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Associations between Mediterranean Diet Adherence Screener and Healthy Eating Index-2015 with Obesity in Adults: A Cross-sectional Study

Yetişkinlerde Akdeniz Diyeti Bağlılık Ölçeği ve Sağlıklı Yeme İndeksi-2015'in Obezite ile İlişkisi: Kesitsel Çalışma

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ABSTRACT

Objective: Evaluating the agreement between the Healthy Eating Index (HEI)-2015 with the Mediterranean Diet Assessment Screener (MEDAS) and the associations with obesity were aimed.

Materials and Methods: Four-hundred-and-four adults (134 men, 270 women) aged 19-65 participated in this study. HEI-2015 components were calculated from 24-hour dietary recall data. Mediterranean diet adherence was assessed using the MEDAS tool. Body mass index (BMI), waist-to-height, waist-to-hip ratio, body shape index (ABSI), and body roundness index (BRI) were calculated. Pearson correlation coefficients between diet quality and obesity were given. Cohen Kappa test was applied to show agreement between HEI-2015 and MEDAS.

Results: Mean BMI, HEI-2015, and MEDAS scores were 25.35±5.21 kg/m^2, 49.34±12.96, and 7.45±2.17, respectively. MEDAS were negatively related to BMI (r=-0.120, p<0.05), waist-to-height ratio (r=-0.137, p<0.01), and BRI (p=-0.130, p<0.05) after adjusting for age, gender, education level, marital status, and smoking status. There was no association between HEI-2015 scores and obesity indices (p>0.05). Cohen Kappa test showed a slight agreement between the binarized MEDAS score and HEI-2015 scores (κ=0.126, p<0.05).

Conclusions: A slight agreement was found between HEI -2015 and MEDAS. Only MEDAS was related to obesity in this study. Future research should aim to replicate these findings in well-controlled studies.

Keywords: Diet quality, healthy eating index 2015, Mediterranean diet, obesity

ÖZ

Amaç: Çalışmada Sağlıklı Yeme İndeksi (HEI)-2015 ile Akdeniz Diyeti Bağlılık Ölçeği (MEDAS) arasındaki uyum ve obezite ile ilişkilerinin değerlendirilmesi amaçlanmıştır.

Materyal ve Metot: Bu çalışmaya 19-65 yaş arası 404 yetişkin (134 erkek, 270 kadın) katılmıştır. HEI-2015 bileşenleri 24-saatlik geriye-dönük besin tüketim kaydı verilerinden hesaplanmıştır. Akdeniz diyetine bağlılık MEDAS aracı kullanılarak değerlendirilmiştir. Beden kütle indeksi (BKİ), bel-boy, bel-kalça oranı, vücut şekli indeksi (VŞİ) ve vücut yuvarlaklık indeksi (VYİ) hesaplanmıştır. Diyet kalitesi ile obezite arasındaki ilişkiler Pearson korelasyon katsayıları sunularak verilmiştir. HEI-2015 ve MEDAS arasındaki uyumu göstermek için Cohen Kappa testi uygulanmıştır.

Bulgular: Ortalama BKİ, HEI-2015 ve MEDAS skorları sırasıyla 25.35±5.21 kg/m^2, 49.34±12.96 ve 7.45±2.17 idi. MEDAS, yaş, cinsiyet, eğitim düzeyi, medeni durum ve sigara içme durumuna gore düzenlendikten sonra BKİ (r=-0.120, p<0.05), bel-boy oranı (r=-0.137, p<0.01) ve VYİ (p=-0.130, p<0.05) ile negatif ilişkiliydi. HEI-2015 skorları ile obezite indeksleri arasında bir ilişki bulunmamıştır (p>0.05). Cohen Kappa testi, MEDAS skoru ile HEI-2015 skorları arasında hafif bir uyum olduğunu göstermiştir (κ=0.126, p<0.05).

Sonuç: Bu çalışmada HEI-2015 ve MEDAS arasında hafif bir uyum gösterilmiştir. Yalnızca MEDAS'ın obezite ile ilişkili olduğu bulunmuştur. Bu bulguların kontrollü çalışmalarla desteklenmesi gerekmektedir.

Anahtar Kelimeler: Akdeniz diyeti, diyet kalitesi, sağlıklı yeme indeksi-2015, obezite

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INTRODUCTION

Poor dietary habits are associated with chronic diseases, such as cardiovascular disease (CVD) and potentially contribute to global non-communicable disease mortality.[1] To assess the risk factors, nutritional epidemiology uses various methodologies, from considering a single food/nutrient to dietary pattern analysis.[2,3] Dietary pattern analysis can be complex, and generally, diet indices with predefined scoring systems are used according to dietary recommendations.[4] Assessing diet quality from predefined dietary pattern indices such as Healthy Eating Index (HEI), Alternative Healthy Eating Index (AHEI), Mediterranean Diet Score (MDS), Mediterranean Diet Pyramid Index (MedPyr) or Mediterranean Diet Adherence Screener (MEDAS) is a valuable tool.[3,4] Among the predefined tools, HEI and Mediterranean diet (MD) indices are widely used.

Current evidence suggests that higher diet quality is related to greater adherence to recommended dietary patterns and/or intake of dietary habits associated with a lower risk of chronic diseases.[5] In a prospective cohort study, the MD pattern has been inversely associated with lower risk for CVD, cancer mortality, and mortality from all causes.[6] A recent comprehensive review showed MD is effective on CVD and its primary outcomes or main risk factors such as metabolic syndrome, obesity, hypertension, blood lipids, diabetes, cancer, psychological/neurological conditions, and osteoporosis.[7] Similarly, HEI-2015 was inversely associated with all-cause mortality, CVD, and cancer.[8]

In a cross-sectional Italian study, total adherence to MD was related lower risk of being obese rather than a single food or nutrient.[9] However, associations between HEI-2015 and obesity measurements are limited and indicate conflicting results.[10,11] In Türkiye, Koksal and colleagues showed that HEI-2005 and HEI-2010 scores were positively correlated with body mass index (BMI).[10]

Assessments of the dietary index scores usually indicate data from dietary recall/record or food frequency questionnaires. Since they are time-consuming, some short indices have been developed to assess the diet pattern.[12] While HEI-2015 requires food consumption data, MEDAS is a short, easy-to-apply, and valid instrument to estimate adherence to the MD. Therefore, in this study, we aimed to evaluate the agreement between HEI-2015 and MEDAS and show the associations with obesity.

MATERIALS AND METHODS

Ethics Committee Approval: This study was conducted according to the Declaration of Helsinki, and all procedures involving human subjects were approved by the Clinical Research Ethics Committee of Ondokuz Mayıs University (Date: 30.04.2021, Decision no: 2021/220).

Study Design and Subjects: This cross-sectional study was conducted on 404 adults (134 men, 270 women) aged 19-65 years who volunteered to participate in Samsun province between June-December 2021. Individuals with self-reported mental diseases, metabolic disorders, following a special diet, and being pregnant or breastfeeding were excluded.

Data were collected using a questionnaire form that included demographic characteristics, comorbidities, smoking status, the MEDAS tool, and a 24-hour dietary recall form. Participants' anthropometric measurements were taken.

Assessment of Diet Quality: Healthy Eating Index-2015 components were assessed using the scoring system detailed elsewhere.[13] Components were calculated from 24-hour dietary recall records by the Nutrition Information System consisting of country-specific food data. The score ranges from 0 to 100, and high scores reflect high diet quality.[13]

The MD adherence of the participants was assessed by the MEDAS tool. MEDAS is a brief, easy-to-apply instrument and was established to predict obesity[14] and cardiovascular risk[15] in PREDIMED studies. The validation and reliability of the Turkish language were performed by Özkan Pehlivanoğlu et al.[16] The tool consists of 14 items and a two-point scoring system (0-1). The highest score is 14, and increasing scores show higher adherence to the MD.

Anthropometric Measurements: Body weight and height were measured with calibrated scales and a wall-mounted measuring tape in an appropriate private environment. Body mass index (BMI-kg/m^2) was calculated accordingly: Body weight (kg) / $height^2$ (m). Waist circumference (cm) was measured midway between the lowest rib and the iliac crest using a measuring tape. Hip circumference (cm) was measured at the widest circumference around the buttocks. The waist circumference to height was calculated as waist circumference divided by height, and waist circumference to hip circumference as waist circumference divided by hip circumference. A body shape index (ABSI) was calculated as (waist circumference/($BMI^{2/3}$*$height^{½}$)).[17] A body roundness index (BRI) as an indicator of % body fat and % visceral adipose tissue was assessed.[18]

Statistical Analysis: Histogram and q-q plots were examined, and Shapiro-Wilk's test was used to test the data normality. The Pearson correlation coefficients were calculated to determine the relationship between HEI-2015 and MEDAS scores and obesity scores after controlling for age, gender, education level, marital status, and smoking status. HEI-2015 and MEDAS scores were binarized using the median

statistics, and the Cohen Kappa coefficient was calculated to determine the agreement between the binarized HEI-2015 and MEDAS scores. Analyses were conducted using TURCOSA (Turcosa Analytics Ltd. Co., Turkey, www.turcosa.com.tr) and R 4.0.1 (www.r-project.org) statistical software. A *p*-value less than 5% was considered statistically significant.

RESULTS

Demographic characteristics are shown in Table 1. The majority of the participants were women and had Bachelor's degrees. Almost half were married, and about a quarter of the subjects were smokers. Mean BMI, HEI-2015, and MEDAS scores were 25.35±5.21 kg/m^2, 49.34±12.96, and 7.45±2.17, respectively.

According to correlation (Table 2), MEDAS scores were negatively related to BMI (r=-0.120, p<0.05), waist-to-height ratio (r=-0.137, p<0.01) and BRI (p= -0.130, p<0.05) after adjusting for age, gender, education level, marital status, and smoking status. There was no association between HEI-2015 and obesity indices used in the study (p>0.05).

We found a positive, weak, and significant relationship between these scores (r=0.209, p<0.05). After

Table 1. Demographic characteristics of participants.

Variable		Descriptive statistic*
Age (years), n (%)		26 (22-46)
Gender (women), n (%)		270 (66.8)
Education level, n (%)	Primary education	57 (14.1)
	Elementary education	26 (6.4)
	Secondary education	133 (32.9)
	Associate's degree	34 (8.4)
	Bachelor's degree	147 (36.4)
	Master/doctorate degree	7 (1.7)
	Marital status (married)	170 (42.0)
	Smoking status (smokers)	93 (23.0)
Comorbidities, n (%)	Hypertension and cardiovascular diseases	34 (8.4)
	Diabetes	21 (5.2)
	Thyroid diseases	12 (3.0)
	Asthma	11 (2.7)
	Migraine	10 (2.5)
	Kidney diseases	4 (1.0)
	Allergy	3 (0.7)
	Stomach diseases	2 (0.5)
	Other (PCOS, cancer, dermatologic, dental diseases)	12 (3.0)
Obesity indices, mean±SD	Waist-to-height ratio	0.51±0.10
	Waist-to-hip ratio	0.84±0.11
	BMI (kg/m^2)	25.35±5.21
	ABSI	0.005±0.001
	BRI	3.71±2.04
Scales/scores, mean±SD	HEI-2015	49.34±12.96
	MEDAS	7.45±2.17

*: Data are summarized as *n* (%): mean±SD; or median (1st-3rd quartiles); BMI: Body mass index; ABSI: A body shape index; BRI: Body roundness index; HEI-2015: Healthy eating index–2015; MEDAS: Mediterranean Diet Adherence Screener.

Table 2. Association between obesity indices, HEI-2015, and MEDAS scores.

Variable	HEI-2015	MEDAS	Waist/Height	Waist/Hip	BMI	ABSI	BRI
HEI-2015	1.000	-	-	-	-	-	-
MEDAS	0.181***	1.000	-	-	-	-	-
Waist/Height	-0.006	-0.137**	1.000	-	-	-	-
Waist/Hip	-0.067	-0.032	0.558***	1.000	-	-	-
BMI	0.051	-0.120*	0.781***	0.290***	1.000	-	-
ABSI	-0.077	0.079	-0.429***	-0.024	-0.857***	1.000	-
BRI	-0.013	-0.130*	0.987***	0.540***	0.780***	-0.424***	1.000

Partial correlation analysis; *: p<0.05; **: p<0.01; ***: p<0.001; Correlation coefficients are calculated by controlling the effect of age, gender, education level, marital status, and smoking status; HEI-2015: Healthy eating index – 2015; MEDAS: Mediterranean Diet Adherence Screener; BMI: Body mass index; ABSI: A body shape index; BRI: Body roundness index.

adjusting the effect of age, gender, education level, marital status, and smoking status, there was still a positive, very weak, and significant relationship between these scores (Table 2, r=0.181, p<0.05). Cohen's Kappa test showed a slight agreement between the binarized MEDAS score and HEI-2015 scores (Table 3, κ=0.126, p<0.05).

DISCUSSION AND CONCLUSION

Several diet quality indices have been utilized in nutritional research and linked with obesity and chronic disease risk. However, not every diet quality index is associated with obesity globally.[19] In our study, HEI-2015 was not associated with obesity indices, whereas MEDAS was negatively associated with waist-to-height, BMI, and BRI (Table 2). Supported that, in a recent cross-sectional study, HEI-2015 scores were not associated with both BMI and body fat percentage in young women; however, other indices negatively were correlated, reflected as the diet indices may be selected according to cultural features of the target population.[19] Likewise, the relationship between HEI-based score and weight or obesity was inconsistent among the Chinese people who lived in developed countries or regions, suggesting the relationship between HEI and obesity is more accurate where obesogenic dietary habits are more accessible.[20] Mediterranean diet pattern is widely associated with reducing obesity risk in adults.[21,22] MD and other dietary patterns cover MD components consistently related to lower overweight or obesity/obesity outcomes. However, in the same study, the evidence is unclear in HEI.[22]

Table 3. Cohen Kappa analysis in investigating the agreement between HEI-2015 and MEDAS scores.

MEDAS	HEI-2015			Cohen Kappa Test	
	≤50	>50	Total	κ	*p-value*
≤6	85 (39.7)	51 (26.8)	136 (33.7)	0.126	0.006
>6	129 (60.3)	139 (73.2)	268 (66.3)		
Total	214 (100.0)	190 (100.0)	404 (100.0)		

HEI-2015: Healthy eating index-2015; MEDAS: Mediterranean Diet Adherence Screener; κ: Cohen Kappa coefficient.

In this study, a weak positive association between total HEI-2015 and MEDAS scores after adjustments for age, gender, education level, marital status, and smoking status were found (Table 2). A slight agreement between the two diet quality scores was observed (Table 3). Reviewing the associations among diet quality indices to predict the risk of obesity, different versions of HEI have demonstrated different efficiency for diet quality and obesity in various populations.[23] Moreover, not only in terms of obesity but diet quality indices may not be related to different health outcomes. In a comparison study of the Healthy Nordic Food Index (HNFI) with modified MD score (mMDS) with all-cause mortality risk, rather than HNFI, mMDS were more associated with mortality, suggesting that HNFI were dependent on mMDS and may not reflect the full potential of a Nordic diet related to health outcomes in the Swedish population.[24] The nutritional concerns were dissimilar when comparing the HEI-2015 components between U.S. and Japanese populations because of the cultural differences. However, it is noteworthy to note that the total HEI-2015 scores of the two countries were similar.[25]

One possible explanation of this result is that HEI-2015 may have limited utility in the Turkish population to reflect obesity risk because the specific components emphasized by the index are not widely consumed. In a recent study, MEDAS validated slightly better in Mediterranean countries.[26] Turkey is one of the three MD regions in the eastern Mediterranean, along with Greece, Syria, Lebanon, Palestine, and Egypt.[27] Moreover, although there is a lack of consensus on an absolute definition, the MD pattern has some healthy critical elements associated with decreasing obesity risk, such as the consumption of nuts and seeds or olive oil[28] is not to be questioned in detail in HEI-2015. Furthermore, the cooking method or the processing is partially considered in MEDAS, particularly for pan dishes and commercial sweets and pastries. However, these are not a subject covered by HEI-2015. Preference for chicken, turkey, or rabbit meat instead of veal, pork, hamburger, or sausage is one component of MEDAS, while HEI-2015 examines the total protein foods. On the other hand, MEDAS does not contain salt or dairy consumption.

In conclusion, our findings indicate that rather than HEI-2015, MEDAS was related to obesity indices in adults in this cross-sectional study. Due to the differences between adherence to the MD and HEI components, it is difficult to state that both indices determine diet quality associated with obesity. Thus, using two indices interchangeably in determining diet quality may not be appropriate, at least in our culture. There is a need and gap for studies to address a Turkish Healthy Eating Index because of the conflicting results of HEI related to obesity in Turkey. Further research should aim to replicate these findings in well-controlled longitudinal studies comparing body composition changes across diet quality

indices. The utility of HEI should be studied in a larger sample. The MD pattern to improve obesity and, possibly, the risk of chronic diseases should be emphasized. Limitations and strengths should be noted in the current study. First, one of the major limitations of our study could be the food intake calculated from a 24-hour dietary record instead of a food frequency questionnaire. In a recent study showed even a self-reported 24-h dietary record is valid for HEI assessment.[29] However, if available, multiple consumption records can eliminate exceptional consumption. Second, the cross-sectional study design did not serve causation. We note that despite the limitations, the sample size is relatively large in the present study among the cross-sectional studies. This is one of the few studies examining diet quality and associations between obesity indices among Turkish adults in the literature.

Ethics Committee Approval: Our study was approved by the Clinical Research Ethics Committee of Ondokuz Mayıs University (date: 30.04.2021, decision number: 2021/220).

Conflict of Interest: No conflict of interest was declared by the authors.

Author Contributions: Concept – YEÖ, ZU, MSMÇ; Supervision – YEÖ; Materials – YEÖ, ZU, MSMÇ, PSK; Data Collection and/or Processing – YEÖ, ZU, MSMÇ; PSK Analysis and/or Interpretation – YEÖ, ZU, MSMÇ; Writing – YEÖ, ZU, MSMÇ, PSK.

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