1401.072).

2.3. Data collection tool

Demographic and clinical information included variables such as age, gender, duration of diabetes, education level, body mass index, and comorbidities.

2.4. Data measurement and analysis tools

Assessment of self-care behaviors

The 15-item Diabetes Management Questionnaire (DSMQ) was used to assess self-care behaviors in people with type 2 diabetes. Responses were assessed on a four-point Likert scale. The options for this scale were: “It completely applies to me” (score 3), “It applies to a great extent” (score 2), “It applies to some extent” (score 1), and “It does not apply to me” (score 0). Higher scores always indicate better performance in self-care. Based on the content of the items, the

distribution of the subscales was as follows: Blood Glucose Management (GM): items 1, 2, 5, 6, 8, 11, 12; Dietary Control (DC): items 3, 7, 13; Physical Activity (PA): item 9; Health Care Service Utilization (HU): items 4, 14; Composite Score (SC): item 15 only. Item 15 was designed as an overall assessment of the individual's self-care behaviors and was used solely to calculate the composite score. The original version of the DSMQ was designed by Schmitt et al. (2013) and its validity and reliability have been confirmed in international studies (Cronbach's alpha overall score: 0.84)(14). The Persian version of this instrument was also translated and validated by Hosseinzadeh et al. (2024) and its four-factor structure was confirmed in confirmatory factor analysis (Cronbach's alpha for the subscales between 0.72 and 0.84)(15). In the present study, the reliability of the instrument was calculated using Cronbach's alpha for the entire questionnaire to be 0.83, indicating the desired internal consistency of the instrument in the studied population.

Mediterranean Diet

A questionnaire on adherence to the Mediterranean diet was used to assess diet. This questionnaire consists of 16 questions. The questionnaire score ranges from 1 to 16. In this questionnaire, a score of 1 to 5 was considered as low adherence (inappropriate dietary pattern), a score of 6 to 9 as moderate adherence, and a score of 10 and above as high adherence (healthy dietary pattern)(16). The original version of this instrument has shown its validity and reliability in several studies; Martínez-González et al. (2012) reported a Cronbach's alpha of 0.76 for it. The Persian version of this questionnaire was also translated and validated by Hebestreit et al. (2017), and its content validity was confirmed by nutritionists(17). In the present study, the reliability of the instrument was calculated using Cronbach's alpha for the entire questionnaire to be 0.79, which indicates acceptable internal consistency of the instrument in the studied population.

2.5. Statistical analysis

All statistical analyses were performed using SPSS version 22. Descriptive statistics including mean and standard deviation were calculated for the main variables among the participants. The Kolmogorov-Smirnov test was used to examine the normality of the data distribution. Variables that met the assumption of normality were included in subsequent parametric analyses. Combined analysis of variance and Bonferroni post hoc test were used to compare between the research groups (grouping of adherence to the Mediterranean diet). Also, Pearson correlation analysis was used to examine the relationships between the Mediterranean diet and self-care indicators in each group. The statistical significance level for all tests was considered to be $p < 0.05$, and where necessary, the 95% confidence interval was also reported.

3. Results.

The frequency distribution of the population groups studied in this study in Iran is 206 people, including Ahvaz city 2 people (0.97%), Anzali 4 people (1.94%), Arak 1 person (0.48%), Ardabil 38 people (18.44%), Borujerd 3 people (1.45%), Dezful 1 person (0.48%), Qom 2 people (0.97%), Shahrekord 3 people (1.45%), Givi 23 people (11.16%), Hamedan 40 people (19.41%), Kermanshah 41 people (19.90%), Kabutar Ahang 6 people (2.91%), Karaj 4 people (1.94%), Khalkhal 4 people (1.94%), Malayer 3 people (1.45%), Nahavand 1 person (0.48%), Tehran 28 people (13.59%) and Yazd. There were 2 people (0.97%).

The descriptive characteristics of the population groups studied in this study are reported in Table 1. This report indicates that the physical condition of the individuals completing the study questionnaires was within a range and all groups in this study had a body mass index between 25-30.

Table 1 Descriptive characteristics of the sample in this study.

Index	Total	Women	Men
Age (years)	56/39±1/13	55/00±1/84	1/41±53/25
Height (cm)	161/05±6/31	166/04±10/15	172/35±10/72
Weight (kg)	74/13±1/11	77/33±2/57	81/37±1/51
BMI (kg/heigh squared)	28/06±0/43	27/5±0/79	26/98±0/58

In comparing men and women in the Iranian sample using a combined analysis of variance test, no significant differences were observed in indicators related to diabetes self-management, including glucose management ($p=0.14$), health care ($p=0.07$), physical activity ($p=0.64$), dietary control ($p=0.74$), and diabetes self-care ($p=0.67$).

Table 2 Comparison of Iranian samples in sections related to the diabetes self-management index

Index	Total	Women	Men
Glucose management)	7/2±43/59	6/9±99/62	7/3±58/16
Health care	5/1±84/90	5/1±19/75	5/2±65/00
Physical activity	1/1±59/08	0/0±93/97	0/0±86/94
Care Daiet	3/1±55/52	3/1±09/55	3/1±12/7
Diabetes self-care	2/1±52/10	1/0±86/95	1/1±80/01

In the comparison between men and women in the Iranian samples using the combined analysis of variance test, no significant difference was observed in the Mediterranean diet adherence factor ($p=0.75$). This means that the level of adherence to this nutritional pattern was almost similar in both sexes and gender did not have a significant effect on the level of adherence to the Mediterranean diet. Therefore, it can be concluded that factors other than gender play a more effective role in determining the level of adherence to this diet.

In the comparison between men and women in the Iranian samples, no significant difference was observed in the diabetic self-care factor using the combined analysis of variance test ($p=0.20$). This means that the level of self-care behaviors related to diabetes among men and women did not differ statistically significantly. In other words, gender as an independent variable did not have a significant effect on the level of diabetic self-care of individuals, and both groups performed relatively similarly in this regard.

Within the framework of the statistical analyses conducted on the study data, the relationship between the Mediterranean diet pattern and the diabetic self-management index was examined. The results indicated a positive but insignificant correlation between these two variables in the Iranian samples ($r = 0.07$; $p = 0.30$); in other words, although the direction of the positive correlation was reported, its

intensity was not so strong that it could be considered statistically significant.

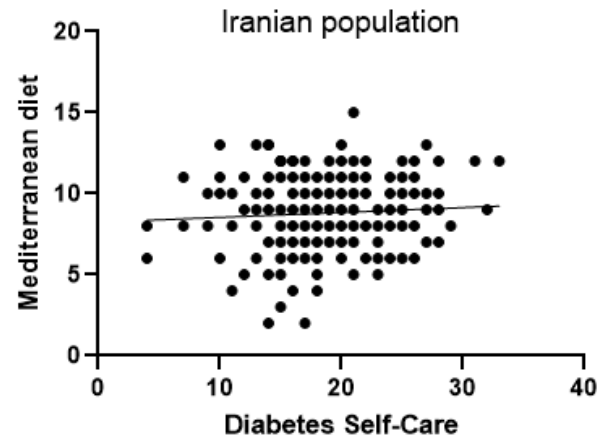


Figure 1. Correlation between diabetic self-management indicators and Mediterranean diet in Iranian society

Based on this finding, individuals with higher scores on the Mediterranean Diet Index were less likely to engage in behaviors related to diabetes self-management—such as diet adherence, regular medication use, periodic testing, and personal care. This finding suggests that a favorable dietary pattern alone, without the presence of factors related to diabetes self-management, does not necessarily lead to improved diabetes self-management.

4. Discussion

The findings of the present study showed that the relationship between the Mediterranean dietary pattern and self-care components in Iranian adults with type 2 diabetes, although positive, was not considered statistically significant. In other words, individuals with higher scores on the Mediterranean diet index had a low tendency to perform self-care behaviors. This finding indicates that following a desirable dietary pattern alone cannot guarantee the promotion of self-care behaviors in diabetic patients. No significant difference was observed in the indicators related to diabetes self-management between men and women in the Iranian samples. These results indicate that planning to promote diabetes self-management behaviors in Iranian samples does not require gender differentiation and that educational, supportive, and therapeutic

interventions can be designed and implemented in an integrated manner and by focusing on the more effective factors of individual motivation. Also, this level of performance between women and men can pave the way for the development of comprehensive and equitable health-oriented policies in the field of diabetes. Also, in the comparison between women and men in the Iranian samples, no significant difference was observed in the Mediterranean diet adherence factor. This means that the level of adherence to this nutritional pattern was almost similar in both sexes and gender did not have a significant effect on the level of adherence to the Mediterranean diet. Therefore, it can be concluded that factors other than gender play a more effective role in determining the level of adherence to this diet. Several studies have been conducted on the association of the Mediterranean diet with type 2 diabetes. For example, Sporzelto et al. showed that adherence to the Mediterranean diet improved glucose control and reduced HbA1c in diabetic

patients(4). Also, Khalili-Moghaddam et al. reported a significant association between adherence to the Mediterranean diet and a reduced risk of type 2 diabetes in an Iranian population(18). These results are consistent with the direction of the findings of the present study, but the difference in the dependent variable—self-care behaviors rather than biochemical indicators—may be the main reason for the difference in the level of significance. In contrast, some studies have also reported findings similar to the present study. For example, Shrivastava et al. showed that self-care behaviors in diabetic patients are more influenced by psychological, social, and educational factors than by dietary patterns alone(4). Hosseinzadeh and colleagues also showed in a study on the Iranian population that lifestyle inflammatory markers play an important role in the progression of diabetes and that their correction requires multidimensional interventions(15).

One possible reason for the lack of significance of the relationship between the Mediterranean diet and self-care behaviors is the difference in the definition and measurement of these two variables in different studies. In the present study, the Mediterranean diet index was calculated based on nutritional questionnaires and scoring of consumption of specific food groups, while self-care behaviors were measured through behavioral and self-report questionnaires. This difference in measurement tools may lead to a decrease in the conceptual and statistical overlap between the two variables(19). From a cultural perspective, the Mediterranean dietary pattern may not be fully accepted in Iranian society or may not be consistent with the prevailing lifestyle. A study by Ramadan, Asgari, Mirmiran, Tahmasbinejad, and Azizi showed that cultural and traditional differences between the Iranian and Mediterranean diets can prevent this pattern from having a full impact in the Iranian population(20). For example, regular consumption of fish, olive oil, fresh vegetables, and nuts, which are the main components of the Mediterranean diet, may be limited in some regions of Iran for economic or cultural reasons (21). On the other hand, self-care behaviors in diabetic patients require intrinsic motivation, continuous education, and environmental support. The study by Delhanty and Nathan showed that behavioral education and lifestyle interventions play a key role in promoting self-care behaviors (21). Also, cultural and Jahangiri research in Iran showed that healthy dietary patterns lead to improved self-care behaviors only when accompanied by education and social support(12).

From a physiological mechanism perspective, the Mediterranean diet is associated with reduced systemic inflammation, improved insulin sensitivity, and regulation of lipid profiles(10). These mechanisms may indirectly influence self-care behaviors, as improved physical fitness may increase

an individual's motivation to pursue self-care. However, in the absence of education and awareness, these effects may not be reflected at the behavioral level (22). Several studies have also pointed to the role of psychological factors in self-care behaviors. For example, Shrivastava's study showed that anxiety, depression, and stress can hinder the implementation of self-care behaviors, even when adequate nutritional resources are available(15). Also, Franz et al.'s study showed that multidimensional interventions including nutrition, physical activity, and psychological counseling are more effective in diabetes management(22). In the present study, the lack of significance of the relationship between the Mediterranean diet and self-care behaviors may be due to the lack of synchronization of nutritional interventions with behavioral education. The study by Ajala et al. showed that diets are more effective when combined with behavioral interventions(11). Also, the study by Hu et al. showed that diet quality alone cannot predict health behaviors, but should be examined together with lifestyle factors(21). Finally, the study by Martinez-Gonzalez et al. emphasizes that the Mediterranean diet should be considered as part of a comprehensive lifestyle including physical activity, social support, and health education in order to have lasting effects on self-care behaviors(23).

Another possible mechanism is the effect of the Mediterranean diet on the regulation of digestive hormones such as GLP-1 and PYY. These hormones, which are secreted in response to the consumption of fiber and healthy fats, play an important role in regulating appetite, blood sugar control, and feelings of satiety(13). Increased levels of these hormones can lead to reduced overeating, improved glucose control, and thus increased motivation to adhere to self-care behaviors. On the other hand, the Mediterranean diet reduces blood sugar fluctuations by reducing the glycemic load of meals. This stability in glucose levels is not only physiologically beneficial, but also psychologically reduces irritability, fatigue, and boredom, all of which are common barriers to the implementation of self-care behaviors(8). In fact, metabolic stability can provide a basis for behavioral stability. The Mediterranean diet also helps improve tissue oxygenation by improving endothelial function and increasing peripheral blood flow. This can reduce chronic fatigue and increase a person's ability to perform daily activities, including exercise, doctor visits, and periodic tests(24). In other words, improved vascular function can indirectly facilitate self-care behaviors. From a psychological perspective, consuming tryptophan-rich foods such as fish, nuts, and dairy products in a Mediterranean diet can increase brain serotonin levels. Serotonin plays an important role in regulating mood, motivation, and feelings of well-being(25). Increasing levels of this

neurotransmitter can lead to reduced depression and increased motivation to take care of oneself.

Studies have shown that the Mediterranean diet helps improve cellular function by reducing oxidative stress markers such as MDA and increasing the body's antioxidant capacity(26). This improvement at the cellular level can increase feelings of energy, vitality, and empowerment in the individual, and thus strengthen self-care behaviors. From a social perspective, the Mediterranean diet is usually implemented in a specific cultural context that includes eating together, family interactions, and psychological comfort. These cultural elements can lead to increased social support, reduced feelings of loneliness, and increased motivation for the individual to adhere to care behaviors(27). Social support is one of the key factors in the success of self-care programs. The Mediterranean diet also improves an individual's mental image of their own body by reducing body mass index (BMI) and improving body composition. This improvement in self-concept can lead to increased self-confidence and motivation to continue care behaviors(28). When a person feels better about themselves and their health, they are more likely to continue healthy behaviors. From a cognitive perspective, the Mediterranean diet, by increasing the intake of antioxidants and omega-3 fatty acids, improves memory and attentional function. This cognitive improvement can help to better remember when to take medications, adhere to the diet, and perform periodic tests(29). In fact, optimal cognitive function is a prerequisite for the accurate implementation of self-care behaviors. Finally, the Mediterranean diet can strengthen the individual's intrinsic motivation to continue the path of health care by creating a sense of satisfaction from eating, reducing feelings of deprivation, and increasing food enjoyment. Unlike restrictive diets, the Mediterranean diet has a high level of dietary variety and increases the individual's sense of control over food choices(6). This sense of control is a key component in health behavior theories that are directly related to self-care.

5. Conclusion

Improving self-care behaviors in diabetic patients requires a multidimensional approach that goes beyond dietary modification. Effective interventions should also consider psychological, educational, and environmental factors to lead to sustainable improvement in individual health. Focusing solely on healthy nutrition, without considering other behavioral components, cannot alone meet the care needs of this group of patients.

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Conflicts of Interest

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Authors' Contributions

All authors contributed substantially to the conception and design of the study, data collection, data analysis and interpretation, manuscript preparation, and critical revision of the manuscript. All authors read and approved the final version of the manuscript..

Supplementary Materials

This article does not contain Supplementary Materials

Data Availability Statement

We have full control over all primary data and we are agreeing to allow the journal to review their data if requested.

Institutional Review Board Statement

Prior to participation, all subjects in this study signed an informed consent document approved by the Ethical Committee of the Mohaghegh Ardabili University (Approval Code: IR.UMA.REC.1401.072).

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