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Original article

The relationship between the adherence to the mediterranean diet, nutrient intake and anthropometric, measurements for adult individuals living in Cyprus

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Abstract. *Objective:* The Mediterranean diet (MD) is recommended as a nutrition model that exhibits preventive characteristics against several chronic diseases with its varied and balanced nutrition pattern. The present study aimed to determine the adherence to MD and the relationship among adherence to MD, nutrition, anthropometric measurements of adult individuals living in Cyprus. *Methods:* The study participants comprised 705 individuals between 19-30 years old. The face-to-face interviews with them comprised general information, the MD adherence score, frequency of food consumption, anthropometric measurements. The data collected were evaluated using the appropriate statistical analyses. *Results:* Of the study participants, 35.7% had low adherence to MD, 57.1% had medium adherence, and only 7.2% had high adherence. A statistical difference was found between the participant's adherence level and body weight, body fat percentage, lean body mass, body water ratio, waist circumference ($p<0.05$). We observed that participants who had low adherence to MD had higher body weight, body fat ratio, body lean tissue mass. A statistically significant difference was observed among the three groups in terms of fiber, monounsaturated-fatty-acid, cholesterol, vitamins A and D intakes ($p< 0.05$). Daily fiber, monounsaturated-fatty-acid intakes were lower. In addition, we observed that individuals with high adherence to MD had higher vitamin A and D intakes than the participants. *Conclusion:* Similar to the results in the literature, we observed that individual adherence to MD might create positive effects on some anthropometric measurements and some nutrient intakes. Therefore, MD is considered to be a healthy diet based on those results.

Key words: Mediterranean Diet, Anthropometric measurements, Nutrient, Obesity, Chronic Diseases

Introduction

The Mediterranean diet (MD) is a sustainable nutrition model that provides sufficient and balanced nutrients that have positive effects on health. MD comprises a high consumption of fresh fruits and vegetables, olive oil, fish, legumes, oil seeds, whole grains, vegetative foods, unprocessed food, and moderate alcohol consumption (e.g., particularly red wine). With the MD model, dietary fiber, antioxidant components, vitamins and minerals, and unsaturated fatty acids are consumed in sufficient amounts (1,2).

The prevalence of obesity that results from unhealthy nutrition is increasing worldwide (1). Data have indicated that the prevalence of overweight and obese individuals has doubled since 1980 and affects nearly one-third of the world's population. It has been reported that this increase has been observed in both men and women throughout all age groups (3).

Obesity is a global health problem might also be the result of other factors, such as genetics, the environment, socioeconomic status, and physical activity, in addition to nutritional habits. It plays a role in the pathogenesis of several chronic diseases, such as diabetes, coronary heart disease, osteoarthritis, and cancer (4,5). Healthy nutrition and lifestyle habits may prevent morbidity and mortality caused by obesity (3). Information from the literature suggests that adherence to MD reduces the risk of obesity and metabolic syndrome, decreases blood pressure (6), prevents type 2 diabetes (7), provides protection against chronic and degenerative diseases and mortality (8), reduces the incidence of cardiovascular disease (9), and decreases cancer risks (10). Reports have indicated that chronic diseases are less prevalent within members of societies who consume a large amount of fiber (11). In addition, the disease-based mortality rates are 10.2% lower in individuals who adhere to MD (6). The MD model, which in general has low energy density, plays a significant role in preventing body weight increase (1). Boghossian et al. (12) have found an inverse relationship between adherence to MD and waist-to-hip ratio, waist circumference, and body mass index (BMI).

It has been emphasized that in addition to nutrition, physical activity is important for preventing obesity and other chronic diseases, a concept that also accompanies adherence to MD. Based on this information, the present study was conducted to determine adult individual adherence to MD and the relationship between adherence and nutrition and anthropometric measurements.

Materials and methods

Time and place of the research and sample selection

The present study was conducted in North Cyprus from December 2020 through February 2021. Female and male individuals between 19 and 30 years old who lived in the Famagusta region were the study participants. According to the data from the 2011 Census of Northern Cyprus, there were 16,110 individuals between 19- and 30-years old living in the Famagusta region. Stratified simple random sampling was used within the context of the research, and the number of individuals who were to be interviewed was determined to be 640 with a 99% confidence interval and a sampling error of 5%. The research was completed using 705 (348 males) participants.

Before beginning the study, approval was obtained from the East Mediterranean University Scientific Research and Publication Ethics Committee on December 12, 2020 (decision #2020/08). Written informed consent was received from each participant who met the research inclusion criteria.

Data collection and evaluation

The questionnaire used comprised questions regarding general information on age and sex, MD adherence score, anthropometric measurements, and frequency of food consumption. The face-to-face interviews were conducted while collecting the data on the participants.

Assessment of adherence to MD

The scale of adherence to MD was developed in 2012 by Martinez Gonzalez et al. This scale comprises 14 items, of which 12 are related to the frequency of food consumption and 2 are related to food consumption habits. The participants scored either a 0 or 1 based on their answers to the questions, with a maximum of 14 points available. Based on total score available, a score of ≤5 points was classified as low adherence, 6–9 points as moderate adherence, and ≥10 points as high adherence (13).

Assessment of food consumption frequency:

All participants were asked to list all foods and beverages that they consumed within the last month using a food catalogue (14). The Nutrition Information System was used to calculate the energy and nutrient contents of their diets (15).

Evaluation of anthropometric measurements:

The body weights, body composition, height, and waist and hip circumferences of each participant were

measured, and the BMI values for each were calculated. The participant's body weight, body fat percentage, body fat mass, lean body mass, body water ratio, trunk fat amount, and visceral adiposity were measured using the Tanita MC-780 S MA device, and their height and waist circumferences were evaluated using a nonflexible measuring tape. Measurements for body analyses were taken at least 4 h after eating, and participants were instructed to wear light-weight clothing. The Tanita device was calibrated before the measurements were taken to a sensitivity of 0.1 kg. (16).

During the measurements, the head orientation of the individuals was along the Frankfort Horizontal Plane (the ear canal and the lowest point on the inferior orbital margin were parallel to the ground). While measuring waist circumference, the horizontal plane midway between the lowest rib and the iliac crest was measured. The hip circumference was measured at the point of the largest gluteal protuberance (16).

Statistical analyses

The data collected in the present study were analyzed using SPSS ver. 18.0 (SPSS Inc., Chicago, IL, USA). The anthropometric measurements of the individuals were determined using descriptive statistics. In statistical comparisons, the fit to the normal distribution was tested using the Kolmogorov–Smirnov test. When the dataset did not show a normal distribution, the Kruskal–Wallis test was used for multiple comparisons and the Mann–Whitney U test for dual comparisons to analyze the anthropometric measurements of the participants and their daily energy and nutrient intakes according to the classifications of MD adherence. Daily energy and nutrient intakes of the participants were analyzed using one-way analysis of variance. $P < 0.05$ was accepted as statistically significant.

Results

The mean ages of the 348 males was 21.7 ± 2.5 years and that of the females was 21.2 ± 1.9 years. Of the study participants, 66.2% did not use alcohol, 67.2% did not smoke, and 67.7% did not exercise regularly (data not shown).

For the female participants, the mean body weight was 58.5 ± 9.9 kg, height was 163.5 ± 6.2 cm, BMI was 21.8 ± 3.4 kg/m^2, waist circumference was 73.7 ± 8.5 cm, hip circumference was 95.9 ± 8.2 cm, body fat percentage was 24.9 ± 6.3, body water ratio was 54.1 ± 4.8, and lean body mass was 41.7 ± 6.4 kg. For the male participants, the mean body weight was 75.7 ± 12.5 kg, height was 176.9 ± 6.8 cm, BMI was 24.1 ± 3.4 kg/m^2, waist circumference was 85.6 ± 9.9 cm, hip circumference was 101.1 ± 9.6 cm, body fat ratio was 17.4 ± 6.1, body water ratio was 59.9 ± 5.3, and lean body mass was 58.8 ± 8.1 kg (Table 1).

The mean MD adherence score was 6.2 ± 2.2 (data not shown). As seen on Table 2 and according to the MD adherence classification, 35.7% of the participants had low, 57.1% had medium, and 7.2% had high adherence to MD. The participants' adherence to MD and their anthropometric measurements are compared in Table 3.

A statistically significant difference was determined among the body weights, body fat percentage, lean body mass, body water ratio, and waist circumference values ($p < 0.05$) of the participants. Using advanced statistics, we determined that the body weight, body fat ratio, and lean body mass of the participants with low adherence to MD was statistically significantly higher than those with medium adherence to MD ($p < 0.05$); however, when comparing these in participants with low adherence to MD with those with high adherence, no statistically significant difference was determined ($p > 0.05$).

As shown in Table 4, daily energy and nutrient intakes of the study participants with low, medium, and high adherence to MD were compared. A statistically significant difference was found among the groups in terms of their fiber, monounsaturated fatty acid, and cholesterol intakes ($p < 0.05$). Using advanced statistics, we determined that the daily fiber and monounsaturated fatty acid intakes of the study participants with high adherence to MD were higher than those with low adherence to MD, and the intake of vitamins C and D was higher in the participants who had high adherence to MD than those with low and medium adherence to MD.

Daily energy and nutrient intakes was compared among the male participants with low, medium, and

Table 1. Anthropometric Measurements of the Study Participants.

Measurement	Male (n: 348)	Female (n: 357)	Total (n: 705)
	$\bar{X}$ ± SD Min (Max)	$\bar{X}$ ± SD Min (Max)	$\bar{X}$ ± SD Min (Max)
Weight (kg)	75.7 ± 12.5 (45.3–123.1)	58.5 ± 9.9 (38.0–97.7)	67.0 ± 14.1 (38.0–123.1)
Height (cm)	176.9 ± 6.8 (156.0–198.0)	163.5 ± 6.2 (147.0–190.0)	170.1 ± 9.3 (147.0–198.0)
Body mass index (kg/m^2)	24.1 ± 3.4 (16.8–34.5)	21.8 ± 3.4 (15.1–37.8)	22.9 ± 3.6 (15.1–37.8)
Waist circumference (cm)	85.6 ± 9.9 (65.0–116.0)	73.7 ± 8.5 (55.0–108.0)	79.6 ± 10.9 (55.0–116.0)
Hip circumference (cm)	101.1 ± 9.6 (65.0–194.0)	95.9 ± 8.2 (59.0–124.0)	98.4 ± 9.3 (59.0–194.0)
Body fat index (%)	17.4 ± 6.1 (3.3–32.9)	24.9 ± 6.3 (7.4–43.2)	21.2 ± 7.2 (3.3–43.2)
Body fat index (kg)	13.8 ± 6.6 (1.5–40.5)	15.2 ± 6.1 (3.9–40.5)	14.5 ± 6.4 (1.5–40.5)
Lean Body Mass (kg)	58.8 ± 8.1 (30.4–84.3)	41.7 ± 6.4 (30.4–73.8)	50.2 ± 11.2 (30.4–84.3)
Body water ratio (%)	59.9 ± 5.3 (41.3-75.5)	54.1 ± 4.8 (42.2–72.3)	57.0 ± 5.8 (41.3–75.5)
Body fat amount (%)	20.0 ± 7.6 (3.0–55.9)	20.1 ± 7.4 (0.8–39.8)	20.0 ± 7.5 (0.8–55.9)
Visceral adiposity (%)	3.3 ± 2.7 (1.0–26.8)	1.7 ± 1.2 (1.0–8.0)	2.5 ± 2.2 (1.0–26.8)

Table 2. Classification of Adherence to the Mediterranean Diet.

Mediterranean diet adherence score	Number (n)	Percentage (%)
Low (≤5 points)	252	35.7
Medium (6–9 points)	403	57.1
High (≥10 points)	51	7.2

high adherence to MD. A statistically significant difference was determined among the groups in terms of proteins (g); carbohydrates (%); fiber; monounsaturated fatty acids; cholesterol; vitamins A, C, and D; and zinc intakes ($p < 0.05$). Using advanced statistics, it was determined that daily protein, fiber, monounsaturated fatty acid, and zinc consumption by the male participants with high adherence to MD was higher than that of those with low adherence to MD. In the male participants with high adherence to MD, it was determined that the consumption of vitamins A, C, and D was higher and the carbohydrate consumption lower than that in participants with medium and low adherence to MD.

When the energy and nutrient intakes were compared among the female participants, a statistically significant difference was determined among the groups in terms of fiber intake ($p < 0.05$). Using advanced statistics, it was determined that daily fiber intake by female participants with high adherence to MD was higher than those with low adherence to MD (Table 4).

Discussion

Anthropometric measurements of individuals

Nutritional habits are created during the early periods of life and affect the individual's health on a significant level. Unhealthy nutritional habits created during

Table 3. Comparison of anthropometric measurements of participants according to the classification of the adherence to the mediterranean diet.

Measurement and adherence classification	Total number (n)	Median (Xmedian)	$\bar{X}$ ± SD	Min–Max	P
Body Weight (kg)					
Low	252	68.5	68.5 ± 13.7	38.0–113.3	0.027*
Medium	402	63.7	66.0 ± 14.3	40.0–118.5	
High	51	66.9	67.4 ± 14.8	43.4–123.1	
BMI (kg/m^2)					
Low	252	22.9	23.1 ± 3.6	15.4–34.2	0.394
Medium	402	22.3	22.8 ± 3.6	15.1–37.8	
High	51	22.9	23.0 ± 3.6	16.7–34.1	
Body Fat Mass (%)					
Low	252	19.9	20.4 ± 7.4	3.8–37.4	0.023*
Medium	402	21.9	21.8 ± 7.3	3.3–43.2	
High	51	20.0	20.4 ± 5.2	8.5–32.9	
Lean Body Mass (kg)					
Low	252	53.6	51.8 ± 11.2	30.4–84.3	0.004*
Medium	402	45.6	49.0 ± 11.2	30.4–82.4	
High	51	50.1	50.7 ± 10.5	36.1–78.6	
Body Water Ratio					
Low	252	57.5	57.5 ± 5.9	43.5–72.5	0.032*
Medium	402	56.1	56.5 ± 5.9	41.3–75.5	
High	51	57.8	57.4 ± 4.5	44.2–67.2	
Waist Circumference (cm)					
Low	252	80.0	80.6 ± 105	55.0–110.0	0.038*
Medium	402	77.6	79.2 ± 11.2	57.0–116.0	
High	51	77.0	77.9 ± 11.0	60.0–110.0	
Hip Circumference (cm)					
Low	252	99.0	98.6 ± 8.4	59.0–128.0	0.56
Medium	402	98.0	98.5 ± 9.8	65.0–124.0	
High	51	98.0	97.0 ± 9.1	70.0–124.0	
Visceral Adiposity					
Low	252	2.0	2.7 ± 2.6	1.0–26.0	0.35
Medium	402	1.0	2.4 ± 2.0	1.0–12.0	
High	51	1.0	2.9 ± 2.2	1.0–12.0	

Compared using the Kruskal-Wallis Test. *p < 0.05

this period may continue throughout the individual's life and cause a risk for obesity (17). In addition, it is known that being overweight or obese are risk factors for cardiovascular and metabolic diseases (18). As a result of the present study, we determined that although body weight and BMI were within normal ranges, these measurements in the male participants were higher than those in the female participants (Table 1). In the studies conducted in the Mediterranean countries (Spain, Italy, and Croatia), body weights and BMI values were

Table 4. Comparison of participants' daily energy and nutrient intakes according to the classification of the adherence to the mediterranean diet.

	Male				Female				Total			
Daily intake	**Low adherence (n = 148)**	**Medium adherence (N = 175)**	**High adherence (N = 25)**		**Low adherence (N = 104)**	**Medium adherence (N = 227)**	**High adherence (N = 26)**		**Low adherence (N = 252)**	**Medium adherence (N = 402)**	**High adherence (N = 51)**	
	X̄± SD Min (Max)	**X̄± SD Min (Max)**	**X̄± SD Min (Max)**	**P**	**X̄± SD Min (Max)**	**X̄± SD Min (Max)**	**X̄± SD Min (Max)**	**P**	**X̄± SD Min (Max)**	**X̄± SD Min (Max)**	**X̄± SD Min (Max)**	**P**
Energy (kcal)	2246.7 ± 789.2 (804.4–5076.5)	2522.6 ± 1276.5 (924.8–9422.8)	2521.1 ± 815.0 (1413.0–4331.5)	0.24	1905.0 ± 786.8 (685.2–4784.1)	1963.2 ± 743.2 (375.2–5422.9)	1758.7 ± 542.2 (663.5–2979.2)	0.41	2105.7 ± 804.5 (685.2–5076.5)	2206.7 ± 1046.6 (375.2–9422.8)	2132.4 ± 783.6 (663.5–4331.4)	0.41
Protein (g)	93.2 ± 32.6 (35.9–193.2)	105.4 ± 55.2 (36.6–347.5)	116.4 ± 51.6 (65.2–296.2)	0.03*	74.3 ± 35.6 (23.3–238.8)	77.6 ± 28.3 (17.6–228.7)	68.2 ± 19.7 (33.6–111.5)	0.06	85.4 ± 35.1 (23.3–238.8)	89.7 ± 44.3 (375.2–9422.8)	91.8 ± 45.4 (33.6–296.2)	0.35
Protein (%)	17.5 ± 4.0 (10.0–30.0)	17.6 ± 4.0 (9.0–31.0)	19.2 ± 4.6 (9.0–31.0)	0.11	16.2 ± 3.6 (7.0–27.0)	16.7 ± 3.7 (8.0–30.0)	16.3 ± 2.7 (11.0–22.0)	0.69	16.9 ± 3.9 (7.0–30.0)	17.1 ± 3.8 (8.0–31.0)	17.8 ± 4.1 (9.0–31.0)	0.41
Carbohydrate (g)	224.5 ± 104.8 (58.9–661.5)	248.4 ± 159.2 (59.0–1262.5)	207.7 ± 64.7 (131.3–362.0)	0.65	189.9 ± 91.1 (31.9–443.0)	190.5 ± 91.9 (13.0–727.0)	180.9 ± 79.1 (44.0–415.9)	0.96	210.3 ± 100.6 (31.9–661.5)	215.7 ± 128.8 (13.0–1262.5)	194.1 ± 72.9 (44.0–415.9)	0.43
Carbohydrate (%)	40.5 ± 8.6 (23.0–68.0)	39.8 ± 9.7 (12.0–70.0)	34.8 ± 7.8 (16.0–51.0)	0.01*	40.4 ± 8.2 (19.0–59.0)	39.2 ± 8.4 (14.0–67.0)	41.1 ± 8.4 (27.0–57.0)	0.38	40.4 ± 8.4 (19.0–68.0)	39.5 ± 9.1 (12.0–70.0)	38.1 ± 8.6 (16.0–57.0)	0.14
Oil (g)	101.5 ± 40.3 (26.4–225.5)	113.5 ± 61.0 (24.7–492.5)	130.0 ± 64.0 (58.1–320.4)	0.07	89.9 ± 41.1 (28.9–304.0)	94.6 ± 41.4 (17.4–330.5)	80.9 ± 25.5 (38.1–119.5)	0.27	96.7 ± 40.9 (26.4–304.0)	102.8 ± 51.6 (17.4–492.5)	105.0 ± 53.9 (38.1–320.4)	0.23
Oil (%)	40.7 ± 8.7 (17.0–66.0)	40.9 ± 9.4 (17.0–66.0)	44.8 ± 9.8 (30.0–73.0)	0.21	42.5 ± 8.3 (23.0–62.0)	43.2 ± 8.4 (20.0–71.0)	42.0 ± 9.0 (23.0–56.0)	0.71	41.5 ± 8.5 (17.0–66.0)	42.2 ± 8.9 (17.0–71.0)	43.4 ± 9.4 (23.0–73.0)	0.23
Fiber (g)	24.7 ± 11.4 (4.5–63.7)	29.9 ± 14.7 (5.4–87.9)	32.1 ± 8.2 (20.1–46.2)	0.00*	21.8 ± 11.6 (3.1–65.4)	26.6 ± 13.0 (1.8–82.6)	27.9 ± 11.2 (9.1–54.8)	0.00*	23.5 ± 11.5 (3.1–65.4)	28.0 ± 13.9 (1.8–87.9)	30.0 ± 10.0 (9.1–54.8)	0.00*
Saturated fatty acids (g)	34.4 ± 15.7 (9.1–113.7)	36.8 ± 21.0 (6.4–134.6)	39.8 ± 20.6 (19.0–104.0)	0.56	30.2 ± 13.0 (6.8–72.4)	29.4 ± 12.5 (5.2–88.9)	24.0 ± 8.0 (7.5–42.9)	0.11	32.7 ± 14.7 (6.8–113.7)	32.6 ± 17.1 (5.2–134.6)	31.7 ± 17.3 (7.5–104.0)	0.93
Monounsaturated fatty acids (g)	33.4 ± 13.6 (9.4–87.0)	39.0 ± 21.0 (6.8–121.6)	55.7 ± 34.6 (18.8–175.4)	0.00*	28.5 ± 12.4 (8.5–62.1)	32.8 ± 14.8 (7.2–90.5)	30.1 ± 11.5 (10.4–49.0)	0.05	31.4 ± 13.3 (8.5–87.0)	35.5 ± 18.1 (6.8–121.6)	42.7 ± 28.4 (10.4–175.4)	0.00*
Polyunsaturated fatty acids (g)	24.8 ± 15.7 (4.4–97.9)	27.6 ± 21.3 (4.4–227.5)	23.6 ± 14.3 (5.0–63.9)	0.21	23.0 ± 17.4 (2.3–152.6)	24.6 ± 17.4 (1.4–151.1)	19.0 ± 8.8 (6.3–35.4)	0.21	24.0 ± 16.4 (2.3–152.6)	25.9 ± 19.2 (1.4–227.5)	21.3 ± 11.9 (5.0–63.9)	0.13
Cholesterol (mg)	409.6 ± 241.4 (109.8–1939.1)	441.0 ± 276.2 (45.3–1709.7)	654.7 ± 458.1 (161.9–2129.6)	0.00*	302.6 ± 209.2 (55.2–1253.7)	291.2 ± 127.6 (42.3–969.5)	278.9 ± 89.0 (93.9–473.3)	0.71	365.4 ± 234.2 (55.2–1939.1)	356.4 ± 218.6 (42.3–1709.7)	463.1 ± 375.1 (93.9–2129.6)	0.01*
Omega-3 (g)	3.3 ± 8.4 (0.0–103.4)	2.7 ± 1.7 (0.5–10.2)	2.4 ± 2.2 (0.2-7.8)	0.19	2.9 ± 3.1 (0.3–29.8)	2.9 ± 3.7 (0.4–48.9)	2.8 ± 2.0 (0.6–8.9)	0.59	3.2 ± 6.7 (0.0–103.4)	2.8 ± 3.0 (0.47–48.9)	2.6 ± 2.1 (0.2–8.9)	0.59
Omega-6 (g)	26.2 ± 51.5 (0.0–611.4)	22.3 ± 12.2 (1.6–74.9)	17.6 ± 12.1 (1.1–41.6)	0.12	21.7 ± 16.1 (3.5–122.8)	22.5 ± 17.2 (1.7–178.5)	20.4 ± 12.1 (3.6–45.4)	0.84	24.3 ± 40.8 (0.0–611.4)	22.4 ± 15.2 (1.6–178.5)	19.06 ± 12.1 (1.1–45.4)	0.39
Vitamin A (µg)	1919.8 ± 3287.9 (140.4–30517.2)	1839.7 ± 2508.8 (244.8–17999.3)	2807.9 ± 3190.9 (583.1–16250.5)	0.00*	2666.2 ± 7238.6 (147.8–54559.8)	1724.8 ± 2279.2 (157.8–16251.3)	1569.9 ± 1386.4 (400.6–6866.2)	0.109	2227.8 ± 5288.5 (140.4–54559.8)	1774.8 ± 2379.5 (157.8–17999.3)	2176.7 ± 2497.8 (400.6–16250.5)	0.28
Vitamin C (mg)	100.3 ± 81.4 (4.5–774.3)	119.4 ± 76.9 (11.2–434.6)	158.7 ± 85.3 (56.2–397.6)	0.00*	94.4 ± 65.5 (12.0–341.0)	110.7 ± 72.9 (6.6–441.2)	119.3 ± 72.3 (30.9–299.8)	0.074	97.9 ± 75.2 (4.5–774.3)	114.5 ± 74.7 (6.6–441.2)	138.6 ± 80.6 (30.9–397.6)	0.00*
Vitamin E (mg)	18.6 ± 11.1 (2.5–68.9)	20.2 ± 11.2 (2.7–77.0)	21.9 ± 10.7 (5.6–50.9)	0.14	17.8 ± 10.6 (2.0–63.1)	18.6 ± 14.3 (1.3–144.7)	14.5 ± 6.2 (4.2–29.5)	0.297	18.3 ± 10.8 (2.0–68.9)	19.3 ± 13.1 (1.3–144.79	18.1 ± 9.4 (4.2–50.9)	0.51
Vitamin D (µg)	1.9 ± 1.8 (0.0–14.1)	2.0 ± 1.7 (0.0–9.2)	3.6 ± 3.1 (0.1–13.1)	0.00*	1.2 ± 1.2 (0.0–6.5)	1.2 ± 0.8 (0.0–6.1)	1.3 ± 0.7 (0.2–3.0)	0.086	1.6 ± 1.6 (0.0–14.19	1.5 ± 1.3 (0.0–9.2)	2.5 ± 2.4 (0.1–13.1)	0.00*
Zinc (mg)	14.7 ± 5.2 (5.6–31.3)	16.2 ± 8.6 (6.3–71.2)	17.5 ± 5.1 (10.0–30.6)	0.03*	12.0 ± 5.5 (4.6–35.2)	12.4 ± 4.7 (2.4–39.1)	11.2 ± 3.2 (6.4–20.5)	0.171	13.5 ± 5.5 (4.6–35.2)	14.1 ± 7.0 (2.4–71.2)	14.3 ± 5.3 (6.4–30.6)	0.598

similarly higher in the male participants than in the female participants. Some studies determined that this difference observed in males might be based on the fact that they move from their known environment and adopt a different style of living (19-21). Among the methods to measure visceral and abdominal fat distribution, it was reported that waist circumference > 102 cm in men and > 88 cm in women and the body fat ratio ≥ 20% in men and ≥ 33% in women are associated with the risk of cardiovascular disease (22,23). It was determined that waist circumference and body fat ratios of the participants were within the recommended ranges (Table 1). The results other studies were similar (23,24); however, in another study conducted in Italy in 2020, waist circumference and body fat ratios of the participants were found lower (25).

Adherence to MD

Among the Mediterranean countries, it has been observed that adherence to MD has decreased with adaptation of unhealthy nutritional habits in the developed countries worldwide (26). Various factors, such as changing lifestyle, difficulty of work life, time constraints, and financial worries, push the younger populations toward unhealthy preferences in both food selection and preparation (27). In the present study, it was determined that 35.7% (n = 252) had low adherence, 57.1% (n = 403) had medium adherence, and only 7.2% (n = 51) had high adherence to MD (Table 2). In another study conducted in Cyprus, it was similarly determined that the majority of the participants (51.3%) had medium adherence to MD, while 21.8% had low adherence and 26.8% had high adherence (28). The study conducted by Andrade et al. (29) in Portugal using 490 participants has shown results similar to those in the present study. According to the results of their study, 17.1% of the participants showed high adherence to MD, while the majority (62.7%) showed a moderate adherence to MD. In a cross-sectional study in Spain conducted with 310 first-year university students, 65.4% of the participants showed low adherence to MD, while only 24% showed high adherence (30). Contrary to these studies, one conducted using 597 Spanish university students reported that 77.6% of the participants had high adherence to MD (31). Olivares et al. (32) have found using 272 participants that nearly one-half of the study participants (51.5%) showed high adherence to MD, with the remaining (48.5%) showing low adherence. The variability in these study results might be based on the use of different questionnaires to evaluate the adherence to MD.

Adherence to MD—anthropometric measurements

In the study conducted by Agnoli et al. (33) in Italy, they investigated the associations between adherence to MD and long-term changes in body weight and waist circumference. They determined that individuals with normal body weight at the beginning of the study have a significant decrease in body weight after 5 years, as indicated in follow up examinations, but that this result did not have the same significance rate as that in the pre-obese and obese participants. In addition, at the end of the 5-year follow up, it was determined that with an increase in adherence to MD, there is a decrease in waist circumference, even in small amounts. As a result, the researchers concluded that adherence to MD might be useful for preventing increases in body weight and abdominal obesity (33). In another study that examined the effect of adherence to MD on the body composition of adults, it was found that as adherence to MD decreases, mean fat percentage significantly increases ($p < 0.05$) (34). In their study on the same subject, Renzo et al. (35) have observed that there is a significant relationship between MD and total body fat and gynoid fat ratios ($p < 0.05$), and that there is a reduction in body fat ratios as adherence to MD increases. In their study using university students in Spain, Cobo-Cuenca et al. (30) have observed that the participants who have high adherence to MD have higher body weight, BMI, and total lean mass compared with those who have medium and low adherence to MD ($p < 0.05$). In addition to studies that suggested that adherence to MD is related to low adiposity (36), there are studies that indicate that adherence to MD is not related to changes in body weight (37) and waist circumference (38). In the present study, a statistically significant difference was observed among the study participants in body weight, body fat ratio, body lean tissue mass, body water ratio, and waist circumference ($p < 0.05$) (Table 3). It was

determined that body weight, body fat ratio, and lean body mass of those who had low adherence to MD were statistically significantly higher than those who had medium adherence to the MD ($p < 0.05$); however, when participants with low adherence to MD and those with high adherence to MD were compared, the results were not statistically significant ($p > 0.05$) (Table 3). We considered that these results were based on the low number of participants who had high adherence to MD. Differences in the study results found in the literature with regard to anthropometric measurements might have been influenced by other factors, such as physical activity and genetics.

Adherence to MD—energy and nutrients

Mediterranean Diet is a nutrition model characterized by daily consumption of olive oil, whole grains, fruits, and vegetables and weekly moderate consumption of legumes, oily seeds, fish, lean meat, dairy products, and red wine, as stated above. This nutrition model provides vitamins, minerals, mono- and polyunsaturated fatty acids, fiber, antioxidants and anti-inflammatory compounds (39); therefore, the present study compared the participants' adherence to MD with their daily energy and nutrient intakes.

In the present study, no statistically significant difference was found among the female and male participants in the high, medium, and low adherence groups in terms of daily energy intakes ($p > 0.05$) (Table 4). Cobo-Cuenca et al. (30), in their study conducted on individuals with a mean age of 20.9 ± 2.5 years, have reported that daily energy consumption by study participants is not significantly different among the groups based on adherence to MD ($p > 0.05$). The results of another study indicated that although the mean energy intake of male participants with low adherence to MD is higher than that of with high adherence to MD, there is no significant difference among the groups in terms of daily mean energy intake by female participants ($p > 0.05$) (40).

Another study has reported that the most energy consumption is from protein and fats in Mediterranean countries, and the ratio of carbohydrates to energy intake is lower (40). In the present study, we determined that for the male participants with high adherence to MD, daily protein (g), fiber, and monounsaturated fatty acid intakes were higher, while their carbohydrate (%) intake was lower than that in those with low adherence to MD; however, we also determined that daily fiber intake by female participants with high adherence to MD was statistically significantly higher than that by those with low adherence to MD ($p < 0.05$) (Table 4).

The results of the present study and findings from other studies are similar (30,41,42). For example, Inan-Eroğlu et al. (41) have reported that daily carbohydrate intake by male participants with high adherence to MD is lower than that by those with low adherence to MD, while daily fiber consumption by female participants with high adherence to MD is higher than that by those with low adherence to MD. Similarly, Cobo-Cuenca et al. (30) have reported that the study participants with high adherence to MD consume more protein than those with low and medium adherence to MD.

According to the results of the present study, monounsaturated fatty acid intake through diet was found particularly high in participants with high adherence to MD, which might be related to the frequent consumption of olive oil in the MD nutrition model as a monounsaturated fatty acid source. Similarly, high daily fiber intake by study participants with high adherence to MD might have been related to high fruit and vegetable consumption. In addition, daily cholesterol intake by the male participants with high adherence to MD was higher than that in those with low and moderate adherence to MD; however, no statistically significant difference in daily cholesterol intake was determined for female participants in the high, moderate, and low adherence groups ($p > 0.05$) (Table 4).

Several studies have reported that the intake of antioxidant vitamins A, C, and E is high in MD (43,44,45). In the present study, it was determined that vitamin C intakes by participants with high adherence to MD were higher than that by those with low adherence to MD, and this result was statistically significant ($p < 0.05$) (Table 4). In a similar study conducted in Italy, vitamin C intake levels by participants with high adherence to MD were statistically

significant (44). These results can be associated with excess fruit and vegetable consumption. In the present study, it was determined that vitamin A intake by the male participants with high adherence to MD was statistically significantly higher than that by those with low and medium adherence to MD ($p < 0.05$); however, this significant difference was not observed in female participants ($p > 0.05$). In the present study, it was determined that vitamin D intake by participants with high adherence to MD was higher than that in those with medium and low adherence to MD (Table 4). The results of Marventano et al. (42) were similar ($p < 0.05$).

In the present study, it was determined that daily zinc intake by male participants with high adherence to MD was higher than that in those with low adherence to MD (Table 4). Similarly, in a cohort study conducted in Spain, it was determined that zinc intake by participants with high adherence to MD is higher than that in those with low adherence to MD (46). We suggest that these results could be based on a high consumption of oily seeds, which are part of MD.

Conclusion

The present study details significant information about study participants who adhered to MD determined by their nutrient intakes and anthropometric measurements. Similar to data from the literature, in the present study, we observed that adherence to MD can result in positive effects on the anthropometric measurements and nutrient intakes of individuals. In accordance with these data, it is considered that MD is a healthy alternative to other diets and that these results might shed encourage further studies.

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Conflicts of Interest: Each author declares that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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