

Evaluation of Sustainable Food Choices and Adherence to the Mediterranean Diet in Turkish Adults

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Received: 01.10.2025 • Accepted: 24.10.2025

ABSTRACT

Aim: The growing global population and unsustainable dietary patterns have intensified environmental degradation and public health challenges. This study aimed to examine the relationship between sustainable food choices and adherence to the Mediterranean Diet (MD) among Turkish adults. **Individuals and Methods:** A cross-sectional survey was conducted with 320 participants aged 19–64 years using validated tools including the Food Choice Questionnaire (FCQ), Sustainable Food Choice Questionnaire (SUS-FCQ), and the Mediterranean Diet Adherence Screener (MEDAS). Anthropometric data and 24-hour dietary recalls were also collected. **Results:** Results showed that female participants had significantly higher adherence to the Mediterranean Diet (MEDAS score: 6.26 ± 2.02) than men (5.12 ± 2.12 ; $p < 0.001$). A higher proportion of women demonstrated moderate or strong MD adherence (46.2%) compared to men (24.6%; $p < 0.05$). Regarding sustainability, women scored significantly higher on the "Health" subscale of the FCQ (2.95 ± 0.70 vs. 2.72 ± 0.75 ; $p = 0.019$), the "General Sustainability" score (75.41 ± 17.83 vs. 68.99 ± 21.45 ; $p = 0.033$), and the "Local and Seasonal Foods" subscale (15.71 ± 4.65 vs. 13.94 ± 5.55 ; $p = 0.020$). Participants with high MD adherence also had significantly higher scores for local and seasonal food choices (17.39 ± 4.10) than those with low (14.84 ± 4.73) or moderate adherence (15.45 ± 5.32 ; $p = 0.004$). Correlation analysis revealed significant, albeit weak, positive associations between MEDAS scores and sustainability measures: General Sustainability ($r = 0.137$; $p = 0.014$), Local and Seasonal Foods ($r = 0.164$; $p = 0.003$), and Total SUS-FCQ score ($r = 0.173$; $p = 0.002$). **Conclusion:** Modest associations were observed between Mediterranean Diet adherence and sustainable food choices, suggesting a potential link between dietary quality and sustainability-oriented behaviors among Turkish adults. Promoting the MD could therefore serve as a dual strategy for improving both public health and environmental sustainability in Turkey.

Keywords: Mediterranean Diet, sustainable food choice, public health, dietary patterns

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INTRODUCTION

The global population has been growing at an unprecedented rate, leading to a continuous rise in food demand and exerting increasing pressure on natural ecosystems (1). This surge in demand has amplified concerns about the sustainability of current food systems, both in terms of environmental degradation and human health outcomes (2). The food supply chain alone accounts for approximately 26% of global greenhouse gas (GHG) emissions (3), and this contribution is expected to escalate unless dietary patterns shift toward more sustainable alternatives.

Present-day dietary systems have been identified as environmentally, socially, and economically unsustainable (4). Diets rich in ultra-processed foods, saturated fats, sugars, and sodium are increasingly prevalent worldwide (5), contributing to a dual burden of malnutrition and non-communicable diseases (NCDs) such as obesity, cardiovascular disease, and type 2 diabetes (6). Simultaneously, these dietary trends are key contributors to deforestation, biodiversity loss, freshwater depletion, and climate change (7,8).

In this context, the role of individual food choices extends beyond personal health, influencing planetary boundaries, societal well-being, and future food security (9,10). Consumers consider multiple factors such as taste, cost, convenience, cultural norms, and perceived health benefits when selecting foods (11). However, studies suggest that encouraging sustainable food choices at the individual level—especially those aligned with public health goals—may play a vital role in transitioning to sustainable dietary systems (12).

Among various dietary models proposed as sustainable, the Mediterranean Diet (MD) has emerged as a well-evidenced, health-promoting and environmentally friendly option (13). Characterized by high consumption of fruits, vegetables, whole grains, legumes, nuts, olive oil, and moderate intake of fish and dairy, the MD is associated with reduced risk of NCDs and all-cause mortality (14,15). Importantly, it has a lower environmental footprint compared to Western dietary patterns, with significantly lower GHG emissions, land use, and water consumption (2,16).

Furthermore, the MD supports biodiversity, local food systems, seasonality, and traditional agricultural practices—key principles of sustainable food systems (17). Its adoption may therefore contribute not only to better health outcomes, but also to climate mitigation and environmental preservation (18,19). Understanding the factors that influence sustainable food choices and the extent to which individuals align with Mediterranean dietary principles is

crucial for guiding public health and environmental policy. Therefore, investigating the relationship between sustainable food choices and adherence to the Mediterranean Diet among adults provides valuable insights into both behavioral drivers and potential intervention points. Thus, the main objective of this study is to examine the relationship between sustainable food choices and adherence to the Mediterranean Diet in adult individuals. It is hypothesized that higher alignment with sustainable food practices is positively associated with greater adherence to the Mediterranean Diet.

MATERIALS AND METHODS

Study Design and Participants

This cross-sectional study was conducted between January and October 2022 among adults aged 19–64 years residing in Türkiye. The required sample size was calculated using a standard formula for cross-sectional studies, assuming a 95% confidence level, a 5% margin of error, and an expected prevalence of 50% to ensure maximum variability. Based on these assumptions, the minimum sample size was estimated at 384 individuals. Due to time and feasibility constraints, data collection was completed with a final sample of 320 participants, which was deemed adequate for the planned statistical analyses.

Participants were recruited using a nationwide online convenience sampling approach. This strategy enabled the inclusion of individuals from different regions of Türkiye and from a range of sociodemographic backgrounds. Although the study encompassed a wide age range and a geographically diverse population, the sample was not intended to be nationally representative. Therefore, the findings should be interpreted with caution regarding generalizability across different age groups, sexes, socioeconomic strata, and nutritional status categories.

Individuals younger than 19 years or older than 64 years, those with mental or cognitive impairments that could interfere with survey completion, and illiterate individuals were excluded. Additional exclusion criteria included pregnancy, lactation, adherence to medically prescribed diets, and implausible energy intakes (<800 kcal/day or >4000 kcal/day).

Participation was voluntary, and informed consent was obtained electronically prior to data collection. Ethical approval was obtained from the Hacettepe University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Decision No. 2021/14-05), and the study was conducted in accordance with the Declaration of Helsinki (20).

Data Collection

The data were collected using an online structured questionnaire administered via Google Forms, consisting of five main sections:

General Information Form: This included demographic (age, sex, education level, occupation), and lifestyle variables.

Food Choice Questionnaire (FCQ): The Food Choice Questionnaire was developed by Steptoe et al. (21) and validated for the Turkish population by Dikmen et al. (22). The FCQ consists of 36 items grouped into nine subscales: health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern. Items are rated on a 4-point Likert scale ranging from 1 (“not at all important”) to 4 (“very important”), reflecting the importance of each factor in food choice. Subscale scores are calculated as the mean of the items within each subscale, with higher scores indicating greater importance attributed to that food choice motive. No overall total score is calculated for the FCQ.

Sustainable Food Choice Questionnaire (SUS-FCQ): The Sustainable Food Choice Questionnaire was developed by Verain et al. (23) to assess motivations related to sustainable food choices and was validated for Turkish populations by Aksoy-Canyolu et al. (24). The questionnaire comprises multiple items covering key sustainability-related dimensions, including environmental impact, animal welfare, and social responsibility. Items are scored using a Likert-type scale, with higher scores indicating stronger motivation toward sustainable food choices. Subscale and total scores are calculated by averaging the relevant item scores, in accordance with the original instrument guidelines.

Mediterranean Diet Adherence Screener (MEDAS): Adherence to the Mediterranean diet was assessed using the 14-item Mediterranean Diet Adherence Screener (MEDAS), which was validated for the Turkish population by Pehlivanoglu et al. (25). Each item is scored as 0 or 1 based on predefined criteria, resulting in a total score ranging from 0 to 14. Higher scores indicate greater adherence to the Mediterranean diet. A score of >7 reflects acceptable adherence, while scores >9 indicate high adherence to the Mediterranean dietary pattern. Adherence was categorized as low (0–7 points), moderate (8–9 points), and high (≥ 10 points).

24-Hour Dietary Recall: Participants reported all food and beverages consumed in the previous 24 hours. Portion sizes were estimated using the Turkish “Photographic Atlas of Food Portions” (26). Two days after survey completion, researchers contacted participants to confirm and validate the dietary recall data. Nutrient intake analysis was performed using the BeBiS 7.2

software. Recipes were standardized using participant-reported ingredients and/or the national standard recipe database (27). The 24-hour dietary recall was used solely to support the calculation of the MEDAS score.

Anthropometric Measurements

Self-reported height (cm), weight (kg), waist and hip circumference (cm) were recorded through the survey. Participants were provided with instructions and visual materials to ensure proper measurement of waist and hip circumference. Body mass index (BMI) was calculated as weight (kg) / height (m²) and classified based on the WHO guidelines (28). Waist-to-hip ratio was computed and assessed as per WHO risk thresholds: >0.85 for women and >0.90 for men were considered at increased cardiometabolic risk (29).

Statistical Analysis

Statistical analyses were performed using SPSS (version 23.0). Descriptive statistics (means, SDs, frequencies, percentages) were used to characterize the sample. Normality of distributions was assessed using the Kolmogorov–Smirnov test. Pearson correlation analyses were used to assess relationships between FCQ, SUS-FCQ, and MEDAS scores. Multiple linear regression models were applied to identify predictors of Mediterranean diet adherence, adjusting for sociodemographic and anthropometric factors.

Although the number of female participants was approximately four times higher than that of male participants, gender-based comparisons were performed to explore potential differences between men and women. To minimize the impact of unequal group sizes on statistical validity, appropriate statistical tests were selected, and variance assumptions were checked prior to analysis. In addition, effect sizes were considered alongside p-values to support the interpretation of findings. Gender distribution was also considered in multivariable models, where gender was included as a covariate to reduce potential confounding related to sample imbalance. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1 presents the sociodemographic and anthropometric characteristics of the study population. The majority of participants were female (78.4%) and employed (79.3%), with a high proportion holding university or postgraduate degrees (87.5%). While no significant gender difference was observed in age ($p = 0.731$), male participants had significantly higher

BMI, waist circumference, and waist-to-hip ratio values compared to females ($p < 0.001$). These findings underscore potential gender-related differences in body composition that may influence dietary behavior and health outcomes.

Table 1. Sociodemographic and anthropometric characteristics of the participants

	n (%)	
Gender		
Female	251 (78.4)	
Male	69 (21.6)	
Marital Status		
Single	195 (60.9)	
Married	125 (39.1)	
Education Status		
High School	40 (12.5)	
University	154 (48.1)	
Post-graduate	126 (39.4)	
Occupational Status		
Employed	258 (79.3)	
Unemployed	24 (7.6)	
Student	42 (13.1)	
	$\bar{x} \pm SD$	p
Age (years)		
Female	32.07 $\pm$ 9.1	0.731
Male	32.49 $\pm$ 8.7	
BMI (kg/m²)		
Female	23.1 $\pm$ 4.3	<0.001
Male	26.3 $\pm$ 3.6	
Waist Circumference (cm)		
Female	75.7 $\pm$ 12.4	<0.001
Male	88.5 $\pm$ 14.7	
Hip Circumference (cm)		
Female	99.3 $\pm$ 11.5	<0.001
Male	97.5 $\pm$ 16.2	
Waist/Hip Ratio		
Female	0.76 $\pm$ 0.8	<0.001
Male	0.91 $\pm$ 0.9	

Statistically significant at $p < 0.05$; * Mann Whitney U test was used;

Table 2 compares FCQ and SUS-FCQ total and sub-dimension scores by gender. While overall food choice scores did not differ significantly between men and women, a gender-based divergence was evident in the health subdimension, where females scored significantly higher ($p = 0.019$), suggesting a greater emphasis on health-oriented food decisions among women. Furthermore, women demonstrated significantly higher scores in general sustainability ($p = 0.033$), local and seasonal consumption ($p = 0.020$), and overall sustainable food choice ($p = 0.023$), indicating more sustainable dietary attitudes compared to men.

Table 2. Comparison of total mean scores of the food choice questionnaire (FCQ) and SUS-FCQ and their sub-dimensions by gender

Questionnaire / Sub-dimension	Female $\bar{X} \pm SD, (Min-Max)$	Male $\bar{X} \pm SD, (Min-Max)$	p-value
Food Choice Questionnaire (Total)	24.86 $\pm$ 4.72 (9.33–35.60)	24.55 $\pm$ 4.62 (15.07–33.97)	0.632
Health	2.95 $\pm$ 0.70 (1–4)	2.72 $\pm$ 0.75 (1–4)	0.019*
Mood	2.64 $\pm$ 0.77 (1–4)	2.75 $\pm$ 0.77 (1–4)	0.275
Convenience	2.90 $\pm$ 0.72 (1–4)	3.07 $\pm$ 0.61 (1–4)	0.058
Sensory Appeal	3.05 $\pm$ 0.74 (1–4)	3.01 $\pm$ 0.65 (1–4)	0.522
Natural Content	2.99 $\pm$ 0.84 (1–4)	2.85 $\pm$ 0.90 (1–4)	0.204
Price	2.86 $\pm$ 0.75 (1–4)	2.90 $\pm$ 0.73 (1–4)	0.719
Weight Control	2.56 $\pm$ 0.79 (1–4)	2.55 $\pm$ 0.78 (1–4)	0.890
Familiarity	2.60 $\pm$ 0.75 (1–4)	2.50 $\pm$ 0.79 (1–4)	0.456
Ethical Concern	2.32 $\pm$ 0.86 (1–4)	2.20 $\pm$ 0.93 (1–4)	0.248
Sustainable Food Choice Questionnaire			
General Sustainability Score	75.41 $\pm$ 17.83 (13–91)	68.99 $\pm$ 21.45 (13–91)	0.033*
Local and Seasonal Consumption	15.71 $\pm$ 4.65 (3–21)	13.94 $\pm$ 5.55 (3–21)	0.020*
Sustainable Food Choice	91.12 $\pm$ 20.41 (16–112)	82.93 $\pm$ 25.41 (18–112)	0.023*

* Statistically significant at $p < 0.05$; Mann-Whitney U test was used;

Table 3 reveals a statistically significant gender difference in Mediterranean Diet adherence. Female participants scored significantly higher on the Mediterranean Diet Adherence Score ($p < 0.001$). Additionally, distribution across adherence levels differed markedly between genders ($p = 0.005$), with a larger proportion of males classified as having low adherence (75.4%) compared to females (53.8%). These results suggest that women in this sample are more likely to adopt dietary patterns aligned with the Mediterranean Diet.

Table 3. Comparison of Mediterranean diet adherence scores and adherence levels by gender

Variable	Female (n:251) $\bar{X} \pm SD, (Min-Max)$	Male (n:69) $\bar{X} \pm SD, (Min-Max)$	p-value
Mediterranean Diet Adherence Score	6.26 $\pm$ 2.02 (1–11)	5.12 $\pm$ 2.12 (2–11)	<0.001*
Adherence Level	n (%)	n (%)	
Low adherence	135 (53.8)	52 (75.4)	
Moderate adherence	82 (32.7)	13 (18.8)	0.005**
High adherence	34 (13.5)	4 (5.8)	

Statistically significant at $p < 0.05$; * Mann Whitney U test was used; ** Chi-square test was used.

Table 4 evaluates the relationship between Mediterranean Diet adherence levels and sustainable food choices. Although the overall general sustainability and total SUS-FCQ scores did not reach statistical significance across adherence levels ($p = 0.066$ and $p = 0.146$, respectively), the local and seasonal consumption subscore was significantly higher among those with high adherence to the Mediterranean Diet ($p = 0.004$). This finding highlights a potential overlap between Mediterranean dietary practices and sustainable food behaviors, particularly in the context of food seasonality and locality.

Table 4. Comparison of SUS-FCQ total and sub-dimension scores by MEDAS levels

Mediterranean Diet Adherence Level	Low adherence (n:187)	Moderate adherence (n:95)	High adherence (n:38)	p-value
	$\bar{X} \pm SD, (\text{Min-Max})$	$\bar{X} \pm SD, (\text{Min-Max})$	$\bar{X} \pm SD, (\text{Min-Max})$	
General Sustainability Score	73.15 $\pm$ 18.66 (13–91)	73.94 $\pm$ 19.39 (13–91)	78.58 $\pm$ 17.98 (13–91)	0.066
Local and Seasonal Consumption	14.84 $\pm$ 4.73 (3–21)	15.45 $\pm$ 5.32 (3–21)	17.39 $\pm$ 4.10 (5–21)	0.004*
Sustainable Food Choice	24.36 $\pm$ 4.75 (9.33–35.60)	25.30 $\pm$ 4.91 (10.50–35.33)	25.62 $\pm$ 3.57 (17.82–33.97)	0.146

* Statistically significant at $p < 0.05$; Kruskal–Wallis test and Dunn’s post-hoc tests were used.

Table 5 demonstrates statistically significant but weak positive correlations between Mediterranean Diet adherence scores and sustainable food choice metrics. Notably, the strongest correlation was observed with the total sustainable food choice score ($r = 0.173$, $p = 0.002$), followed by local and seasonal consumption ($r = 0.164$, $p = 0.003$), and general sustainability ($r = 0.137$, $p = 0.014$). These results support the idea that adherence to the Mediterranean Diet is positively associated with more sustainable dietary preferences and practices.

Table 5. Correlations Between MEDAS Scores and SUS-FCQ Scores

Variable	MEDAS Score	
	r	p-value
General Sustainability Score	0.137	0.014*
Local and Seasonal Consumption	0.164	0.003*
Sustainable Food Choice	0.173	0.002*

* Statistically significant at $p < 0.05$; Pearson test was used.

DISCUSSION

The present study examined the association between adherence to the Mediterranean diet and sustainable food choices among Turkish adults, with a specific focus on identifying gender-related differences in food choice motivations, sustainable food choice attitudes, and adherence to the Mediterranean dietary pattern. Given the well-documented influence of gender on dietary behaviors, comparisons between men and women were central to the study objectives. The findings revealed modest yet statistically significant positive associations between Mediterranean diet adherence and sustainable food choices, alongside distinct gender-specific patterns. These results are further contextualized by recent literature highlighting the dual role of the Mediterranean diet in supporting both human health and environmental sustainability. Although the gender distribution in the study sample was unbalanced, gender-based analyses were conducted using appropriate statistical approaches to ensure valid interpretation of the

findings. Systematic reviews have demonstrated that the MD generally exhibits a lower environmental impact compared to alternative dietary patterns, with reductions in greenhouse gas emissions, water usage, land requirements, and energy consumption (16).

Longitudinal intervention evidence further supports these environmental benefits. For instance, participants in the PREDIMED-Plus program experienced significant decreases in multiple environmental impact indicators—including greenhouse gas emissions, acidification, eutrophication, energy use, and land use—following one year of increased MD adherence (30). These results indicate that even incremental improvements in MD adherence at the population level can yield measurable sustainability outcomes.

Within the Turkish context, large-scale data reinforce these associations. A national study ($n = 5,285$) reported a strong positive correlation ($r = 0.47$) between awareness of sustainable healthy eating behaviors and ecological footprint reduction, highlighting the influence of environmental awareness on sustainable dietary behaviors (31). Similarly, research among working adults found that greater knowledge of food sustainability and more favorable attitudes toward sustainable eating were associated with higher MD adherence and more favorable body composition outcomes (32). These patterns parallel the present study's observation that women scored higher on both MD adherence and sustainability indices, suggesting potential benefits of integrated educational approaches that explicitly connect nutritional and environmental objectives.

The conceptualization of the MD as a sustainable dietary model is further reinforced by the “Med Diet 4.0” framework, which situates the diet within a multidimensional context encompassing health, low environmental impact, biodiversity, socio-cultural heritage, and support for local economies (33). While the current study primarily investigated individual behaviors such as the consumption of local and seasonal foods, the broader Med Diet 4.0 framework positions these actions within systemic sustainability efforts.

Seasonality, a key element of sustainable dietary practice, has received increasing scholarly attention. A recent systematic review identified local and seasonal food consumption as a promising strategy to reduce food miles and carbon emissions, despite the absence of universally accepted definitions (34). The environmental benefits of seasonal consumption are further underscored by bioregional models such as the Atlantic diet, which integrates hyper-local, seasonal, and socially embedded eating practices—providing a complementary paradigm to the MD.

Emerging concepts in nutrition science, including nutritional biodiversity, also strengthen the sustainability narrative. Diets characterized by higher species diversity have been linked to improved micronutrient intake, enhanced immune function, and greater gut microbiota diversity, thereby underscoring the potential of the MD when it incorporates diverse, plant-forward food choices.

Furthermore, global analyses of affordability indicate that sustainable and healthy dietary patterns can be structured to achieve simultaneous reductions in greenhouse gas emissions and daily food costs (35). These findings bolster policy arguments for promoting MD adherence by demonstrating that environmentally sustainable diets can also be economically accessible.

Nevertheless, translating these benefits into long-term behavior change remains challenging. Evidence from MD-based interventions suggests that adherence trajectories differ across demographic groups; notably, men—particularly those in younger and older age categories—demonstrated post-intervention declines in sustainability-related scores (36). This pattern highlights the importance of tailoring strategies to the specific needs of different gender and age cohorts to optimize the durability of behavior change.

This study has several limitations that should be acknowledged. First, the cross-sectional design restricts the ability to establish causal relationships between adherence to the Mediterranean diet and sustainable food choices. Second, the study sample was characterized by an unequal gender distribution and was highly skewed toward female participants. This lack of sociodemographic diversity substantially limits the generalizability of the findings to the broader adult population. Third, anthropometric measurements and dietary intake data were self-reported and are therefore vulnerable to recall and reporting biases, which may have led to misclassification. These biases may have been further exacerbated by the timing of data collection during and in the aftermath of the COVID-19 pandemic, a period marked by disruptions to daily routines, changes in dietary behaviors, and altered perceptions of health-related practices. Finally, although validated instruments were used to assess sustainability-related outcomes, these measures primarily reflected consumer-level behaviors and did not incorporate comprehensive life-cycle assessments of the environmental impacts of foods consumed. Future research should employ longitudinal study designs, incorporate objective anthropometric and dietary assessment methods, recruit more diverse and representative samples, and integrate broader sustainability metrics to enhance the robustness and generalizability of findings.

CONCLUSION

This study identified a modest positive association between adherence to the Mediterranean Diet and sustainable food choices among Turkish adults, particularly with respect to local and seasonal food consumption. Women tended to demonstrate higher Mediterranean diet adherence and stronger sustainability-oriented behaviors than men; however, not all gender-related differences reached statistical significance. Although the observed associations were generally weak, they suggest potential links between dietary quality and sustainability-oriented food choices. These findings may inform the development of public health strategies that seek to align nutritional guidance with environmental sustainability objectives. Given the well-documented health benefits of the Mediterranean Diet and its relatively lower environmental impact, its promotion may represent a promising approach for addressing both chronic disease prevention and environmental concerns in Turkey. Nevertheless, the cross-sectional study design, reliance on self-reported data, and limited demographic diversity warrant cautious interpretation of the results and highlight the need for longitudinal studies with more diverse and representative samples.

Ethics approval: Hacettepe University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Decision No. 2021/14-05).

Conflict of interest: The authors declare that they have no conflict of interest.

Author contributions: Study design: BO, MF; Data collection: BO; Data analysis: BO; Draft preparation: BO; Critical review for content: MF; Final approval of the version to be published: BO, MF.

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