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Relationship Between Adherence to Cardioprotective Diet Recommendations and Disease Risk Awareness: A Cross-Sectional Study

Kardiyoprotektif Diyet Önerilerine Uyum ile Hastalık Riski Farkındalığı Arasındaki İlişki: Kesitsel Araştırma

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ABSTRACT Objective: This study aims to assess the alignment of the Mediterranean diet with the 2021 American Heart Association (AHA) Dietary Guidelines and examine the relationship between adherence to cardioprotective dietary recommendations and awareness of cardiovascular disease (CVD) risk factors. **Material and Methods:** This study included 200 individuals diagnosed with CVD who applied to the Cardiology Clinic of Fethiye State Hospital. Data were collected through face-to-face surveys, assessing participants' sociodemographic characteristics, body mass index (BMI) and blood pressure values, and dietary habits. Adherence to cardioprotective dietary recommendations was evaluated using the Mediterranean Diet Adherence Scale (MEDAS) and a 10-item questionnaire assessing adherence with the 2021 AHA Dietary Guidelines. Additionally, CVD risk awareness was assessed using the Cardiovascular Disease Risk Awareness Assessment Questionnaire (CDRAAQ). **Results:** Participants with higher adherence to the Mediterranean diet had significantly greater awareness of CVD risk factors ($p<0.05$) compared to those with low or moderate adherence. They were also older ($p=0.010$) and had lower diastolic blood pressure ($p=0.033$), while no significant differences were observed in BMI or systolic blood pressure ($p>0.05$). Individuals who followed the AHA dietary guidelines demonstrated higher Mediterranean diet adherence and greater awareness of CVD risk factors ($p<0.05$). Additionally, CDRAAQ scores were positively correlated with MEDAS scores and negatively correlated with BMI and blood pressure ($p<0.05$). **Conclusion:** These findings emphasize the role of disease-specific awareness and educational interventions in promoting adherence to cardioprotective dietary patterns among individuals with CVD. Enhancing awareness of CVD risk factors may contribute to improved dietary adherence and cardiovascular health outcomes.

Keywords: Mediterranean diet; cardiovascular disease; risk factors

ÖZET Amaç: Bu çalışma, Akdeniz diyetinin 2021 Amerikan Kalp Derneği'nin [American Heart Association (AHA)] Beslenme Kılavuzu ile uyumunu değerlendirmeyi ve kardiyoprotektif beslenme önerilerine uyum ile kardiyovasküler hastalık (KVH) risk faktörleri farkındalığı arasındaki ilişkiyi incelemeyi amaçlamaktadır. **Gereç ve Yöntemler:** Çalışmaya, Fethiye Devlet Hastanesi Kardiyoloji Kliniği'ne başvuran ve KVH tanısı almış 200 birey dâhil edilmiştir. Veriler, yüz yüze uygulanan anketler yoluyla toplanmış; katılımcıların sosyodemografik özellikleri, beden kitle indeksi (BKİ), kan basıncı değerleri ve beslenme alışkanlıkları değerlendirilmiştir. Kardiyoprotektif beslenme önerilerine uyum, Akdeniz Diyeti Uyum Ölçeği [Mediterranean Diet Adherence Scale (MEDAS)] ve 2021 AHA Beslenme Kılavuzu'na uyumu değerlendiren 10 maddelik bir anket ile ölçülmüştür. Ayrıca KVH risk farkındalığı, Kardiyovasküler Hastalık Risk Farkındalığı Değerlendirme Anketi [Cardiovascular Disease Risk Awareness Assessment Questionnaire (CDRAAQ)] kullanılarak değerlendirilmiştir. **Bulgular:** Akdeniz diyetine yüksek uyum gösteren katılımcılar, düşük veya orta uyum gösterenlere kıyasla KVH risk faktörleri farkındalığında anlamlı derecede daha yüksek puan almıştır ($p<0,05$). Ayrıca, bu katılımcılar daha yaşlı ($p=0,010$) olup, daha düşük diyastolik kan basıncına sahipti ($p=0,033$). Ancak BKİ ve sistolik kan basıncı açısından anlamlı bir fark bulunmamıştır ($p>0,05$). AHA beslenme kılavuzlarına uyan bireylerin Akdeniz diyetine daha yüksek uyum gösterdiği ve KVH risk faktörleri farkındalıklarının daha yüksek olduğu belirlenmiştir ($p<0,05$). Ek olarak, CDRAAQ puanları MEDAS puanları ile pozitif, BKİ ve kan basıncı ile negatif korelasyon göstermiştir ($p<0,05$). **Sonuç:** Bu bulgular, KVH'ye özgü farkındalık ve eğitsel müdahalelerin, kardiyoprotektif beslenme kalıplarına uyumu teşvik etmede önemli bir role sahip olduğunu vurgulamaktadır. KVH risk faktörleri farkındalığının artırılması, beslenme uyumunun ve kardiyovasküler sağlık sonuçlarının iyileştirilmesine katkıda bulunabilir.

Anahtar Kelimeler: Akdeniz diyeti; kardiyovasküler hastalık; risk faktörleri

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Cardiovascular diseases (CVDs) are a major cause of premature mortality and disability worldwide, posing a persistent public health challenge.[1] Many environmental, lifestyle, behavioral, and genetic factors contribute to the development and progression of CVDs.[2] A balanced diet, regular physical activity, and smoking cessation constitute the "golden triad" of primary prevention and treatment of CVDs. Moreover, other modifiable lifestyle factors, such as moderate alcohol consumption and achieving and maintaining a healthy weight, further support cardiovascular health.[3]

According to American and European guidelines, diet plays a crucial role in influencing cardiovascular risk factors and is central to disease prevention. Accordingly, both guidelines emphasize the consumption of whole, unprocessed foods, the replacement of saturated fats with unsaturated fats, the avoidance of trans fats and sugar-containing foods and beverages, and the reduction of sodium intake to promote cardiovascular health. Additionally, they recommend the Dietary Approaches to Stop Hypertension (DASH) and Mediterranean diets, both of which encourage the consumption of fruits, vegetables, whole grains, legumes, and nuts to support healthy eating habits.[4-6] Although there is a general consensus on dietary patterns proven to be effective in reducing cardiovascular risk, knowledge gaps still remain.[3]

A recent study evaluated the alignment of popular diets with the 2021 American Heart Association (AHA) Dietary Guidelines, categorizing dietary patterns into four groups based on their adherence levels. The results indicated that DASH, Mediterranean, Pescetarian, and Vegetarian diets demonstrated the strongest alignment, whereas Vegan, low-fat, and low-carbohydrate diets ranked at lower adherence levels.[7]

As the prevalence of CVD risk factors continues to rise worldwide, it is crucial to focus on understanding the causes of this disease and increasing awareness. Although symptoms are one of the primary reasons patients seek medical care for chronic diseases, they may sometimes go unnoticed or be disregarded until the disease reaches an advanced stage. At this point, disease awareness plays a critical role in effective management. Awareness of CVD and its associated risk factors is anticipated to be highly significant in encouraging individuals to adopt healthy lifestyle changes and adhere to disease-specific dietary recommendations.[8,9]

While existing guidelines provide dietary recommendations to protect cardiovascular health, the extent to which individuals adhere to these recommendations and the role of awareness in this process remain unclear. This study aims to evaluate the alignment of the Mediterranean diet with the 2021 AHA Dietary Guidelines and analyze the relationship between adherence to cardioprotective dietary recommendations and awareness of CVD risk factors, thereby addressing the knowledge gap in this field.

MATERIAL AND METHODS

SAMPLE OF THE STUDY

The population of this study consists of individuals diagnosed with CVD who applied to the Cardiology Clinic of Fethiye State Hospital under the Muğla Provincial Health Directorate. All diagnosed individuals who voluntarily participated in the study within the designated data collection period (October-December 2022), met the study-specific inclusion criteria, and fully completed the survey were included in the study, which was finalized with a total of 200 participants. The inclusion criteria for the study were being over 18 years old, voluntarily participating in the study, and having no verbal communication barriers. The exclusion criteria included being pregnant or in the breastfeeding period, as well as being physically, psychologically, or socially unable to complete the survey. The sample size was calculated using the Power Analysis Program (G*Power 3.1.9.7), and a one-way analysis of variance was performed. In the calculation, a medium effect size ($f=0.25$), a 5% margin of error ($\alpha=0.05$), and 80% power ($1-\beta=0.80$) were considered, resulting in a required sample size of 195. The minimum sample size for the study was determined to be 195, and data collection was completed with a total of 200 participants.

This study was approved by the Muğla Sıtkı Koçman University Medical and Health Sciences Ethics Committee with the decision dated June 29, 2022, and numbered 220090-89. It was also approved by the Research Requests Evaluation Committee of the Muğla Provincial Health Directorate on October 14, 2022.

Written informed consent was obtained from all participants. Participants were provided with preliminary information regarding the procedures to be carried out within the scope of the study and their expected involvement. If they voluntarily agreed to participate, their consent was obtained through the Informed Voluntary Consent Form.

DATA COLLECTION TOOLS

The questionnaire was administered by the researcher using the face-to-face interview method to collect data. The questionnaire assessed the sociodemographic characteristics and lifestyle choices of the individuals. Additionally, individuals' body weight and height were recorded based on their self-reported measurements, and these values were used to calculate body mass index (BMI). Individuals' usual systolic blood pressure (SBP) and diastolic blood pressure (DBP) levels were also recorded based on their self-reported measurements.

The Cardiovascular Disease Risk Awareness Assessment Questionnaire (CDRAAQ) was used to assess awareness of CVD risk, while the Mediterranean Diet Adherence Scale (MEDAS) measured adherence to the Mediterranean diet. Additionally, adherence to the recommendations outlined in the AHA 2021 Dietary Guidelines for Improving Cardiovascular Health was evaluated.

Cardiovascular Disease Risk Awareness Assessment Questionnaire

The first version of the CDRAAQ developed by the European Society of Cardiology consisted of 65 items. Later, Woringer et al. adapted this form to the British society in 2017 and obtained a 26-item scale.[10] Vural Doğru et al. adapted this version to the Turkish society in 2021 and obtained its validity and reliability.[11]

The first 8 items in the scale are knowledge questions, with responses given as "true", "false", or "I don't know". Each correct answer is scored as 1 point, while incorrect or "I don't know" responses are scored as 0 points. The correct answer for the first 7 questions is "true", while the correct answer for question 8 is "false". Apart from this, the scale consists of three sub-dimensions: perceived heart attack/stroke risk (7 items), healthy eating intentions (5 items), and perceived benefits and intentions for change (2 items). The scale is structured as a 4-point Likert scale, where "1=Strongly Disagree" and "4=Strongly Agree". Additionally, items 15-16 are reverse-scored.[11]

A higher average score in the perceived heart attack/stroke risk sub-dimension indicates a greater perception of heart attack or stroke risk. A higher average score in the healthy eating intentions sub-dimension suggests that individuals are more prepared for changes related to healthy eating behaviors. A higher average score in the perceived benefits and intentions for change sub-dimension reflects a better understanding of the benefits of diet and exercise and a greater readiness for change in exercise behavior. An increase in the total and sub-dimension scores indicates a higher awareness of cardiovascular diseases.[11]

In the original version of the scale, the internal consistency reliability of the factor structure was evaluated using Cronbach's α coefficient. The Perceived Risk of Heart Attack/Stroke factor had α=0.85, the Perceived Benefits and Intentions to Change factor had α=0.82, and the Healthy Eating Intentions factor had α=0.56. In the Turkish version, these values were found to be α=0.915, α=0.792, and α=0.682, respectively.[10,11]

Mediterranean Diet Adherence Scale

MEDAS was used to assess participants' adherence with the Mediterranean diet. This scale was developed by Martínez-González et al. in 2012, and its Turkish validity and reliability study was conducted by Özkan Pehlivanoğlu et al. in 2020. The scale consists of 14 questions, with 1 or 0 points assigned to each question based on consumption amounts, and the total score range for MEDAS has been specified as 0-14. These scores are summed to obtain a total score, with adherence categorized as low (≤5 points), medium (6-9 points), or high (≥10 points).[12,13]

In the original version of the MEDAS, the correlation of the scale with the full-length Food Frequency Questionnaire was found to be Pearson correlation coefficient (ICC) r=0.52 and intraclass ICC=0.51. In the Turkish adaptation, the internal consistency reliability of the scale was calculated as Cronbach's alpha coefficient of 0.829, indicating that the scale is reliable.[12,13]

Assessment of adherence to AHA Dietary Guidelines

In the AHA 2021 Guidelines for Improving Cardiovascular Health, 10 key recommendations were outlined, 5 of which align with the principles of the Mediterranean diet. In this study, these recommendations were transformed into yes/no questions to assess participants' adherence to them. In this context, individuals are encouraged to consume plenty of fruits and vegetables, ensure dietary variety, choose whole grains over refined grains, obtain protein from healthy sources, opt for plant-based oils instead of animal or partially hydrogenated fats, and prioritize minimally processed or unprocessed foods over ultra-processed products.[6]

This study aims to evaluate the implementation of the AHA's 2021 recommendations for improving cardiovascular health. Assessing individuals' adherence to these recommendations will contribute to the development of more effective dietary strategies for the prevention and management of cardiovascular diseases.

STATISTICAL ANALYSIS

All statistical analyses were performed using the SPSS Statistics Version 24.0 (SPSS, Inc.; Chicago, USA). Prior to conducting the analyses, the normality of continuous variables was assessed using the Kolmogorov-Smirnov test, as it is more appropriate for larger sample sizes (n>50 per group). Additionally, visual methods, including histograms, Q-Q plots, and box plots, were examined to further support the normality assessment. Skewness and Kurtosis values were also considered, with values within the range of ±1 indicating an approximately normal distribution. For descriptive statistics, frequency and percentage were calculated for qualitative variables, while mean and standard deviation were reported for quantitative variables.

For group comparisons, parametric tests were used for normally distributed variables, specifically the independent samples t-test for 2 independent groups. When the normality assumption was not met, non-parametric tests were applied, namely the Mann-Whitney U test for comparisons between 2 independent groups. For categorical variables, group comparisons were performed using the chi-square test.

Correlation analyses were conducted using Pearson correlation for normally distributed variables and Spearman correlation for non-normally distributed variables.

A $p<0.05$ was considered statistically significant.

RESULTS

A total of 200 patients diagnosed with CVD participated in this study. The mean age of the participants was 60.0±13.4 years, and the mean BMI was 29.6±5.4 kg/m². Slightly less than half of the participants were female (48.5%). The majority was married (75%), not employed (83%), and had primary school education (48.5%). Additionally, 25% of the participants reported smoking, while 17.5% reported alcohol consumption. Just over half of the participants (50.5%) had at least one comorbid condition, and 20.5% reported regular use of nutritional supplements.

CDRAAQ total and sub-dimension scores, along with selected health indicators (BMI, DBP, and SBP) of participants according to their adherence levels to the Mediterranean diet, are presented in Table 1. Among the 200 participants, those with high Mediterranean diet adherence had a significantly higher average CDRAAQ total score (45.2±10.8) than the low or medium adherence group (40.8±12.6, $p<0.05$). Similar significant results were shown in other sub-factors except for the knowledge sub-factor ($p=0.456$). Participants with high adherence had significantly higher scores in CDRAAQ SF2 (20.3±6.3 vs. 18.5±7.0, $p=0.036$), CDRAAQ SF3 (13.2±3.6 vs. 11.6±4.3, $p=0.010$), and CDRAAQ SF4 (5.3±3.0 vs. 4.6±2.9, $p=0.049$) compared to the low or medium adherence group.

TABLE 1: CVD risk awareness and selected health indicators in relation to participants' Mediterranean diet adherence levels

Variables	Total (n=200)	Low or medium adherence (n=81)	High adherence (n=119)	p value
Age (years)	60.0±13.4 (61)	56.3±15.6 (57)	62.5±11.2 (62)	**0.010**
BMI (kg/m^2)	29.6±5.4 (29)	30.1±5.5 (29)	29.3±5.3 (29)	0.313
SBP (mmHg)	134.1±20.2 (130)	135.2±22.6 (130)	133.3±18.5 (130)	0.570
DBP (mmHg)	78.2±13.0 (80)	80.5±13.8 (80)	76.7±12.3 (80)	**0.033**
CDRAAQ TS	43.4±11.7 (44)	40.8±12.6 (42)	45.2±10.8 (48)	**0.011**
CDRAAQ SF1	6.3±1.7 (7)	6.1±1.8 (7)	6.4±1.6 (7)	0.456
CDRAAQ SF2	19.6±6.6 (22)	18.5±7.0 (21)	20.3±6.3 (23)	**0.036**
CDRAAQ SF3	12.6±4.0 (13)	11.6±4.3 (11)	13.2±3.6 (13)	**0.010**
CDRAAQ SF4	5.0±3.0 (7)	4.6±2.9 (6)	5.3±3.0 (7)	**0.049**
MEDAS TS	9.9±2.3 (10)	7.6±1.5 (8)	11.4±1.3 (11)	**0.000**

BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; CDRAAQ: Cardiovascular Disease Risk Awareness Assessment Questionnaire; TS: Total score; SF: Sub-factor; MEDAS: Mediterranean Diet Adherence Scale. CDRAAQ SF1: Knowledge; CDRAAQ SF2: Heart attack/stroke risk; CDRAAQ SF3: Healthy eating intentions; CDRAAQ SF4: Perceived benefits and intentions for change.

This table presents the comparison of Cardiovascular Disease Risk Awareness (CDRAAQ TS and sub-factors) and Selected Health Indicators (BMI, SBP, DBP) based on participants' adherence levels to the Mediterranean diet (MEDAS TS). Values are expressed as mean±standard deviation (median). For normally distributed variables, the independent samples t-test was used, whereas the Mann-Whitney U Test was applied for non-normally distributed variables.

Participants in the high adherence group were significantly older (62.5±11.2 years vs. 56.3±15.6 years, p=0.010) and had significantly lower DBP (76.7±12.3 mmHg vs. 80.5±13.8 mmHg, p=0.033). However, there were no statistically significant differences between the groups in terms of BMI (29.3±5.3 kg/m² vs. 30.1±5.5 kg/m², p=0.313) and SBP (133.3±18.5 mmHg vs. 135.2±22.6 mmHg, p=0.570).

The correlation analysis between adherence to the Mediterranean diet and CVD risk awareness is presented in Table 2. The MEDAS total score showed a positive correlation with CDRAAQ sub-factor 3 (r=0.184, p<0.01) and the total score (r=0.155, p<0.05). A significant negative correlation was found between BMI and CDRAAQ sub-factor 4 (r=-0.220, p<0.01). Furthermore, DBP was negatively correlated with CDRAAQ sub-factor 4 (r=-0.159, p<0.05), while SBP demonstrated negative correlations with CDRAAQ sub-factor 3 (r=-0.147, p<0.05), CDRAAQ sub-factor 4 (r=-0.295, p<0.01), and the total score (r=-0.183, p<0.01).

The alignment of the Mediterranean diet with the 2021 AHA Dietary Guidance is presented in Table 3.

TABLE 2: Correlation between Mediterranean diet adherence, CVD risk awareness, and selected health indicators

Variables	MEDAS TS	BMI (kg/m^2)	DBP (mmHg)	SBP (mmHg)
MEDAS TS	1.000			
BMI (kg/m^2)	-0.051	-		
DBP (mmHg)	-0.136	**0.153***	-	
SBP (mmHg)	-0.055	**0.150***	**0.607****	-
CDRAAQ SF1	0.041	-0.138	-0.014	-0.077
CDRAAQ SF2	0.108	-0.036	-0.039	-0.107
CDRAAQ SF3	**0.184****	-0.111	-0.063	**-0.147***
CDRAAQ SF4	0.120	**-0.220****	**-0.159***	**-0.295****
CDRAAQ TS	0.155*	-0.130	-0.084	**-0.183****

*Indicates significance at the 0.05 level; **indicates significance at the 0.01 level. MEDAS: Mediterranean Diet Adherence Scale; TS: Total score; BMI: Body mass index; DBP: Diastolic blood pressure; SBP: Systolic blood pressure; CDRAAQ: Cardiovascular Disease Risk Awareness Assessment Questionnaire; SF: Sub-factor. CDRAAQ SF1: Knowledge; CDRAAQ SF2: Heart attack/stroke risk; CDRAAQ SF3: Healthy eating intentions; CDRAAQ SF4: Perceived benefits and intentions for change.

The correlations were assessed using the Pearson correlation analysis for normally distributed variables and the Spearman rank correlation analysis for non-normally distributed variables. The table presents correlation coefficients (r) to evaluate the strength and direction of relationships between variables. Statistically significant correlations are indicated by p values, with p<0.05 considered significant and p<0.01 considered highly significant.

TABLE 3: Alignment of the Mediterranean diet with the 2021 AHA Dietary Guidance

AHA features		MEDAS TS	Low or medium adherence (n=81)	High adherence (n=119)
(1)	Energy balance needed to maintain a healthy weight			
	Adherents (n=124, 62.0%)	10.1±2.2 (10.0)	43 (53.1%)	81 (68.1%)
	Non-adherents (n=76, 38.0%)	9.5±2.4 (9.5)	38 (46.9%)	38 (31.9%)
	p value	0.071	0.032	
(2)	Eat plenty of vegetables and fruits, a wide variety			
	Adherents (n=120, 60.0%)	10.2±2.2 (10.0)	43 (53.1%)	77 (64.7%)
	Non-adherents (n=80, 40.0%)	9.4±2.4 (10.0)	38 (46.9%)	42 (35.3%)
	p value	0.027	0.100	
(3)	Choose mostly whole grains rather than refined grains			
	Adherents (n=128, 64.0%)	10.0±2.3 (10.0)	54 (66.7%)	74 (62.1%)
	Non-adherents (n=72, 36.0%)	9.7±2.3 (10.0)	27 (33.3%)	45 (37.8%)
	p value	0.734	0.517	
(4)	[a]Mostly protein from plants (legumes and nuts)			
	Adherents (n=140, 70.0%)	10.0±2.2 (10.0)	51 (63.0%)	89 (74.8%)
	Non-adherents (n=60, 30.0%)	9.5±2.5 (9.5)	30 (37.0%)	30 (25.2%)
	p value	0.129	0.073	
	[b]Fish and seafood			
	Adherents (n=146, 73.0%)	10.2±2.3 (10.0)	50 (61.7%)	96 (80.7%)
	Non-adherents (n=54, 27.0%)	9.0±2.3 (9.0)	31 (38.3%)	23 (19.3%)
	p value	0.002	0.003	
	[c]Low-Fat or fat-free dairy products instead of full-fat dairy			
	Adherents (n=40, 20.0%)	9.9±2.8 (10.0)	18 (22.2%)	22 (18.5%)
	Non-adherents (n=160, 80.0%)	9.9±2.2 (10.0)	63 (77.8%)	97 (81.5%)
	p value	0.901	0.517	
	[d1]If consuming poultry, choose lean cuts			
	Adherents (n=132, 66.0%)	10.2±2.1 (10.0)	48 (59.3%)	84 (70.6%)
	Non-adherents (n=68, 34.0%)	9.3±2.6 (10.0)	33 (40.7%)	35 (29.4%)
	p value	0.017	0.097	
	[d2]If consuming meat, choose lean cuts			
	Adherents (n=112, 56.0%)	10.1±2.1 (10.0)	40 (49.4%)	72 (60.5%)
	Non-adherents (n=88, 44.0%)	9.6±2.5 (10.0)	41 (50.6%)	47 (39.5%)
	p value	0.090	0.120	
(5)	Use liquid plant oils rather than tropical oils			
	Adherents (n=158, 79.0%)	10.1±2.3 (10.0)	58 (71.6%)	100 (84.0%)
	Non-adherents (n=42, 21.0%)	9.1±2.1 (9.0)	23 (28.4%)	19 (16.0%)
	p value	0.008	0.034	
(6)	Minimize intake of beverages and foods with added sugars			
	Adherents (n=134, 67.0%)	10.3±2.0 (10.0)	43 (53.1%)	91 (76.5%)
	Non-adherents (n=66, 33.0%)	9.1±2.7 (9.0)	38 (46.9%)	28 (23.5%)
	p value	0.001	0.001	
(7)	Choose and prepare foods with little or no salt			
	Adherents (n=168, 84.0%)	9.9±2.4 (10.0)	70 (86.4%)	98 (82.4%)
	Non-adherents (n=32, 16.0%)	9.8±2.1 (10.0)	11 (13.6%)	21 (17.6%)
	p value	0.909	0.441	
(8)	If you do not drink alcohol don't start, if you choose to drink alcohol, limit intake			
	Adherents (n=168, 84.0%)	9.9±2.2 (10.0)	68 (84.0%)	100 (84.0%)
	Non-adherents (n=32, 16.0%)	10.0±2.7 (10.0)	13 (16.0%)	19 (16.0%)
	p value	0.925	0.987	
(9)	Choose minimally processed foods instead of ultra-processed			
	Adherents (n=150, 75.0%)	10.1±2.2 (10.0)	57 (70.4%)	93 (78.2%)
	Non-adherents (n=50, 25.0%)	9.3±2.7 (10.0)	24 (29.6%)	26 (21.8%)
	p value	0.133	0.212	
(10)	Adhere to this guidance wherever food is prepared/consumed			
	Adherents (n=163, 81.5%)	10.0±2.2 (10.0)	62 (76.5%)	101 (84.9%)
	Non-adherents (n=37, 18.5%)	9.1±2.7 (9.0)	19 (23.5%)	18 (15.1%)
	p value	0.047	0.136	

*The main heading of item 4 is "Adequate Healthy Plant-Based and Other Protein Sources".

AHA: American Heart Association; TS: Total score; MEDAS: Mediterranean Diet Adherence Scale

Continuous variables, such as MEDAS total scores, were presented as mean±standard deviation (median) and compared using the independent samples t-test for normally distributed data or the Mann-Whitney U test for non-normally distributed data. Categorical variables, such as adherence groups, were expressed as numbers and percentages (n, %) and compared using the chi-square test.

Overall, participants who reported maintaining a healthy body weight were more likely to be in the high Mediterranean diet adherence group (68.1%) compared to those in the low or medium adherence group (53.1%) (p=0.032). Dietary behaviors that aligned with AHA recommendations were significantly associated with higher adherence to the Mediterranean diet. Specifically, participants who consumed a wide variety of fruits and vegetables demonstrated significantly higher MEDAS scores than non-adherents (p=0.027). Similarly, adherence to the consumption of fish and seafood was notably stronger among those with higher Mediterranean diet adherence, as reflected by their significantly higher MEDAS scores (p=0.002). In terms of proportional adherence, 80.7% of individuals in the high adherence group complied with the fish and seafood recommendation, compared to 61.7% in the low or medium adherence group (p=0.003).

Preferences for lean protein sources also played a significant role. Participants who selected lean cuts of poultry had higher MEDAS scores than those who did not (p=0.017). Moreover, the use of liquid plant oils instead of tropical oils was associated with significantly higher MEDAS scores (p=0.008). This preference was more prominent in the high adherence group, where 84.0% adhered to this recommendation, compared to 71.6% in the low or medium adherence group (p=0.034). Limiting added sugar intake also emerged as a significant factor. Participants who restricted their intake of added sugars had higher MEDAS scores (p=0.001), with 76.5% of the high adherence group complying with this recommendation, compared to 53.1% in the low or medium adherence group (p=0.001). Lastly, participants who adhered to dietary recommendations regardless of where the food was prepared or consumed also demonstrated significantly higher MEDAS scores (p=0.047).

DISCUSSION

Despite declining CVD mortality rates in recent decades, CVD remains a major public health concern, particularly in regions where adherence to preventive health behaviors is suboptimal.[14] Modifiable risk factors such as obesity, unhealthy dietary patterns, and sedentary lifestyles contribute to the majority of CVD cases, with estimates suggesting that up to 80-90% of cases could be prevented through lifestyle interventions.[15]

Awareness of CVD risk factors is a crucial component of disease prevention, influencing dietary choices and lifestyle behaviors.[9] This study aimed to evaluate the alignment between the Mediterranean diet and the 2021 AHA Dietary Guidelines while analyzing the relationship between adherence to cardioprotective dietary recommendations and awareness of CVD risk factors. The findings indicate that individuals with high adherence to the Mediterranean diet have significantly higher levels of CVD risk awareness. Moreover, individuals who follow to the AHA dietary recommendations demonstrate greater adherence to the Mediterranean diet.

MEDITERRANEAN DIET ADHERENCE AND CVD RISK AWARENESS

The study revealed that individuals with higher adherence to the Mediterranean diet exhibited significantly greater awareness of CVD risk factors, as reflected in their CDRAAQ scores. Among the subfactors, perceived risk (SF2), healthy eating intentions (SF3), and perceived benefits of behavioral change (SF4) were all significantly higher in participants with greater adherence to the Mediterranean diet. This study also found a significant association between greater awareness of CVD risk factors and increased adherence to the Mediterranean diet. These findings suggest a reciprocal relationship between adherence to the Mediterranean diet and awareness of CVD risk factors. This implies that greater awareness of CVD risks may encourage individuals to make healthier dietary choices and foster long-term adherence to heart-protective eating patterns, such as the Mediterranean diet. These findings are further supported by previous studies indicating that individuals with higher CVD awareness are more likely to adopt healthy lifestyle changes and show improved adherence to healthy dietary approaches.[16,17] Similarly, a study has shown that a short-term, group-based, multidisciplinary cardiovascular health program delivered by health professionals improves individuals' adherence to the Mediterranean diet. This suggests

that educational programs aimed at increasing nutritional awareness may promote adherence to the Mediterranean diet.[18]

These findings are aligned with the Knowledge-Attitude-Behavior Model, which suggests that health behavior change occurs through a 3-step process: gaining knowledge, developing positive attitudes, and changing eating behaviors.[19] Being informed and aware of the effects of nutritional behavior on health, such as the link between diet and chronic diseases, is an important 1st step in adopting healthy nutritional behaviors.[20] In parallel, it has been shown that lack of knowledge is among the barriers to adherence with the Mediterranean diet in adults at high risk for CVD.[21] However, while knowledge is a fundamental component of behavior change, it is not always sufficient on its own, as other social, psychological, and environmental factors may play a role.[19]

The Mediterranean Diet reduces CVD risk factors and improves metabolic health due to its high content of bioactive compounds and antioxidants. It has positive effects on blood pressure, glycemic control, lipid profile, and inflammation, ultimately providing long-term protection against CVD.[22] A previous study indicated that individuals with pre-existing medical conditions, such as diabetes, hypertension, and CVD, exhibit better adherence to the Mediterranean diet. A possible explanation for this finding could be that individuals tend to improve their dietary behaviors positively following a CVD diagnosis or heightened perception of risk.[23]

Consistent with this perspective, our study suggests that individuals might enhance adherence to the Mediterranean diet after receiving a CVD diagnosis or with increased perceived cardiovascular risk. In line with this, our study found a significant negative correlation between BMI and the perceived benefits and intentions to change sub-dimension of the CDRAAQ ($p<0.05$), indicating that individuals with greater awareness of the benefits of lifestyle modifications tend to have a lower BMI. Although lower BMI values may seem advantageous compared to higher values, given the average age of individuals diagnosed with CVD, being within a normal weight range might be particularly beneficial. In support of this, another study conducted among university students reported higher median scores on the Cardiovascular Disease Risk Factor Knowledge Level Scale among underweight, overweight, or obese individuals compared to those with normal body weight.[24]

Differences in results may be partially explained by findings from another study indicating that many adults with high BMI in high-risk populations are aware of their elevated cardiovascular risk due to factors such as obesity and family history of CVD. Nevertheless, it should also be noted that a significant proportion of adults with high BMI remain unaware of their increased cardiovascular risk. Thus, awareness alone may not be sufficient to induce dietary behavior change, highlighting the need for effective interventions aimed at translating awareness into behavioral modifications.[25]

Furthermore, adherence to the Mediterranean diet was associated with lower DBP ($p<0.05$), but no significant differences were found in SBP between adherence groups ($p>0.05$). These findings suggest that adherence to the Mediterranean diet may facilitate hypertension control in adults with cardiovascular disease. Magriplis et al. observed a 36% reduction in the likelihood of hypertension among individuals with higher adherence to the Mediterranean diet, highlighting its potential role in cardiovascular health.[26] A systematic review and metaanalysis found lower SBP in individuals with high Mediterranean diet adherence, though no significant difference in DBP was observed between groups.[27] While blood pressure awareness is less studied than obesity as a cardiovascular risk factor, increased awareness has been associated with positive changes in health behaviors, including improved nutrition and physical activity.[17] This study found a correlation between higher awareness of cardiovascular diseases and lower diastolic or SBP ($p<0.05$).

ALIGNMENT OF AHA GUIDELINES WITH THE MEDITERRANEAN DIET

The findings of this study reveal that adherence to specific AHA recommendations is associated with higher MEDAS scores. It was observed that participants who reported maintaining a healthy body weight were more likely to be in the high Mediter-

ranean diet adherence group. This suggests that awareness of maintaining a healthy body weight may contribute to greater adherence to the Mediterranean diet. The Mediterranean diet provides a weight loss outcome that is similar to or greater than other diets (such as low-fat and/or low-carbohydrate diets) that promise weight loss but whose long-term health effects are not clearly known.[28] The "Prevención con Dieta Mediterránea (PREDIMED)" and "CORonary Diet Intervention with olive oil and cardiovascular PREVention (CORDIPREV)" studies have confirmed the clear cardiovascular benefits of the Mediterranean diet and have also supported its positive effects on weight loss.[29,30]

Although no significant association was found between BMI and overall MEDAS scores in this study, the significant negative correlation between the "perceived benefits and intentions for change" sub-factor of the CDRAAQ and BMI provides an explanation for this. This finding suggests that while individuals have awareness and intentions to change regarding obesity, this awareness does not fully translate into healthy dietary attitudes and behaviors. Moreover, a previous study evaluating this alignment also reported that the recommendation to maintain a healthy body weight was not scored in the comparison, as it is not included in the Mediterranean diet model.[7]

A detailed examination of dietary habits revealed that adherence to key AHA dietary recommendations was associated with increased adherence to the Mediterranean diet. Specifically, individuals who reported higher and more diverse consumption of fruits and vegetables, preferred fish and seafood, consumed poultry instead of red and processed meats, and favored liquid plant oils over tropical oils demonstrated significantly greater adherence to the Mediterranean diet. These findings are consistent with previous studies emphasizing the importance of these food groups for cardiovascular health. Furthermore, the results suggest that choosing healthy sources of fats and proteins may also enhance dietary adherence.[31,32]

It was found that individuals who limited their intake of added sugars had significantly higher MEDAS scores. Although no significant associations were found between MEDAS scores and the limitation of ultra-processed food consumption in this study, previous research showed that higher adherence to the Mediterranean diet was significantly associated with lower consumption of ultra-processed foods. In that study, children in the highest adherence group reported an 8.5% lower energy intake from ultra-processed foods compared to those in the lowest adherence group. Additionally, it was highlighted that 71.6% of the variability in free sugar intake was explained by the variability in ultra-processed food consumption. These findings suggest that ultra-processed food consumption plays a significant role in increasing free sugar intake, and reducing UPF consumption could be an effective strategy to enhance adherence to the Mediterranean diet.[33,34]

Furthermore, no significant associations were found between MEDAS total scores and the consumption of whole grains, dairy product preferences, salt use, alcohol consumption ($p>0.05$). This suggests that these dietary habits may have a limited impact on adherence to the Mediterranean diet. Consistent with this, previous research indicated that adherence to recommendations regarding salt and alcohol was only partially achieved, while recommendations concerning dairy product consumption were not scored, as dairy is not considered a core component of the Mediterranean diet.[7]

STRENGTHS, LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS

One of the strengths of this study is its comprehensive assessment of dietary adherence using both the Mediterranean diet and AHA guideline frameworks, which provides a more nuanced understanding of dietary behaviors in CVD patients. However, several limitations should be acknowledged. First, the cross-sectional design limits causal interpretations, as it cannot establish whether greater awareness leads to improved adherence or vice versa. Second, the reliance on self-reported dietary intake and risk awareness measures introduces potential recall and social desirability biases. Additionally, since the study sample was drawn from a single clinic, the generalizability of the findings may be limited. Future longitudinal

studies incorporating objective biomarkers of dietary adherence and broader, more diverse populations are needed to further elucidate these relationships.

LIMITATIONS

This study has certain methodological limitations. Although the sample size meets the predetermined power analysis criteria, a larger sample would provide more robust statistical power and enhance the generalizability of the findings. Additionally, the study employed a cross-sectional design, which limits the ability to establish causal relationships between Mediterranean diet adherence and cardiovascular risk awareness. Future studies using longitudinal or interventional designs may help better assess these associations. Lastly, as the study population was recruited from a single cardiology clinic, the findings may not be fully representative of the general population. Expanding the sample to include multiple healthcare settings could improve the external validity of future research.

CONCLUSION

These findings contribute to the growing body of evidence on dietary patterns and cardiovascular health, emphasizing the need for targeted dietary interventions to enhance cardiovascular risk awareness. The results suggest that increased knowledge and awareness of CVD risk factors and preventive health behaviors can facilitate adherence to cardioprotective dietary patterns, such as the Mediterranean diet, among individuals with CVD. Higher adherence to these dietary patterns was associated with better cardiovascular risk awareness, lower BMI, and improved blood pressure control.

This study underscores the critical role of patient education and awareness programs in the prevention and management of cardiovascular diseases. By integrating structured educational interventions into clinical care, healthcare professionals can empower patients to make informed dietary choices that support cardiovascular health. Future research should focus on developing and evaluating long-term educational strategies that enhance adherence to heart-healthy diets and improve overall cardiovascular outcomes.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Büşra Başar Gökcen, Dila Özdemir;* ***Design:*** *Büşra Başar Gökcen, Dila Özdemir;* ***Control/Supervision:*** *Büşra Başar Gökcen;* ***Data Collection and/or Processing:*** *Dila Özdemir, Sena Aksu;* ***Analysis and/or Interpretation:*** *Büşra Başar Gökcen;* ***Literature Review:*** *Büşra Başar Gökcen, Sena Aksu;* ***Writing the Article:*** *Büşra Başar Gökcen;* ***Critical Review:*** *Büşra Başar Gökcen, Sena Aksu;* ***References and Fundings:*** *Dila Özdemir;* ***Materials:*** *Dila Özdemir.*

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