Medical Journal of Bakırköy

Med J Bakirkoy 2025;21(4):419-429
DOI: 10.4274/BMJ.galenos.2025.2024.9-4

Research

Evaluation of the Effect of Dietary Habits on the Health Profile in Women with Endometriosis

Endometriozisli Kadınlarda Beslenme Alışkanlıklarının Sağlık Profili Üzerine Etkisinin Değerlendirilmesi

Tuğçe Deveci[1], Nihan Çakır Biçer[2,3], Pınar Yalçın Bahat[4]

[1]Acıbadem Mehmet Ali Aydınlar University Institute of Health Sciences, Department of Nutrition and Dietetics, İstanbul, Türkiye
[2]Acıbadem Mehmet Ali Aydınlar University Faculty of Health Sciences, Department of Nutrition and Dietetics, İstanbul, Türkiye
[3]Kocaeli University Institute of Gastroenterology and Hepatology, Department of Molecular Gastroenterology and Hepatology, Kocaeli, Türkiye
[4]University of Health Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital, Clinic of Obstetrics and Gynecology, İstanbul, Türkiye

ABSTRACT

Objective: Healthy eating habits in women with endometriosis play a role in the treatment and improvement of quality of life. This study aimed to evaluate the effect of adherence to the Mediterranean diet (MD) and polyphenol intake on health profile in endometriosis.

Methods: The study was conducted with 34 endometriosis patients admitted to Gynecology and Obstetrics Clinic of University of Helath Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital. Demographic characteristics and food consumption were recorded, the Healthy Eating Index (HEI)-2015 scores were calculated, and the polyphenol consumption questionnaire, the 14-item MD Adherence Scale (MEDAS), and the Endometriosis Health Profile-30 (EHP-30) were applied.

Results: The mean body mass index of the participants was 22.92±2.94 kg/m^2, total polyphenol intake was 657.70±304.56 mg/day, and MEDAS, HEI-2015, and EHP-30 scores were 7.85±2.26, 61.71±18.51, and 41.25±20.77, respectively. 26.5% of participants had low; 44.1% had medium; 29.4% had high adherence to the MD; and 44.1% had low HEI-2015 scores. While no relationship was found between the MEDAS score and EHP-30 total and subscale scores, an inverse relationship was found between the HEI-2015 score and EHP-30 pain subscale score (r=-0.34, p=0.04).

Conclusion: Despite the role of nutrition in endometriosis, the adherence of the participants to the MD and their HEI-2015 scores were found to be low. It is predicted that a multidisciplinary treatment approach for endometriosis with the implementation of the MD and the promotion of healthy lifestyle habits will improve symptom management and quality of life.

Keywords: Endometriosis, Mediterranean diet, polyphenols, health profile

ÖZ

Amaç: Endometriozisli kadınlarda sağlıklı beslenme alışkanlıklarının hastalığın tedavisinde rol oynayacağı ve yaşam kalitesinin artırılmasına destek olacağı bildirilmektedir. Bu çalışmada Akdeniz diyetine uyumun ve polifenol alımının endometriozis sağlık profili üzerine etkisinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Sağlık Bilimleri Üniversitesi, İstanbul Kanuni Sultan Süleyman Eğitim ve Araştırma Hastanesi Kadın Hastalıkları ve Doğum Polikliniği'ne başvuran 34 endometriozis hastasının demografik özellikleri ve besin tüketimleri kaydedilmiş, Sağlıklı Yeme İndeksi (HEI)-2015 puanları hesaplanmış ve katılımcılara polifenol tüketim sıklığı anketi, 14 maddeli Akdeniz Diyeti Uyum Ölçeği (MEDAS), Endometriozis Sağlık Profili Anketi (EHP-30) uygulanmıştır.

Bulgular: Katılımcıların ortalama beden kütle indeksi 22,92±2,94 kg/m^2, MEDAS puanı 7,85±2,26, HEI-2015 puanı 61,71±18,51 ve EHP-30 toplam puanı 41,25±20,77 ve toplam polifenol alımı 657,70±304,56 mg/gün'dür. %26,5'inin Akdeniz diyetine düşük, %44,1'inin orta, %29,4'ünün yüksek düzeyde uyum gösterdiği, %44,1'inin HEI-2015 puanının düşük olduğu bulunmuştur. MEDAS puanı, EHP-30 toplam ve alt boyut puanları arasında ilişki saptanmazken, HEI-2015 puanı ile EHP-30 ağrı alt boyut puanı arasında ters yönlü ilişki belirlenmiştir (r=-0,34, p=0,04).

Address for Correspondence: Assist, Prof, Nihan Çakır Biçer, PhD, Acıbadem Mehmet Ali Aydınlar University Faculty of Health Sciences, Department of Nutrition and Dietetics, İstanbul, Türkiye; Kocaeli University Institute of Gastroenterology and Hepatology, Department of Molecular Gastroenterology and Hepatology, Kocaeli, Türkiye
E-mail: nihan.bicer@acibadem.edu.tr, nihancakir@gmail.com **ORCID ID:** orcid.org/0000-0002-7581-9083

Cite as: Deveci T, Çakır Biçer N, Yalçın Bahat P. Evaluation of the effect of dietary habits on the health profile in women with endometriosis. Med J Bakirkoy. 2025;21(4):419-429

Received: 17.09.2024
Accepted: 04.03.2025
Publication Date: 18.12.2025

ÖZ

Sonuç: Endometrioziste beslenmenin rolüne dikkat çekilmesine rağmen, çalışmaya katılan kadınların sağlıklı bir beslenme modeli olan Akdeniz diyetine uyumu ve HEI-2015 puanları düşük saptanmıştır. Endometriozis tedavisinde multidisipliner bir tedavi yaklaşımı ile Akdeniz diyetinin uygulanmasının ve sağlıklı yaşam tarzı alışkanlıklarının teşvik edilmesinin semptom yönetimini ve yaşam kalitesini iyileştireceği ön görülmektedir.

Anahtar Kelimeler: Endometriozis, Akdeniz diyeti, polifenol, sağlık profili

INTRODUCTION

Endometriosis, which usually affects women of reproductive age, is defined as a chronic gynecological disease associated with estrogen-dependent infertility and pelvic pain. It has been reported that the prevalence of endometriosis varies according to ethnicity, with black women having a higher prevalence than Asian women (1). 10% of women of reproductive age (~190 million women) and 18% of Turkish women are affected by endometriosis (2,3). At least one-third of women with chronic pelvic pain and 5% of women without pain or infertility have endometriosis (4). Endometriosis may be accompanied by fibromyalgia, allergic rhinitis and asthma, iron deficiency anemia, lipedema, depression, fibrocystic breasts, polycystic ovaries, adenomyosis, and central-peripheral nervous system diseases (5-7). In addition to medical, pharmacological, and surgical treatment in endometriosis, healthy eating habits and positive lifestyle changes have been reported to be effective in alleviating the symptoms of the disease (8).

According to Casas et al. (9) and Cirillo et al. (10), the Mediterranean diet (MD) has a protective and therapeutic effect on many chronic diseases and can reduce inflammation and associated pain symptoms. Vegetables and fruits are the main antioxidant sources of MD due to their rich content of vitamins, minerals, and phytochemicals, and these foods have been associated with a reduced risk of developing the disease. In the management of endometriosis, while saturated fat, red meat, and alcohol consumption have been associated with an increased risk of the disease (11). Additionally, the olive oil composition and omega-3 fatty acids of the MD has been associated with a reduced risk of endometriosis (8,10). It has been reported that dietary fatty acid composition has the potential to affect endogenous hormone metabolism and endogenous estrogen levels (12). Polyphenols, which are secondary metabolites of plants, are defined as compounds that are naturally found in foods and are generally considered safer than traditional pharmaceutical drugs. They also have antioxidant properties. Polyphenols are divided into different categories such as flavonoids, stilbenes, lignans, and phenolic acids according to the number of phenol rings they contain and the structural elements that connect these rings (13). It has been reported that these components may improve the quality of life by modulating estrogen networks, thanks to their anti-inflammatory and potential phytoestrogenic effects, without causing serious adverse effects, unlike anti-estrogenic treatment (14). Nutrition also contributes to the management of endometriosis, a disease characterized by inflammation and affecting life in many ways. This study aimed to evaluate the relationship between the nutritional status of endometriosis patients as assessed by the Healthy Eating Index (HEI), their adherence with the MD, their polyphenol intake, and their health status assessed by the Endometriosis Health Profile-30 (EHP-30).

METHODS

Research Design and Sample of the Study

Acıbadem Mehmet Ali Aydınlar University and Acıbadem Healthcare Institutions Medical Research Ethics Committee (ATADEK) approval was received (approval no: 2023-13/447, date: 17.08.2023). All patients were informed about the study, and written informed consent was obtained for the protocol. This prospective, cross-sectional study was conducted with women who applied to the Obstetrics and Gynecology Clinic of University of Helath Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital between September and December 2023. Women aged 18-55 years, who were not pregnant or breastfeeding, not in menopause, and diagnosed with endometriosis stage I, II, or III by a physician, were included in the study. Individuals on a special diet were not included in the study. The sample of the study was determined as 34 participants, based on the research of Asencio et al. (15), by performing a power analysis using the R v3.6.1 program (Vienna, Austria), taking the margin of error as 5% and the beta error as 20%.

Data Collection Tools

Descriptive characteristics form: Sociodemographic and menstrual characteristics and health status were questioned. Anthropometric measurements (height, body weight, waist, and hip circumference) were taken by the researcher. Body mass index (BMI) was calculated and grouped by the recommendations of the World Health Organization (WHO) (16).

14-Point Mediterranean Diet Adherence Screener (MEDAS): The MEDAS was developed by Martínez-González et al. (17) in 2012 to assess adherence with the MD, and its Turkish validation was conducted by Bekar and Goktas (18) in 2023. The MEDAS consists of 14 questions that evaluate the daily consumption of vegetables, fruits, meat, butter, margarine, cream, alcohol and sugary drinks, olive oil, and the weekly consumption of legumes, fish, oilseeds, pastries, sauces, and the type of oil used in meals. A score of <7 indicates low adherence with the MD, 7-9 points indicate moderate adherence, and >9 points indicate high adherence. The Cronbach's alpha value of the MEDAS was reported as 0.829 (18).

Food Records: Food consumption was evaluated using a 24-hour recall method, and energy, macronutrient, and micronutrient intakes were calculated using the Nutrition Information System software (Türkiye, İstanbul).

Polyphenol Consumption Frequency Survey: To determine polyphenol intake, the Phenol-Explorer (version 3.6) database and literature were scanned, and a questionnaire was created focusing on the frequency and amount of consumption of 64 foods with high polyphenol content in the last year. According to the survey, daily intake was determined, and polyphenol consumption was calculated using Phenol-Explorer (19).

HEI-2015: The HEI-2015 was developed by the Center for Nutrition Policy and Promotion of the United States Department of Agriculture to measure adherence to dietary guidelines. The HEI-2015 consists of 13 components, the first 9 of which determine the adequacy of the diet and the last 4 of which should be consumed in limited amounts. The total score is calculated out of 100 points by adding the adequacy and limited consumption components and is defined as "poor diet quality" if ≤50, "dietary quality that needs improvement" if 51-80, and "good diet quality" if >80 (20). In addition, letter grades are given to the score ranges: 90-100 points: A, 80-89 points: B, 70-79 points: C, 60-69 points: D, and 0-59 points: F (21).

Endometriosis Health Profile-30: EHP-30 was developed by Jones et al. (22) to determine health-oriented quality of life criteria for women with endometriosis. The Turkish validation was conducted by Şahin (23). The survey consists of 53 questions and 11 subscales, including pain, control, powerlessness, emotional well-being, social support, self-image, work, sexual intercourse, relationship with children, the medical profession, treatment, and infertility. The survey is answered by considering the last four weeks, and is scored between 0 to 100, with 0 indicating the best and 100 indicating the worst health status. The Cronbach's alpha value of the EHP-30 was reported as 0.980 (23).

Statistical Analysis

The data were analyzed using the SPSS statistics 25.0 program (Armonk, NY). The skewness and kurtosis values of the variables were calculated to assess conformity with the normal distribution, and if the values were within ±2, it was assumed that they showed a normal distribution. The Pearson correlation analysis and the Spearman correlation analysis were used to evaluate the relationship between continuous variables. $P<0.05$ was accepted as significant. For this study, Cronbach's alpha values for the MEDAS and EHP-30 were found to be 0.747 and 0.963, respectively.

RESULTS

The demographic and anthropometric characteristics of the participants are shown in Table 1. The mean age of the 34 women was 35.44±6.72 years. It was determined that 17.6% (n=6) of the participants had secondary education, 79.4% (n=27) had higher education, 58.8% (n=20) were married, 88.2% (n=30) were employed, 35.3% (n=12) had income greater than their expenses, and 38.2% (n=13) had income equal to their expenses. The mean BMI of the participants was 22.92±2.94 kg/m^2, and 64.7% (n=22) of the women had normal weight, while 32.4% (n=11) were overweight (Table 1).

Table 2 presents the characteristics of disease status and menstrual cycle. 64.7% (n=22) of the women had a disease diagnosed by a physician other than endometriosis, and 17.6% (n=6) of these women had bowel problems, 5.9% (n=2), fibromyalgia, 5.9% (n=2), allergic rhinitis and asthma, 5.9% (n=2), fibrocystic breast, and 5.9% (n=2), PCOS and adenomyosis. 79.4% (n=27) of the participants reported regular menstruation (Table 2).

According to food consumption records, it was determined that participants consumed a mean of 1337.25±403.19 kcal/day of energy, 133.58±70.07 g/day carbohydrate, 59.68±17.28 g/day protein, 61.21±22.34 g/day fat, 15.29±6.03 g/day fiber, and 10.22±9.51 g/day added sugar. According to the recommendations of the Türkiye Dietary Guidelines (TDG), the ratio of energy intake from carbohydrates to total daily energy intake of the participants (38.45±12.74%) was below the daily recommendations (45-60%), and the ratio of lipid intake (41.00±12.07%) was above the recommendations (20-35%). In addition, fiber intake was below the recommendations, while added sugar intake (3.47±3.94%) was in line with them.

Table 1. Demographic and anthropometric characteristics of the participants

	Women with endometriosis (n=34)			
	Mean	**SD**	**Min**	**Max**
Age (year)	35.44	6.72	23.00	51.00
Height (cm)	163.09	5.98	150.00	175.00
Weight (kg)	60.98	8.69	44.00	82.00
BMI (kg/m^2)	22.92	2.94	16.98	29.05
Waist circumference (cm)	77.32	8.59	63.00	100.00
Hip circumference (cm)	100.94	7.71	86.00	118.00
Waist/hip ratio	0.77	0.07	0.57	0.93
Education status	**n**		**%**	
Primary school	1		2.9	
Secondary education	6		17.6	
Higher education	27		79.4	
Marital status				
Married	20		58.8	
Single	14		41.2	
Occupational status				
Employee	30		88.2	
Retired/non-employed	4		11.8	
BMI category				
Underweight (<18.5 kg/m^2)	1		2.9	
Normal (18.5-24.9 kg/m^2)	22		64.7	
Overweight (25.0-29.9 kg/m^2)	11		32.4	

BMI: Body mass index, Min: minimum, Max: Maximum, SD: Standard deviation

Table 2. Disease and menstrual cycle status of the participants

Women with endometriosis (n=34)		
Having a disease diagnosed by a physician	**n**	**%**
Yes	22	64.7
No	12	35.3
Diseases diagnosed by a physician* (n=22)		
Intestinal problems	6	17.6
Fibromyalgia	2	5.9
Allergic rhinitis and asthma	2	5.9
Iron deficiency anemia	2	5.9
Fibrocystic breast - cyst in the breast	2	5.9
PCOS-adenomyosis	2	5.9
Lipedema	1	2.9
Depression	1	2.9
Other diseases	10	29.4
Having a regular menstrual cycle		
Yes	27	79.4
No	7	20.6

*: Multiple response, PCOS: Polycystic ovary syndrome

Table 3. The energy, nutrient, and polyphenol intakes of the participants

Women with endometriosis (n=34)						
	Mean	**SD**	**Min**	**Max**	**TDG %***	**TDG recommendations**
Energy (kcal/day)	1337.25	403.19	577.30	2253.30	77.20[a]	-[a]
CHO (g/day)	133.58	70.07	28.30	298.80	-[b,c]	130[c]
CHO (%)	38.45	12.74	12.61	60.23	-[b]	45-60[b]
Protein (g/day)	59.68	17.28	24.10	93.00	112.7[a,b]	-[a]
Protein (%)	18.58	5.64	9.13	30.51	-[b]	10-20[b]
Lipid (g/day)	61.21	22.34	20.10	118.00	-[b]	-[d]
Lipid (%)	42.00	12.07	19.36	57.96	-[b]	20-35[b]
Fiber (g/day)	15.29	6.03	5.00	27.20	61.16[c]	25[c]
Added sugar (g/day)	10.22	9.51	0.00	32.50	-[e]	-[e]
Added sugar (%)	3.47	3.42	0.00	16.70	-[e]	<10[e]
SFA (g/day)	20.82	10.67	0.00	46.40	-[c]	-[c]
SFA (%)	14.91	4.73	7.47	24.56	-[c]	-[c]
MUFA (g/day)	21.60	8.51	6.80	39.20	-[d]	-[d]
PUFA (g/day)	11.87	9.02	2.90	49.90	-[d]	-[d]
Omega-3 (g/day)	1.47	1.11	0.40	4.30	-[d]	-[d]
Omega-6 (g/day)	10.2 3	8.44	2.10	46.00	-[d]	-[d]
Polyphenols (mg/day)						
Flavonoids	339.86	183.05	33.42	682.68	-[d]	-[d]
Flavonols	57.56	35.59	1.89	130.87	-[d]	-[d]
Flavanons	20.99	18.65	0.95	78.82	-[d]	-[d]
Flavanols	246.43	158.49	8.07	507.92	-[d]	-[d]
Flavons	8.43	6.26	2.49	31.61	-[d]	-[d]
Anthocyanidin	17.75	29.13	0.12	151.86	-[d]	-[d]
Stilbens	0.37	0.44	0.00	1.96	-[d]	-[d]
Lignans	10.51	6.44	2.98	31.20	-[d]	-[d]
Phenolic acids	207.66	118.03	37.38	440.50	-[d]	-[d]
Hydroxycinnamic acid	156.96	113.74	23.77	424.87	-[d]	-[d]
Hydroxybenzoic acid	50.70	32.19	0.75	107.25	-[d]	-[d]
Other polyphenols	94.70	153.68	5.09	769.48	-[d]	-[d]
Total polyphenols	657.70	304.56	146.85	1313.44	-[d]	-[d]

*: TDG %: The rate of meeting Türkiye Dietary Guidelines (TDG) recommendations.
a: Calculated according to age and the Türkiye Nutrition Guide adequate requirement of energy and AR/population reference intakes. b: Reference intake ranges for macronutrients (%) are recommended.
c: Population reference intakes is recommended as 130 g/day for CHO, and adequate intake is recommended as 25 g/day for fiber and as little as possible for SFA.
d: There is no specific intake recommendation.
e: It is recommended not to exceed 10% of energy intake.
CHO: Carbohydrate, SFA: Saturated fatty acids, MUFA: Monounsaturated fatty acids, PUFA: Polyunsaturated fatty acids, SD: Standard deviation, Min: Minimum, Max: Maximum

According to the polyphenol consumption frequency questionnaire, participants consumed a mean of 339.86 mg/day of flavonoids, 207.66 mg/day of phenolic acids, and 657.70 mg/day of total polyphenols (Table 3).

The mean MEDAS score was 7.85±2.26; the HEI-2015 score was 61.71±18.51 and the EHP-30 total score was 41.25±20.77. According to MEDAS scores, it was determined that 26.5% (n=9) of the participants had low, 44.1% (n=15) moderate, and 29.4% (n=10) high adherence with the MD; and according to HEI-2015 scores, in the distribution of letter categories, 5.9% (n=2) received A grade, 14.7% (n=5) received B grade, 20.6% (n=7) received C grade, 14.7% (n=5) received D grade and 44.1% (n=15) received F grade (Table 4).

The relationship between MEDAS, HEI-2015, and EHP-30 total, and subscales scores is shown in Table 5. A weak negative correlation was found between the EHP-30 pain subscale score and the HEI-2015 score ($r=-0.34$, $p<0.05$), but no correlation was found between the EHP-30 total and other subscales scores and the HEI-2015, and MEDAS scores ($p>0.05$, for all).

DISCUSSION

The MD is reported to be effective in relieving endometriosis-related pain, especially with its antioxidant content and anti-inflammatory effects. It is a nutritional model that has positive effects on the treatment process of endometriosis (10). This study aimed to evaluate the relationship between the nutritional habits in women diagnosed with endometriosis, and their health profile.

According to the Turkish Statistical Institute (TURKSTAT) 2023 data, the rate of higher education graduates among women was reported to be 20.9%, and the labor force participation rate for those over the age of 15 was reported to be 32.8% (24). The rate of higher education graduates or employed individuals in this study was found to be above the Turkish average, indicating that the women participating in the study were more informed and economically active individuals.

According to TURKSTAT 2023 data, 23.6% of women are obese (24). In a study conducted in Türkiye on endometriosis, the mean waist circumference (WC) was 75.02 cm, and BMI was 22.43 kg/m^2, and there were no underweight or obese subjects in the study (25). Similarly, in this study, WC was 77.32 cm and BMI was 22.92 kg/m^2, and although there were no obese women, the majority of women (64.7%) were found to be of normal weight.

Table 4. The MEDAS, HEI-2015, and EHP-30 scores of the participants

Women with endometriosis (n=34)	Mean	SD	Min	Max
MEDAS	7.85	2.26	2.00	11.00
HEI-2015	61.71	18.51	25.59	94.25
EHP-30	41.25	20.77	3.92	91.18
Pain	43.32	25.18	0.00	100.00
Control and powerlessness	48.04	31.69	0.00	100.00
Emotional well-being	40.44	29.36	0.00	100.00
Social support	44.36	28.39	0.00	87.50
Self-image	40.69	31.37	0.00	100.00
Work	31.62	27.95	0.00	100.00
Relationship with children	11.03	24.57	0.00	100.00
Sexual intercourse	35.48	35.59	0.00	100.00
Medical profession	15.99	21.22	0.00	100.00
Treatment	48.53	34.17	0.00	100.00
Infertility	36.95	32.87	0.00	100.00
MEDAS	**n**		**%**	
Low adherence	9		26.5	
Medium adherence	15		44.1	
High adherence	10		29.4	
HEI-2015 letter categories				
A (90-100 point)	2		5.9	
B (80-89 point)	5		14.7	
C (70-79 point)	7		20.6	
D (60-69 point)	5		14.7	
F (0-59 point)	15		44.1	

MEDAS: Mediterranean diet adherence screener, HEI-2015: Healthy eating index-2015, EHP-30: Endometriosis health profile-30, SD: Standard deviation, Min: Minimum, Max: Maximum

Table 5. Relationship between the MEDAS, HEI-2015, and EHP-30 scores

n=34		BMI	Total polyphenols	MEDAS	HEI-2015	EHP-30	1	2	3	4	5	6	7	8	9	10	11
MEDAS	r	-0.05	0.11	1.00													
	p	0.78	0.52	-													
HEI-2015	r	-0.18	-0.07	0.15	1.00												
	p	0.30	0.71	0.40	-												
EHP-30	r	0.19	0.06	-0.01	-0.19	1.00											
	p	0.29	0.74	0.94	0.29	-											
1. Pain	r	0.22	0.06	-0.23	-0.34	0.83	1.00										
	p	0.20	0.72	0.18	**0.04***	**<0.001***	-										
2. Control and powerlessness	r	0.21	0.04	-0.05	-0.21	0.87	0.71	1.00									
	p	0.24	0.82	0.80	0.23	**<0.001***	0.00	-									
3. Emotional well-being	r	0.02	-0.15	0.08	0.15	0.79	0.53	0.74	1.00								
	p	0.91	0.39	0.66	0.39	**<0.001***	**<0.001***	**<0.001***	-								
4. Social support	r	0.15	0.02	0.07	0.11	0.76	0.48	0.71	0.82	1.00							
	p	0.39	0.91	0.69	0.53	**<0.001***	**<0.001***	**<0.001***	**<0.001***	-							
5. Self-image	r	0.29	-0.07	0.09	0.09	0.52	0.41	0.48	0.46	0.45	1.00						
	p	0.09	0.69	0.63	0.61	**<0.001***	**0.02***	**<0.001***	**0.01***	**0.01***	-						
6. Work	r	0.16	0.09	-0.16	-0.08	0.64	0.64	0.48	0.45	0.26	0.28	1.00					
	p	0.38	0.60	0.35	0.65	**<0.001***	**<0.001***	**<0.001***	0.01*	0.14	0.11	-					
7. Relationship with children	r	0.26	0.35	0.11	0.06	0.16	0.18	0.30	0.04	0.18	-0.02	-0.05	1.00				
	p	0.37	**0.04***	0.55	0.75	0.37	0.32	0.09	0.84	0.31	0.93	0.78	-				
8. Sexual intercourse	r	0.05	0.28	0.14	-0.12	0.61	0.47	0.45	0.46	0.44	0.08	0.37	0.20	1.00			
	p	0.80	0.11	0.44	0.52	**<0.001***	**0.01***	**0.01***	**0.01***	**0.01***	0.64	**0.03***	0.27	-			
9. Medical profession	r	0.08	0.12	0.01	-0.10	0.45	0.27	0.32	0.27	0.19	0.20	0.05	0.02	0.35	1.00		
	p	0.91	0.51	0.94	0.58	**0.01***	0.13	0.07	0.13	0.28	0.27	0.80	0.89	0.04*	-		
10. Treatment	r	-0.14	0.12	0.18	-0.02	0.52	0.30	0.44	0.37	0.33	0.03	0.23	0.35	0.23	0.60	1.00	
	p	0.44	0.52	0.31	0.89	**<0.001***	0.09	0.01*	0.03**	0.06	0.86	0.18	**0.04***	0.19	**<0.001***	-	
11. Infertility	r	-0.06	-0.06	-0.05	-0.30	0.50	0.27	0.28	0.22	0.20	0.01	0.42	-0.18	0.26	0.30	0.38	1.00
	p	0.74	0.74	0.77	0.08	**<0.001***	0.12	0.11	0.21	0.26	0.96	**0.02***	0.30	0.14	0.08	**0.03***	-

BMI: Body mass index, MEDAS: Mediterranean diet adherence screener, HEI-2015: Healty eating index-2015, EHP-30: Endometriosis healt profile-30, *p<0.05

In addition, the WC of women was found to be below the WHO recommendations (<80 cm) (16). Although these results may be due to the demographic characteristics of women, they are similar to the literature also showing the anthropometric characteristics of women with endometriosis (26). Holdsworth-Carson et al. (27) reported that chronic pain symptoms related to endometriosis trigger gastrointestinal symptoms or emotional stress, leading to decreased appetite and food intake, which in turn leads to reduced body size in women with endometriosis. In this study, no significant difference was observed between BMI and EHP-30 subscale scores.

According to the Türkiye Nutrition and Health Survey 2019 data, the rate of women aged 15 years and older with a disease diagnosed by a physician was 48.5% (28). The rate of women with a disease diagnosed by a physician other than endometriosis was higher in this study (64.7%). It is thought that this may be due either to the characteristics of the sample group or to the educational level of the women, and differences in their access to health services.

The risk of endometriosis has been reported to be more than double in women with short menstrual cycles (≤27 days) and longer bleeding durations (≥1 week) (29). Consistent with the literature, more than two-thirds of women in this study reported regular menstruation, occurring at intervals of one month or less.

According to the food consumption records of the participants, the energy intake from carbohydrates is below the recommendations of the TDG 2022 (30). This is because fat consumption is above the recommendations. SFA intake at levels approximately three times higher than the recommended limit of 7% of daily energy intake also contributes to this result. A saturated fat intake of ≤8% of total energy has been reported to score the highest on the HEI-2015 (31). In this study, the number of individuals with high HEI-2015 scores is low, since SFA consumption is above the recommended limits. Furthermore, the recommendation for an optimal omega-6/omega-3 ratio varies from 1/1 to 4/1, depending on the disease, although in Western diets this ratio is 15/1 to 16.7/1 (32). In this study, the omega-6/omega-3 ratio that was determined as approximately 10/1 does not meet the recommendation. added sugar consumption (3.47%), which is associated with chronic diseases and inflammation, is below the WHO recommendations of "not exceeding 5-10% of daily energy" (33). It is thought that this result may be related to the socio-demographic characteristics of the population. Additionally, Bogusz and Górnicka (8) reported that 77.3% of women with endometriosis increased their consumption of anti-inflammatory foods after diagnosis. However, they had lower MD Score and Pro-Healthy Diet Index scores than the healthy control group and consumed fewer fruits, vegetables, dairy products, and whole grains than recommended. Similarly, in this study, the low number of individuals with adequate adherence to the MD according to the MEDAS score (29.4%) and the high number of individuals in the worst letter category according to the HEI-2015 score (44.1%) draw attention to the importance of the quality and nutrient diversity of the foods in the diet, as well as the daily energy and macronutrient consumption of individuals.

In adherence to the MD, polyphenol intake, which is one of the bioactive components in plant foods, also increases (9). Polyphenols have antioxidant properties, and a diet high in polyphenols may help relieve symptoms of endometriosis, an inflammatory disease (14).

Although there are no intake recommendations for polyphenols as there are for micronutrients, intake of polyphenol types has been evaluated in different studies. Polyphenol intake was reported to be higher in Japan (≥1277 mg/day) than in other regions. No significant differences were observed among European countries. Higher intakes were reported in Poland (≥500 mg/day) and France (≥1000 mg/day), intakes with lower Italy and Spain. Flavonoid and phenolic acid consumption was highest in Poland and Australia (34). In a study conducted in Türkiye, the total polyphenol intake of women was reported as 333.9 mg/day and the consumption of some polyphenol types, such as flavanols, flavonols, and phenolic acids, was lower in comparison to our study (13). In this study, total polyphenol consumption (657.70 mg/day) was higher than previously reported values. It is thought that the reason for this difference may be because the other study was conducted during the pandemic period, and with participants from different regions.

EHP-30 is a questionnaire developed to measure the quality of life of endometriosis patients and aims to evaluate the effects on their physical, mental, and social health (22). When the studies conducted with EHP-30 in the literature are evaluated, there are results both similar and different from those of this study (35-37). These differences may be due to the demographic or cultural characteristics of the participants. In this study, a positive correlation was found between the EHP-30 total score and all subscales except the relationship with children subscale. This shows that the EHP-30 is consistent among its subscales. In addition, the correlations between EHP-30 total and pain, control, and powerlessness subscales' scores were found to be very strong. This may be explained

by the fact that the subscales of the EHP-30, such as pain, control, and powerlessness, are the main factors that directly reflect the physical and emotional burden of the disease and seriously affect the quality of life. In the literature, these subscales are reported to have a significant impact on women with endometriosis (38). Another study reported that women with endometriosis experienced a loss of control and power due to pain and loss of functionality, which prevented them from participating in necessary and enjoyable activities that make life worth living (39). In a study on chronic pelvic pain, it was reported that women experienced a lack of social support and that this was associated with deep pain and suffering (40). In this study, a significant relationship was observed between pain and the scores of the emotional well-being and social support subscales' scores. All these results emphasize that pain management, especially, and psychosocial and holistic approaches are critical in coping with endometriosis. Studies have reported that pelvic pain due to endometriosis is associated with impaired body image, decreases quality of life and sexual satisfaction, and self-image is significantly weakened in women with dyspareunia (41,42). It was also reported that impaired body image was significantly associated with greater emotional loneliness and lower perceived social support (43). This study found positive correlations that are similar to those in the literature, specifically between pain and self-image and sexual life subscale scores, as well as between social support and self-image subscale scores. This suggests that women with higher perceived social support have a more positive self-image.

Recent studies on the role of the MD and its components in the treatment of endometriosis are notable for their contributions. In an endometriosis animal model study with *Urtica dioica* L. (above-ground parts of nettle), a significant and promising difference was found in TNF-alpha and IL-6 levels compared to the control group (44). In a study on clove and its components, clove and its components were reported to cause regression in endometrial implants without affecting fertility in animal models with endometriosis (45). In another study, clove, one of the important spices of the MD, showed a suppressive effect on pro-inflammatory cytokines (IL-6, TNF-alpha) with its antioxidant activity (46). Ott et al. (47) reported that the MD was effective in reducing endometriosis-associated pain. Another study reported an inverse association between adherence to the MD and pain, with adherence being associated with a higher intake of polyphenols (48). While Zhou et al. (49) found no association between pain and adherence to the MD in their study on middle-aged Chinese, Cirillo et al. (10) reported a significant association between the MD and pain-relieving effect. Dougan et al. (50) similarly reported that adherence to the alternative HEI would be beneficial for pelvic pain. In the present study, no correlation was found between the MEDAS scores assessing adherence to the MD and the HEI-2015 scores assessing diet quality, and the EHP-30 total score, but a negative correlation was found between the HEI-2015 and the pain subscale scores. This result points to the importance of nutrition in pain management in women with endometriosis. Although the effect of dietary changes varies individually, a period of several weeks to several months is usually required to reduce the inflammation and symptoms associated with endometriosis (51-53). The length of this period depends on the initial state of health, the level of inflammation and the degree of dietary compliance (52). Dietary patterns based on food restriction are feasible in the short term but are not sustainable in the long term.

Therefore, the literature recommends implementing such diets with personalized plans for a few weeks before switching to the MD for both its anti-inflammatory effects and sustainability (54).

Study Limitations

This study provides a detailed assessment of the nutritional status of women with endometriosis by applying MEDAS, HEI-2015, and polyphenol consumption frequency questionnaires. In addition, EHP-30, which provides assessments of many health-related areas for women with endometriosis, was applied and its relationship with nutrition was determined. While this situation constitutes a strength of the study, there are also some limitations. Considering the demographic characteristics of the individuals participating in this cross-sectional study, the sample does not reflect the general population. In addition, the calculation of the HEI-2015 score was based on the self-report of a one-day food consumption record. On the other hand, polyphenol consumption was determined through a retrospective consumption frequency questionnaire. The accuracy of the consumption frequency data depends on the information declared by the participants. As in studies in both national and international literature, when calculating daily polyphenol intake, the Phenol-Explorer database was used (19) as there is no polyphenol database that provides analysis results of foods specific to Türkiye. The polyphenol content of foods is affected by many factors, such as the conditions in which the food is grown, geographical region, season, post-harvest processing, and storage conditions.

Therefore, it is difficult to precisely determine the polyphenol intake of individuals, although international databases are used, there is a need for geographically specific food composition databases developed with a more consistent

approach. Although the results obtained in this study shed light on future studies on adherence to the MD, diet quality, and health profile of women with endometriosis, prospective studies with a more comprehensive sample and design are needed.

CONCLUSION

In conclusion, this study, which evaluated the nutritional status and health profile of women with endometriosis, draws attention to the importance of nutrition in the treatment of endometriosis. The findings indicate that women with endometriosis have low adherence to the MD a healthy dietary model and low diet quality. Nutrition should be emphasized, especially in the management of pain, which is a common complaint in endometriosis. At this point, nutrition education and counseling provided through a multidisciplinary approach to women with endometriosis after diagnosis will be an important step towards improving quality of life. More research is needed to develop nutritional strategies to improve the health and well-being of women with endometriosis.

ETHICS

Ethics Committee Approval: Acıbadem Mehmet Ali Aydınlar University and Acıbadem Healthcare Institutions Medical Research Ethics Committee (ATADEK) approval was received (approval no: 2023-13/447, date: 17.08.2023).

Informed Consent: All patients were informed about the study, and written informed consent was obtained for the protocol.

Acknowledgement

This study was carried out within the scope of Tuğçe Deveci's master's thesis in 2024 and was presented in 13th National Healthy Life Congress as an oral presentation. The authors would like to thank all participated in the study and to the research and the health professionals who facilitated the conduct of the study.

FOOTNOTES

Author Contributions

Concept: T.D., N.Ç.B., Desing: T.D., N.Ç.B., P.Y.B., Data Collection or Proccessing: T.D., N.Ç.B., P.Y.B., Analysis or Interpretation: T.D., N.Ç.B., Literature Search: T.D., N.Ç.B., Writing: T.D., N.Ç.B., P.Y.B.

Conflict of Interest: The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Financial Disclosure: This research was supported by the Acıbadem Mehmet Ali Aydınlar University Scientific Research Projects Commission (ABAPKO) [TYL-2023-136].

REFERENCES

1. Bougie O, Yap MI, Sikora L, Flaxman T, Singh S. Influence of race/ethnicity on prevalence and presentation of endometriosis: a systematic review and meta-analysis. BJOG. 2019;126:1104-15.
2. World Health Organization. Endometriosis [Internet]. 2023 [cited 2024 August 19]. Available from: https://www.who.int/news-room/fact-sheets/detail/endometriosis
3. Nnoaham KE, Hummelshoj L, Webster P, d'Hooghe T, de Cicco Nardone F, de Cicco Nardone C, et al. Impact of endometriosis on quality of life and work productivity: a multicenter study across ten countries. Fertil Steril. 2011;96:366-373.e8.
4. Howard FM. Endometriosis and mechanisms of pelvic pain. J Minim Invasive Gynecol. 2009;16:540-50.
5. Sinaii N, Cleary SD, Ballweg ML, Nieman LK, Stratton P. High rates of autoimmune and endocrine disorders, fibromyalgia, chronic fatigue syndrome and atopic diseases among women with endometriosis: a survey analysis. Hum Reprod. 2002;17:2715-24.
6. Sepulcri Rde P, do Amaral VF. Depressive symptoms, anxiety, and quality of life in women with pelvic endometriosis. Eur J Obstet Gynecol Reprod Biol. 2009;142:53-6.
7. Holoch KJ, Savaris RF, Forstein DA, Miller PB, Higdon HL, Likes CE, et al. Coexistence of polycystic ovary syndrome and endometriosis in women with infertility. J Endometr Pelvic Pain Disord. 2014;6:79-83.
8. Bogusz A, Górnicka M. Low diet quality and nutritional knowledge in women with endometriosis: a pilot study. Healthcare (Basel). 2024;12:673.
9. Casas R, Sacanella E, Estruch R. The immune protective effect of the Mediterranean diet against chronic low-grade inflammatory diseases. Endocr Metab Immune Disord Drug Targets. 2014;14:245-54.
10. Cirillo M, Argento FR, Becatti M, Fiorillo C, Coccia ME, Fatini C. Mediterranean diet and oxidative stress: a relationship with pain perception in endometriosis. Int J Mol Sci. 2023;24:14601.
11. Piecuch M, Garbicz J, Waliczek M, Malinowska-Borowska J, Rozentryt P. I am the 1 in 10-what should I eat? A research review of nutrition in endometriosis. Nutrients. 2022;14:5283.
12. Minihane AM, Vinoy S, Russell WR, Baka A, Roche HM, Tuohy KM, et al. Low-grade inflammation, diet composition and health: current research evidence and its translation. Br J Nutr. 2015;114:999-1012.
13. Acar MN. Yetişkin bireylerde polifenol tüketim sıklığının ruh haline etkisi ve bireylerin polifenol tüketim alışkanlıklarının Covid-19 pandemi sürecindeki değişiminin incelenmesi [dissertation] Karabük: Karabük University; 2022.
14. Tassinari V, Smeriglio A, Stillittano V, Trombetta D, Zilli R, Tassinari R, et al. Endometriosis treatment: role of natural polyphenols as anti-inflammatory agents. Nutrients. 2023;15:2967.
15. Asencio FA, Fins RJP, Mitie CK, Ussia A, Wattiez A, Ribeiro HS, et al. Segmental rectum resection for deep endometriosis and excision similarly improve sexual function and pain. Clin Pract. 2023;13:780-90.
16. World Health Organization. (2011). Waist circumference and waist-hip ratio: report of a WHO expert consultation, 1st ed. Geneva, 2008. Available from: https://iris.who.int/handle/10665/44583
17. Martínez-González MA, García-Arellano A, Toledo E, Salas-Salvadó J, Buil-Cosiales P, Corella D, et al. A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: the PREDIMED trial. PLoS One. 2012;7:e43134.
18. Bekar C, Goktas Z. Validation of the 14-item Mediterranean diet adherence screener. Clin Nutr ESPEN. 2023;53:238-43.
19. Rothwell JA, Perez-Jimenez J, Neveu V, Medina-Remón A, M'hiri N, García-Lobato P, Manach C, et al. Phenol-Explorer 3.0: a major update of the Phenol-Explorer database to incorporate data on

the effects of food processing on polyphenol content. Database (Oxford). 2013;2013:bat070.

20. Reedy J, Lerman JL, Krebs-Smith SM, Kirkpatrick SI, Pannucci TE, Wilson MM, et al. Evaluation of the Healthy Eating Index-2015. J Acad Nutr Diet. 2018;118:1622-33.
21. National Cancer Institute. Visualizing and interpreting Healthy Eating Index (HEI) scores [Internet]. Bethesda (MD): National Cancer Institute; [cited 2024 August 19]. Available from: https://epi.grants.cancer.gov/hei/interpret-visualize-hei-scores.html
22. Jones G, Jenkinson C, Kennedy S. Evaluating the responsiveness of the endometriosis health profile questionnaire: the EHP-30. Qual Life Res. 2004;13:705-13.
23. Şahin S. Endometriozisli kadınlarda yaşam kalitesinin belirlenmesi [master's thesis]. İstanbul: Haliç Üniversitesi Sağlık Bilimleri Enstitüsü; 2010. p. 5-73.
24. Türk İstatistik Kurumu. İstatistiklerle Kadın, 2023 [internet]. Ankara: Türkiye İstatistik Kurumu; 2023 [2023; cited 2024 Aug 22]. Available from: https://data.tuik.gov.tr/Bulten/Index?p=Istatistiklerle-Kadin-2023-53675
25. Mahmutoğlu M. Endometriyozisli kadınların beslenme alışkanlıkları ile yaşam kaliteleri arasındaki ilişkinin değerlendirilmesi [master's thesis]. İstanbul: Biruni University; 2023.
26. Hong J, Yi KW. What is the link between endometriosis and adiposity? Obstet Gynecol Sci. 2022;65:227-33.
27. Holdsworth-Carson SJ, Dior UP, Colgrave EM, Healey M, Montgomery GW, Rogers PA, et al. The association of body mass index with endometriosis and disease severity in women with pain. J Endometr Pelvic Pain Disord. 2018;10:79-87.
28. T.C. Sağlık Bakanlığı. Türkiye Beslenme Sağlığı Araştırması (TBSA). Ankara: T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü; 2019. Report No: 1132.
29. Cramer DW, Wilson E, Stillman RJ, Berger MJ, Belisle S, Schiff I, et al. The relation of endometriosis to menstrual characteristics, smoking, and exercise. JAMA. 1986;255:1904-8.
30. T.C. Sağlık Bakanlığı. Türkiye Beslenme Rehberi (TÜBER) 2022. Ankara: T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü; 2022. Report No: 1031.
31. Krebs-Smith SM, Pannucci TE, Subar AF, Kirkpatrick SI, Lerman JL, Tooze JA, et al. Update of the Healthy Eating Index: HEI-2015. J Acad Nutr Diet. 2018;118:1591-602.
32. Simopoulos AP. The importance of the ratio of omega-6/omega-3 essential fatty acids. Biomed Pharmacother. 2002;56:365-79.
33. Dünya Sağlık Örgütü. Uluslararası fonksiyon, engellilik ve sağlık sınıflaması [Internet]. Cenevre: Dünya Sağlık Örgütü; 2001. Available from: https://iris.who.int/bitstream/handle/10665/42407/9241545429.pdf
34. Del Bo' C, Bernardi S, Marino M, Porrini M, Tucci M, Guglielmetti S, et al. Systematic review on polyphenol intake and health outcomes: is there sufficient evidence to define a health-promoting polyphenol-rich dietary pattern? Nutrients. 2019;11:1355.
35. Jia SZ, Leng JH, Sun PR, Lang JH. Translation and psychometric evaluation of the simplified Chinese-version Endometriosis Health Profile-30. Hum Reprod. 2013;28:691-7.
36. Pontoppidan K, Olovsson M, Grundström H. Clinical factors associated with quality of life among women with endometriosis: a cross-sectional study. BMC Womens Health. 2023;23:551.
37. Marí-Alexandre J, García-Oms J, Agababyan C, Belda-Montesinos R, Royo-Bolea S, Varo-Gómez B, et al. Toward an improved assessment of quality of life in endometriosis: evaluation of the Spanish version of the Endometriosis Health Profile 30. J Psychosom Obstet Gynaecol. 2022;43:251-7.
38. Jones G, Jenkinson C, Taylor N, Mills A, Kennedy S. Measuring quality of life in women with endometriosis: tests of data quality, score reliability, response rate and scaling assumptions of the Endometriosis Health Profile Questionnaire. Hum Reprod. 2006;21:2686-93.
39. Warwick R, Joseph S, Cordle C, Ashworth P. Social support for women with chronic pelvic pain: what is helpful from whom? Psychology & Health. 2004;19:117-34.
40. Volker C, Mills J. Endometriosis and body image: comparing people with and without endometriosis and exploring the relationship with pelvic pain. Body Image. 2022;43:518-22.
41. Pazmany E, Bergeron S, Van Oudenhove L, Verhaeghe J, Enzlin P. Body image and genital self-image in pre-menopausal women with dyspareunia. Arch Sex Behav. 2013;42:999-1010.
42. Tripoli TM, Sato H, Sartori MG, de Araujo FF, Girão MJ, Schor E. Evaluation of quality of life and sexual satisfaction in women suffering from chronic pelvic pain with or without endometriosis. J Sex Med. 2011;8:497-503.
43. Calvi C, Sherman KA, Pham D. Loneliness and perceived social support in endometriosis: the roles of body image disturbance and anticipated stigma. Int J Behav Med. 2024;31:433-44.
44. Ilhan M, Ali Z, Khan IA, Taştan H, Küpeli Akkol E. Bioactivity-guided isolation of flavonoids from Urtica dioica L. and their effect on endometriosis rat model. J Ethnopharmacol. 2019;243:112100.
45. Taghipour Z, Bahmanzadeh M, Rahimi R. The effects of clove and its constituents on reproductive system: a comprehensive review. Reprod Sci. 2023;30:2591-614.
46. Talib WH, AlHur MJ, Al Naimat S, Ahmad RE, Al-Yasari AH, Al-Dalaeen A, et al. Anticancer effect of spices used in Mediterranean diet: preventive and therapeutic potentials. Front Nutr. 2022;9:905658.
47. Ott J, Nouri K, Hrebacka D, Gutschelhofer S, Huber J, Wenzl R. Endometriosis and nutrition-recommending a Mediterranean diet decreases endometriosis-associated pain: an experimental observational study. J Aging Res Clin Pract. 2012;1:162-6.
48. Ortolá R, García-Esquinas E, Sotos-Prieto M, Struijk EA, Caballero FF, Lopez-Garcia E, et al. Mediterranean diet and changes in frequency, severity, and localization of pain in older adults: the seniors-ENRICA cohorts. J Gerontol A Biol Sci Med Sci. 2022;77:122-30.
49. Zhou YF, Song XY, Wu J, Chen GC, Neelakantan N, van Dam RM, et al. Association between dietary patterns in midlife and healthy ageing in Chinese adults: the Singapore Chinese health study. J Am Med Dir Assoc. 2021;22:1279-86.
50. Dougan MM, Fest S, Cushing-Haugen K, Farland LV, Chavarro J, Harris HR, et al. A prospective study of dietary patterns and the incidence of endometriosis diagnosis. Am J Obstet Gynecol. 2024;231:443.e1-10.
51. Moore JS, Gibson PR, Perry RE, Burgell RE. Endometriosis in patients with irritable bowel syndrome: specific symptomatic and demographic profile, and response to the low FODMAP diet. Aust N Z J Obstet Gynaecol. 2017;57:201-5.
52. Vennberg Karlsson J, Patel H, Premberg A. Experiences of health after dietary changes in endometriosis: a qualitative interview study. BMJ Open. 2020;10:e032321.
53. Marziali M, Venza M, Lazzaro S, Lazzaro A, Micossi C, Stolfi VM. Gluten-free diet: a new strategy for management of painful endometriosis related symptoms? Minerva Chir. 2012;67:499-504.
54. Nirgianakis K, Egger K, Kalaitzopoulos DR, Lanz S, Bally L, Mueller MD. Effectiveness of dietary interventions in the treatment of endometriosis: a systematic review. Reprod Sci. 2022;29:26-42.