The Relationship between Pain, Sleep, and Nutrition During the Premenstrual, Menstrual, and Postmenstrual Phases in Women of Reproductive Age[*]

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Abstract

Aim: The aim of this study was to investigate the relationship between pain, sleep, and nutrition during the premenstrual, menstrual, and postmenstrual phases in women of reproductive age.

Method: This descriptive and cross-sectional study was conducted with 250 women aged 19-40 years. Data were collected using a demographic questionnaire, the Sleep Quality Scale, the Premenstrual Symptoms Coping Scale, dietary records, and the Visual Analog Scale. Data were obtained at three stages: premenstrual, menstrual, and postmenstrual. Statistical analyses were performed using SPSS 24.

Results: This rates of appetite increase were found to be 55.6% in the premenstrual phase, 45.6% in the menstrual phase, and 16.0% in the postmenstrual phase. Single women had significantly lower sleep quality scale scores and higher visual analogue scale scores in the menstrual phase compared to married women ($p<0.05$). Menstrual cycle length and duration were found to have statistically significant effects on visual analogue scale and sleep quality scale scores ($p<0.05$). Energy, carbohydrate, fiber intake were higher during the premenstrual phase compared to other phases ($p<0.05$).

Conclusion: The severity of pain in the menstrual phase may affect sleep quality and lead to changes in appetite and food consumption.

Keywords: Menstruation, nutrition, pain, premenstrual syndrome, sleep.

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ETHICAL STATEMENT: The study was approved by the Health Sciences Ethics Committee of Ankara Yıldırım Beyazıt University, under approval number 09-424, dated 23/11/2023. Each participant signed a Voluntary Consent Form, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

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Üreme Çağındaki Kadınlarda Menstrüel Dönem Öncesi, Sırası ve Sonrası Ağrı ve Uyku ile Beslenme Arasındaki İlişkinin Değerlendirilmesi

Öz

Amaç: Bu çalışmanın amacı, üreme çağındaki kadınlarda menstrüel dönem öncesi, sırası ve sonrası ağrı, uyku ve beslenme arasındaki ilişkiyi incelemektir.

Yöntem: Bu tanımlayıcı ve kesitsel çalışma, 19-40 yaş arası 250 kadın üzerinde gerçekleştirilmiştir. Veriler, demografik anket, Uyku Kalitesi Ölçeği, Premenstrüel Semptomlarla Baş Etme Ölçeği, Besin Tüketim Kaydı ve Vizüel Analog Skala ile toplanmıştır. Kadınlardan menstrüasyon öncesi, sırası ve sonrası olmak üzere üç aşamada veriler alınmıştır. İstatistiksel analizlerde SPSS 24 kullanılmıştır.

Bulgular: Katılımcıların premenstrüel dönemde iştah artışı oranı %55.6, menstrüel dönemde %45.6, postmenstrüel dönemde ise %16.0 olarak saptanmıştır. Bekar kadınların menstrüel dönemde uyku puanları evli kadınlara göre anlamlı derecede düşük, ağrı skorları ise daha yüksek bulunmuştur ($p<0.05$). Menstrüasyon sıklığı ve süresinin ağrı ve uyku ölçek puanları üzerinde istatistiksel olarak anlamlı etkileri görülmüştür ($p<0.05$). Premenstrüel dönemde enerji, karbonhidrat ve posa alımı, diğer dönemlere göre daha yüksek bulunmuştur ($p<0.05$).

Sonuç: Menstrüel dönemde ağrı şiddetinin uyku kalitesini etkileyebileceği, iştah ve besin tüketiminde değişikliklerin yapabileceği belirlenmiştir.

Anahtar Sözcükler: Menstrüasyon, beslenme, ağrı, premenstrüel sendrom, uyku.

Introduction

Menstruation is a physiological process characterized by the periodic shedding and expulsion of the endometrial layer in the lining of the uterus in women of reproductive age[1]. The menstrual cycle is repeated approximately every 28 days, although it varies for each individual, and its normal range can vary between 21 and 35 days[1]. While environmental conditions, heat, light, stress, and nutrition affect hormone secretion, hormones also cause various changes in the body. Hormonal changes in the menstrual cycle can lead to problems such as anxiety, irritability, depressive mood, sudden mood swings, sleep disturbances, fatigue, changes in sexual desire, breast swelling and tenderness, weight gain, headaches, appetite changes, general body aches, and edema in many women[2].

Dysmenorrhea, also known as menstrual pain, is a condition associated with various physical symptoms that begin a few hours before or after menstruation and usually last for 24 to 48 hours[3]. This condition is characterized by common symptoms such as cramping, lower abdominal pain, and low back pain[4]. In a study, it has been found that pain experienced in the menstrual phase in women of reproductive age affects the quality of life and decreases sleep quality[5]. Various dietary factors can reduce the severity of menstrual pain or minimize the risk factor[6,7]. In one study, it was reported that a reduced-fat, vegetable-based diet during the menstrual cycle decreased estrogen and progesterone levels and reduced fluid retention. The positive effects of such a diet on dysmenorrhea were emphasized[6]. Nagata et al. found that the consumption of fibrous

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foods significantly reduced menstrual pain by lowering estrogen levels and regulating bowel movements[8]. Additionally, fibrous foods have been found to be effective in alleviating the severity of dysmenorrhea by partially reducing fat and sugar absorption[8]. Some studies have shown that a low-fat vegetarian diet reduces symptoms, and a diet rich in vitamin E can reduce the severity of menstrual pain[6,7]. Studies have shown that oral intake of 1200 mg of calcium daily can significantly reduce menstrual pain and fluid retention[7].

Sleep is one of the factors that may change across different phases of the menstrual cycle in women. Estrogen and progesterone receptors in the basal forebrain, locus coeruleus, dorsal raphe nuclei, and hypothalamus, where sleep is regulated, along with hormonal fluctuations occurring during the menstrual cycle, play important roles in affecting sleep patterns[9]. Especially in the premenstrual phase, sleep interruption and decreased sleep quality are among the most frequently encountered problems. This is thought to result from factors such as pain, physical complaints, increased internal temperature due to the release of progesterone before menstruation, and mood disturbances[10]. The literature shows that sleep quality decreases in women during menstruation and that there are interruptions in the frequency of sleep[11-13]. It has been observed that sleep problems are more common in the female population, and women's sleep quality may be worse compared to men[14]. Significant fluctuations in estrogen and progesterone hormone levels occur during the menstrual cycle, and these fluctuations can affect sleep patterns during the luteal phase. An increase in progesterone occurs, and this increase is associated with higher body temperature, which may indirectly make it difficult for some women to fall asleep comfortably. High progesterone levels also affect neurotransmitters such as serotonin and gamma-aminobutyric acid, which play an active role in sleep regulation, and the changes caused by these effects may lead to disturbances in sleep quality[15].

Food consumption is influenced by neurochemical, hormonal, psychological, and physiological factors. There are significant differences in appetite and energy intake in women during the menstrual cycle[16]. According to the results of a study, the increase in estrogen and progesterone hormones before menstruation compared to after menstruation suggests that progesterone may increase food consumption by interacting with estrogen. For this reason, it has been found that women experience a significant increase in appetite before menstruation, and this increase is more common in individuals with premenstrual syndrome[17]. During the ovulation phase, it was found that there was a decrease in portion sizes and a preference for consuming sweet foods rather than an increase in eating frequency[18].

Based on the existing literature and the aim of the present study, it was hypothesized that pain severity differs across the premenstrual, menstrual, and postmenstrual phases in women of reproductive age (H1) and that sleep quality also varies significantly across these menstrual cycle phases (H2). It was further hypothesized that energy and macronutrient intake, particularly carbohydrate intake, differ between the premenstrual, menstrual, and postmenstrual phases (H3). Additionally, increased pain severity during the menstrual phase was expected to be associated with decreased sleep quality (H4),

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and changes in pain severity and sleep quality were assumed to be associated with alterations in appetite and dietary intake across the menstrual cycle (H5). The aim of this study was to examine the relationship between pain, sleep, and nutrition during the premenstrual, menstrual, and postmenstrual phases in women of reproductive age. With the data obtained from this study, more effective interventions for women's menstrual health problems can be developed, and social awareness can be increased.

Material and Methods

This descriptive and cross-sectional study was conducted between 15 January and 15 April 2024 in Ankara, Türkiye, and included participants aged 19-40 years. The exclusion criteria were as follows: menopausal women, pregnant women, women with PCOS, women taking birth control pills, women with menstrual cycle irregularities, women with any chronic disease, women with psychiatric or neurological disorders diagnosed by a doctor (such as dementia or Alzheimer's disease), and women with alcohol or substance abuse. The minimum sample size was calculated using G-Power 3.1 as 93 participants, with a 5% margin of error and 80% statistical power. Initially, 295 participants were recruited, but those with missing anthropometric, demographic, or dietary data were excluded, resulting in a final sample size of 250.

Data Collection Tools

The questionnaire included questions about participants' age, gender, educational level, marital status, comorbidities, medication use, physical functioning, oral and dental health, and dietary habits. Dietary intake was assessed using the 24-hour dietary recall method, in which participants reported all foods and beverages consumed on the previous day. All measurements were obtained from the same participants during the premenstrual, menstrual, and postmenstrual phases. Thus, each participant was followed longitudinally across three menstrual cycle phases. The study was conducted in three phases:

Phase 1: Pre-menstrual phase (maximum interval of 4 days to 1 day before menstruation): During this phase, participants completed the Demographic Structure Questionnaire, the Coping with Premenstrual Symptoms Scale, the Sleep Quality Scale, the Visual Analogue Scale, and a daily food consumption record.

Phase 2: Menstrual phase: During this phase, the Sleep Quality Scale, the Visual Analogue Scale, and a one-day food consumption record were applied to the participants.

Phase 3: Postmenstrual phase (at least 1 week later): During this phase, the Sleep Quality Scale and a one-day food consumption record were applied to the participants.

Demographic Structure Questionnaire: The demographic structure questionnaire consisted of a total of 19 questions designed to obtain information about

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the menstrual phase, including questions on age, body weight, height, educational status, marital status, age at menarche, and the menstrual duration.

Height (cm) and body weight (kg) were measured by the researchers. Measurements were taken while the participants were standing upright, looking straight ahead, with the top of the ears and the outer corner of the eyes aligned in a parallel plane (Frankfort Plane)[19]. Body weight, height, and BMI values were calculated using the following formula: Weight (kg) / height (m)^2 and classified according to WHO criteria.

Sleep Quality Scale: Sleep Quality Scale (SQS) was used to assess the sleep quality of women of reproductive age in all menstrual phases. It was developed by Van den Wittenboer and Meijer in 2004 and consists of 7 questions. The questions have 3 response options, and results are scored in the range of 7-21 points[20]. The validity and reliability of the scale in Türkiye were evaluated by Önder and colleagues (Cronbach's alpha: 0.72)[21]. As the score on the scale increases, sleep quality improves. In the present study, the Cronbach's alpha coefficient of the Sleep Quality Scale during the premenstrual phase was found to be 0.780.

Premenstrual Change Coping Inventory: Premenstrual Change Coping Inventory (PCCI) was developed by Kaiser et al. in 2017 to assess women's coping methods during the premenstrual phase. It consists of 17 items and three sub-dimensions: 'Seeking Positive Influencing Behaviours,' 'Seeking Support,' and 'Health Care Utilisation Behaviour.' The items are answered using a 4-point Likert scale, and a score between 17 and 68 points can be obtained from the scale[22]. Its validity and reliability in Türkiye were assessed by Sarı Çetin and Erbil (Cronbach's alpha: 0.78)[23]. In this study, the Cronbach's alpha coefficient of the Premenstrual Change Coping Inventory during the premenstrual phase was found to be 0.849.

Food Consumption Record: In order to determine the energy and nutrient intakes of the individuals, 24-hour food consumption records were collected during all three phases. The types and amounts of nutrients in foods and beverages prepared at home were recorded on the food consumption form, and standardized recipes were used as references for foods consumed outside the home. After determining the amounts of food consumed, the daily energy and nutrient intakes of individuals were assessed on a daily and meal basis (breakfast, lunch, dinner, and three snacks) using the Turkey-specific Computer-Assisted Nutrition Programme (BeBIS) (BeBiS 9, Ebispro for Windows; Pasifik Elektrik Elektronik Ltd. Şti., Istanbul, Türkiye, 2021)[24]. The 24-hour dietary recalls were collected retrospectively through face-to-face interviews conducted by the researchers during each phase.

Visual Analogue Scale (VAS): The Visual Analogue Scale (VAS) is a widely used instrument for measuring pain intensity. This scale allows individuals to rate their pain on a scale from 0 (no pain) to 10 (excruciating pain). It usually consists of a 10 cm long horizontal or vertical line, and subjects indicate their pain levels by marking their position on this line[25].

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Ethical Statement

The study was conducted in accordance with the principles of the Declaration of Helsinki, and ethical approval was obtained from the Ankara Yıldırım Beyazıt University Health Sciences Ethics Committee (approval date: 23 November 2023; decision number: 09-424). Informed consent was obtained from all participants before participation.

Data Evaluation

Statistical analyses were conducted using IBM SPSS Statistics 24. The Independent Samples t-test and Mann-Whitney U test were used for comparing two independent groups with and without normal distribution, respectively. ANOVA and Kruskal-Wallis H tests were applied for three or more groups based on distribution. The Friedman test was used to compare energy and nutrient intakes across the premenstrual, menstrual, and postmenstrual phases, as measurements were obtained from the same participants. Pearson and Spearman correlation coefficients assessed relationships between quantitative variables depending on normality. Logistic regression analysis was used to assess the factors affecting severe pain in women. Pain intensity was determined based on the VAS score obtained in the menstrual phase. Statistical significance was accepted as 0.05.

Result

The mean age of the individuals participating in the study was 25.81±5.84 years, and their BMI values were 23.2±4.16 kg/m². A total of 141 women (56.4%) reported that the duration of their menstruation was between 2-6 days. Among the participants, 45.6% stated that their appetite increased in menstrual phase, 55.6% during the premenstrual phase, and 16.0% during the postmenstrual phase (Table 1).

Table 1. Anthropometric and demographic characteristics of the participants.

		n	**X± SS**
Age (year)		250	25.81±5.84
Weight (kg)		250	61.67±11.51
BMI (kg/m²)		250	23.2±4.16
		n	**%**
Marital status	Married	181	72.4
	Single	69	276
Age at menarche	≤ 12 (y)	118	47.2
	≥ 13 (y)	132	52.8
Menstrual cycle length	≤ 27 days	122	48.8
	≥ 28 days	128	51.2
Menstrual duration	2-6 days	141	56.4
	≥ 7 days	109	43.6
Appetite in the premenstrual phase	Increases	139	55.6

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	Decreases	20	8.0
	Remains unchanged	91	36.4
Appetite in the menstrual phase	Increases	114	45.6
	Decreases	56	22.4
	Remains unchanged	80	32.0
Appetite in the postmen. phase	Increases	40	16.0
	Decreases	34	13.6
	Remains unchanged	176	70.4
Sleep duration in the premenstrual phase	< 8 hours	167	66.8
	≥ 8 hours	83	33.2
Sleep duration in the menstrual phase	<8 hours	156	62.4
	≥8 hours	94	37.6
Sleep duration in the postmenstrual phase	<8 hours	167	66.8
	≥8 hours	83	33.2

BMI: Body mass index

The menstrual VAS score of single individuals was found to be statistically higher than that of married individuals ($p<0.05$). The premenstrual (3.7±2.7) and postmenstrual (2.0±2.4) VAS scores of women with a menstrual cycle length of 27 days or fewer were higher than those with a length of 28 days or more ($p<0.05$). The SQS score before, during, and after menstruation was significantly lower in women with severe pain in the menstrual phase compared to those in other phases. In women with mild pain during menstruation, the postmenstrual phase VAS score was significantly lower than in the other groups. Among the female participants, the SQS score during menstruation was found to be significantly lower in single women ($p<0.05$) (Table 2). In analyses comparing groups according to marital status (Table 2), menstrual pain intensity was higher and sleep quality during menstruation was lower in single women. However, in the multivariate logistic regression model including BMI, marital status, menstrual cycle length, and menstrual duration, only marital status remained a significant independent predictor of severe menstrual pain (Table 5).

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Table 2. PCCI, SQS and VAS scores of the participants according to demographic and menstrual status variables

		PCCI		Premen. phase SQS		Men. phase SQS		Postmen. phase SQS		Premen. Phase VAS		Men. phase VAS	
		X±SS	p*	X±SS	p*	X±SS	p*	X±SS	p*	X±SS	p*	X±SS	p*
BMI (kg/m²)	UW	45.9±9.5	0.082##	14.9±2.0	0.430**	13.9±1.8	0.691**	14.3±1.5	0.250**	4.1±3.2	0.355 **	5.8±3.3	0.055**
	Normal	46.8±9.2		15.0±2.5		14.2±4.0		15.0±2.7		3.1±2.8		5.4±3.1	
	OW/obese	44±8.2		14.5±2.8		13.7±2.8		14.7±2.4		3.3±2.6		4.4±3.3	
	Total	45.9±9.0		14.9±2.6		14.0±3.6		14.9±2.5		3.3±2.8		5.1±3.2	
Marital status	Single	46.3±9.2	0.289#	14.8±2.5	0.437*	13.7±2.9	**0.035***	14.8±2.6	0.198*	3.4±2.7	0.067*	5.6±3.0	**<0.001***
	Married	45.0±8.7		14.9±2.7		15.0±4.8		15.1±2.4		2.8±2.8		3.9±3.3	
Men. cycle length	≤27 days	46.0±8.3	0.863#	14.8±2.4	0.480*	14.1±4.0	0.863*	14.7±2.2	0.207*	3.7±2.7	**0.007***	5.3±2.9	0.588*
	≥28 days	45.8±9.7		15.0±2.8		14.0±3.1		15.0±2.8		2.9±2.8		5.0±3.4	
Men. duration	2-6 days	46.5±9.6	0.281#	14.8±2.5	0.768*	13.7±2.5	0.165*	14.8±2.3	0.485*	3.7±2.8	**0.009***	5.5±3.0	**0.029***
	≥7 days	45.2±8.2		14.9±2.7		14.5±4.5		15.0±2.8		2.8±2.6		4.6±3.3	
Men. phase VAS	Mild[1]	45.4±9.9	0.338##	15.3±2.5	**0.004** [3-1.2]**	15.4±4.5	**<0.001** [3-1.2]**	15.5±2.4	**0.001** [3-12]**	**1.5±2.3**	**<0.001** [1-2.3]**	**1.0±1.2**	**<0.001** [1-2.3]**
	Moderate[2]	47.0±9.5		15.1±2.5		14.2±2.7		15.0±2.5		**3.3±2.2**		**5.9±1.0**	
	Severe[3]	45.1±7.2		14.0±2.6		**12.3±2.7**		**14.0±2.5**		**5.2±2.8**		**8.6±0.8**	
Regular physical activity	Yes	45.7±9.0	0.441#	14.8±2.5	0.629*	14.1±3.8	0.843*	14.9±2.5	0.769*	3.2±2.7	0.887*	5.3±3.1	0.338*
	No	46.6±8.9		15.0±2.7		13.8±3.0		14.9±2.6		3.3±2.8		4.8±3.4	

*# Independent Samples T-Test ## One-way ANOVA * Mann-Whitney U test*

*** Kruskal-Wallis test UW: Underweight, OW: Overweight, BMI: Body mass index, Men.: Menstrual, PCCI: Premenstrual change coping inventory, VAS: Visual analogue scale*

Energy intake of women in premenstrual phase was 1779±861.7 kcal, 1609.6±625.3 kcal in menstrual phase, and 1559.4±89.1 kcal in postmenstrual phase ($p<0.05$). Carbohydrate intake was 186.3±96.5 g before the menstrual phase, 172.8±73.1 g in menstrual phase, and 162.1±7.1 g in postmenstrual phase ($p<0.05$). The amounts of fiber, vitamin B1, vitamin B3, folate, and magnesium were found to be higher in women in premenstrual phasecompared to other pheses. No significant differences were found in other nutrients evaluated.

Table 3. Macro and micronutrient ıntakes of participants before, during, and after the menstrual phase

	Premenstrual phase	**Menstrual phase**	**Postmenstrual phase**	
	X±SS	**X**±SS	**X**±SS	p*
Energy (cal)	1779±861.7	1609.6±625.3	1559.4±589.1	**0.006**
Carbohydrate (g)	186.3±96.5	172.8±73.1	162.1±70.1	**0.001**
Carbohydrate (%)	43.4±9.3	44.4±9.5	42.9±8.6	0.123
Protein (g)	67.8±33.1	62.7±33	60.4±25.2	0.058
Protein (%)	16.0±4.8	16.1±5.1	16.2±4.3	0.434
Fat (%)	47.5±21.7	48±26.1	45.4±16.4	0.228
Fiber (g)	23.9±14.3	21.5±13.1	21.9±12.9	**0.002**
Cholesterol (mg)	327.7±289.3	294.5±271.8	295.7±258.1	0.662
Vitamin B1 (mg)	0.9±0.6	0.8±0.5	0.8±0.4	**0.011**
Vitamin B2 (mg)	1.3±0.7	1.2±0.6	1.2±0.6	0.428
Vitamin B3 (mg)	15.3±11.4	12.7±9.8	11.8±7.3	**0.002**
Vitamin B12 (µg)	4.2±5.8	4.1±4.5	4.6±6.4	0.919
Folate (µg)	296.5±205.4	267.8±191.2	265.7±160.9	**0.009**

Potassium (mg)	2328.7±1106.9	2124.2±957.4	2156.6±901.3	0.434
Calcium (mg)	611.8±258.3	575.4±258.3	604.5±268.7	0.463
Magnesium (mg)	273.2±159.6	244.2±124.4	244.1±119.3	**0.043**
Phosphorus (mg)	1097.7±548	989.7±448.3	971.4±410.2	0.232
Iron (mg)	10.2±5.7	9.5±5.0	9.4±4.7	0.412

** Friedman test*

A statistically significant positive correlation was found between premenstrual sleep score and during (r=0.695, p<0.001) and postmenstrual (r=0.800, p<0.001) VAS scores. A statistically significant negative correlation was found between premenstrual (r=-0.148, p=0.019) and during (r=-0.199, p=0.002) VAS scores. A negative and statistically significant relationship was found between VAS scores during menstruation and sleep scores before, during, and after menstruation (Table 4).

Table 4. The relationship between the PCCI the relationship between pcci, sqs and vas scores of women

		PCCI	**Premen. Phase SQS**	**Men. phase SQS**	**Postmen. Phase SQS**	**Premen. Phase VAS**	**Men. Phase VAS**
PCCI	r	1					
	p	.					
Premen. phase SQS	r	0.074	1				
	p	0.246	.				
Men. Phase SQS	r	0.119	.695	1			
	p	0.059	**<0.001**	**.**			
Postmen. phase SQS	r	0.088	.800	.704	1		
	p	0.165	**<0.001**	**<0.001**	**.**		
Premen. phase VAS	r	-0.096	-.148	-0.113	-.126	1	
	p	0.128	**0.019**	0.074	**0.047**	.	
Men. phase VAS	r	-0.025	-.199	-.424	-.245	.530	1
	p	0.693	**0.002**	**<0.001**	**<0.001**	**<0.001**	.

Men: Menstrual; PCCI: Premenstrual change coping inventory; VAS: Visual analogue scale

BMI, marital status, menstrual cycle length, and menstrual duration were included in the logistic regression model examining factors associated with severe pain in women. Marital status was found to be a significant factor, and married women had 2.242 times higher odds of experiencing severe pain compared to single women. No statistically significant associations were observed for the other variables (Table 5).

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Table 5. Logistic regression analysis of factors affecting severe pain[#] in women.

	B	Wald	Sig.	OR	95% C.I.for EXP(B)	
					Lower	Upper
BMI (kg/m²)						
Underweight		.076	.963			
Normal	-.061	.011	.918	.941	.296	2.995
Overweight/obese	.061	.032	.859	1.062	.545	2.070
Marital status (Married)	.807	5.725	**.017***	2.242	1.157	4.343
Men. cycle length (≤27 days)	.316	1.202	.273	1.372	.780	2.414
Men. duration (2-6 days)	.538	3.605	.058	1.712	.983	2.983
Constant	.570	7.640	.006	1.768		

*[#]Pain intensity was determined based on the VAS score obtained in the menstrual phase. Reference categories were: underweight for BMI, single for marital status, ≥28 days for menstrual cycle length, and ≥7 days for menstrual duration. BMI: Body Mass Index, Men: Menstrual *p<0.05*

Discussion

This study aimed to examine changes in dietary intake, menstrual pain intensity, and sleep quality across different phases of the menstrual cycle in women of reproductive age. Given the potential impact of menstrual pain and sleep disturbances on daily functioning and quality of life, evaluating these factors together is of clinical and public health importance. The findings indicate that energy and carbohydrate intake were higher during the premenstrual phase, menstrual pain intensity was negatively associated with sleep quality across all phases, and marital status was associated with severe menstrual pain in multivariate analysis. These results underscore the importance of considering menstrual phase–specific variations and individual characteristics when evaluating pain, sleep quality, and nutritional behaviors in women.

Menarche, or the age of first menstruation, is considered a turning point in women's lives as it marks the onset of reproductive capacity[26]. In this study, the proportion of women with an age at menarche of 13 years or older was found to be higher (52.8%). In other studies conducted in our country, the mean age at menarche was reported to vary between 13.1 and 13.4 years[27,28]. This suggests that the age at menarche of the women in the present study falls within normal limits.

In this study, it was found that the majority of participants (56.4%) had menstruation duration lasting between 2-6 days. Similarly, in Kaykaç's study in 2018, it was found that

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the majority of participants had a menstruation duration of 3-6 days[29]. Among the women in this study, the proportion (51.2%) who reported menstruating every 28 days or more was higher. In Özkarslı's study examining the relationship between hedonic hunger and the menstrual cycle, the majority of participants had a menstrual cycle of 21-27 days[30]. Excluding some conditions that are considered specific, the literature generally considers a menstrual cycle between 21-35 days, a menstrual duration between 2-7 days, and age at menarche under 15 years.

Significant differences in appetite and energy intake occur in women during the menstrual cycle. Appetite, defined as the desire for food with pleasure, can be influenced by many factors. One study states that a significant increase in appetite is experienced by women in the premenstrual phase, and this increase is encountered at higher rates, especially in individuals with premenstrual syndrome[31]. A study conducted in 2020 to determine changes in appetite and eating desires during the menstrual cycle in students concluded that the rate of appetite increase in the premenstrual phase (85.8%) was higher than in the menstrual phase (40.2%) and postmenstrual phase (3%)[32]. According to the results of this study, 55.6% of participants reported an increase in appetite during the premenstrual phase, which is higher than in the other two phases. These findings are consistent with previous studies and suggest that appetite may vary according to menstrual phase. This variation may be related to hormonal fluctuations, particularly increases in progesterone levels during the premenstrual phase, which have been suggested to influence energy expenditure and appetite intake (potentially through progesterone-related increases in thermogenesis and alterations in hypothalamic appetite-regulating pathways, such as neuropeptide Y)[33-35].

Different phases of the menstrual cycle play an important role in planning nutritional and physiological studies, as well as determining daily energy requirements for individuals in this group by assessing cyclic changes in energy intake and expenditure. According to a study conducted by Çengel, energy, carbohydrate, protein, fat, saturated fat, monounsaturated fat, and fiber intakes of women were found to be statistically higher in the premenstrual and menstrual phases compared to the postmenstrual phase[36]. In other studies on similar topics, it was found that energy and carbohydrate intake increased during the premenstrual phase[17,30]. In this study, in line with the literature, total energy, carbohydrate, and fiber intake before menstruation was found to be significantly higher than during and after menstruation ($p=0.015$). Fluctuations in the estrogen–progesterone balance, particularly increased progesterone in the premenstrual phase, may influence metabolic rate and appetite regulation, contributing to variations in energy and macronutrient intake[34,35]. These results support the notion that menstrual phase–related hormonal changes may be associated with variations in dietary intake rather than indicating a direct causal effect.

In the study by Çengel, it was found that the values of vitamin A, vitamin B3, vitamin B6, and iron were statistically higher in women during the premenstrual phase compared to the postmenstrual phase[36]. In a study conducted by Güngördü on 200 women with regular menstruation, it was determined that thiamine, riboflavin, folate, potassium,

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calcium, magnesium, phosphorus, and iron intake was higher in the premenstrual phase compared to the normal phase. Specifically, potassium, phosphorus, vitamin B1, and vitamin B3 intakes were found to be statistically higher in the premenstrual phase[37]. In this study, it was found that thiamine, niacin, folate, and magnesium intakes were significantly higher before menstruation (Table 3) ($p<0.05$). These findings are largely consistent with previous literature, suggesting phase-specific differences in micronutrient intake.

Common symptoms in the menstrual phase include low back, groin, and abdominal pain, excessive fatigue, tension, restlessness, changes in appetite, and sleep disorders. These symptoms can significantly affect the quality of life of individuals and impair their daily functionality[38]. In a study conducted by Demir and colleagues, it was revealed that the severity of pain during this phase may increasingly contribute to the deterioration of sleep quality due to symptoms experienced in the menstrual phase[12]. Şahin et al. reported that sleep quality deteriorated with increasing severity of dysmenorrhea, and this relationship was statistically significant[13]. Brown et al. examined the effects of the menstrual cycle on sleep, eating habits, and health behaviors, stating that improving sleep quality during menstruation had positive effects on health and could reduce the severity of pain[39]. In this study, a statistically significant negative correlation was found between VAS and SQS scores in all menstrual phases, including the premenstrual, menstrual, and postmenstrual phases (Table 5). These correlation analyses indicate an association between pain severity and sleep quality rather than a direct causal relationship. Additionally, the lowest SQS score was observed in the group with severe VAS scores. While the SQS score in the menstruation phase was 12.3±2.7 in the severe pain group, this score was 15.4±4.5 in the mild pain group. Furthermore, the postmenstrual SQS score was 14±2.5 in the severe pain group and 15.5±2.4 in the mild pain group (Table 3) ($p<0.05$). These findings suggest that poorer sleep quality is associated with higher pain intensity during menstruation.

In this study, univariate analyses showed that marital status was associated with menstrual pain intensity and sleep quality during menstruation (Table 2). In the multivariate logistic regression model, marital status remained the only significant predictor of severe menstrual pain after adjustment for potential confounders (Table 6). Married women were 2.242 times more likely to experience severe pain than single women ($p=0.017$). Additionally, the VAS pain score of single women was found to be higher than that of married women ($p<0.05$) (Table 3). The apparent differences between univariate and multivariate findings highlight the importance of considering confounding factors when interpreting the relationship between marital status and menstrual pain. In the study by Farahmand et al., it was observed that married individuals experienced more premenstrual syndrome symptoms than single individuals[40]. It was also noted that menstrual pain in married women was much less than in single and divorced women. Furthermore, single and divorced women were reported to experience more premenstrual syndrome than married women[41,42]. The inconsistent findings across studies may be related to differences in study design, cultural factors, and sample characteristics.

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This study has several limitations that should be considered when interpreting the results. First, the cross-sectional design does not allow for causal inferences regarding the relationships between menstrual pain, sleep quality, and dietary intake. Second, dietary intake and sleep quality were assessed using self-reported measures, which may be subject to recall bias. Third, the study sample consisted of a specific population, which may limit the generalizability of the findings.

Conclusion

In conclusion, this study found a correlation between pain levels and lower sleep quality in women. Additionally, appetite was higher during the premenstrual phase and lower during the postmenstrual phase. Such studies on menstrual health can contribute to the development of effective interventions for women's health issues and help raise social awareness. Based on these findings, increased education and awareness-raising activities regarding women's diet and sleep habits during menstrual phases are crucial. Future studies using longitudinal designs and objective assessment methods are recommended to better elucidate the relationships between menstrual pain, sleep quality, and dietary intake.

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