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Original article

Dietary Factors Associated with Premenstrual Syndrome: A Cross-Sectional Study of Turkish University Students

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Summary. *Background/aim:* The etiology of premenstrual syndrome (PMS) is not precisely known; however, eating habits can affect the risk of PMS. This study compared the food consumption of individuals with and without PMS and determined the risk factors for PMS. *Materials and method:* This cross-sectional study consisted of 237 university students (PMS n=131, non-PMS n=106). Data were collected through face-to-face interviews with a questionnaire form including questions about sociodemographic characteristics of the participants, a PMS scale, food frequency questionnaire, and their anthropometric measurements. Participants' 3-day food consumption was recorded. Risk factors for PMS were determined using logistic regression analysis. The threshold of significance level was $p<0.05$. *Results:* The mean score of PMS was significantly higher in participants with PMS (138.59±19.57) compared to those without PMS (92.22±17.99) ($p<0.05$). Participants with PMS consumed milk pudding/ice cream, biscuit/cracker varieties, honey/jam/molasses, sugar, coffee, chocolate/hazelnut-peanut butter, and carbonated/cola drinks more frequently than those without PMS. The amounts of daily energy ($p=0.051$) and carbohydrate consumption ($p=0.036$) of the group with PMS were higher than participants without PMS. The risk of PMS increased 2.903 times more in those who consumed milk puddings/ice cream more frequently (1-2 times/week or more), 2.468 times more in those who consumed honey/jam/molasses (5-6 times/week or more), and 2.270 times more in those who consumed sugar (5-6 times/week or more) ($p<0.05$). As income levels decreased, the risk of PMS increased ($p<0.05$). *Conclusion:* Participants experiencing PMS problems consumed foods with high, simple sugar content more frequently, which increased the risk of PMS. Therefore, a healthy diet rich in complex carbohydrates and with limited consumption of simple sugars is suggested to prevent PMS.

Key words: premenstrual syndrome (PMS), food consumption, sugar

Introduction

PMS is a disorder characterized by recurrent somatic and psychological symptoms that develop in the luteal phase of the menstrual cycle and disappear within a few days after menstruation. Symptoms are generally mild but can also be severe enough to affect daily activities significantly. This condition is defined as premenstrual dysphoric disorder (PMDD). More than half of women who menstruate have experienced at least one premenstrual symptom, albeit mildly. However, studies report that PMS is seen at moderate and severe levels in 20-30% of women and among them, 3-8% are affected by PMDD (1-3). The worldwide prevalence of PMS/PMDD is similar and the symptom types and severity are not affected by country or culture (1).

The etiology of PMS is not known exactly; however, as the symptoms are clearly associated with fluctuations in ovarian sex steroids, the hypothalamic-pituitary-gonadal axis affects the physiological processes. There is no verifiable change in hormone levels during the menstrual cycle of women affected by PMS compared to those without PMS, but they might be physiologically hypersensitive to the usual hormone fluctuations during the

menstrual cycle. This triggers a series of events in women that cause negative symptoms and affect them both physiologically and psychologically. As a neurotransmitter, γ-aminobutyric acid (GABA) and serotonin play a critical role in premenstrual symptoms (1, 3). Physical symptoms include tiredness, an edematous sensation, breast fullness, headache, weight gain, body aches, and swelling of the extremities. Emotional or behavioral symptoms include irritability, nervousness, mood swings, sadness, depression, decreased concentration, hypersomnia/insomnia, and withdrawal from usual activities (2, 3).

Randomized controlled studies have advocated that many vitamins, minerals, and herbal supplements reduce the symptoms seen in PMS, but only calcium supplements have been found to be effective (4, 5). Recent randomized controlled studies have shown that ensuring women with PMS to have sufficient calcium in their diets, supporting the consumption of whole grains, providing education on the importance of following a healthy diet, and supplementation with vitamin D has positive effects on PMS symptoms and quality of life (6-9).

The American College of Obstetricians and Gynecologists (ACOG) has reported that mild–to–moderate symptoms can usually be relieved through changes in lifestyle or diet, but if symptoms are severe enough to affect life, medical treatment may be required. To help relieve the symptoms of women with PMS, the ACOG also suggests a diet rich in complex carbohydrates and calcium and in which intake of fat, salt, and sugar is reduced, caffeine and alcohol are avoided, and the number of meals is increased (10).

Studies conducted in different parts of the world have found that contrary to the ACOG recommendation, those with PMS consumed fast food, soft drinks, alcohol, coffee, and sweet foods more frequently, consumed vegetables and fruits less frequently, eat breakfast irregularly, and have a low-quality diet compared to those who did not experience PMS. Also, results indicating that diets with this content increase the risk of PMS or its symptoms have been found (11-19).

Studies including subgroups of the Nurses' Health Study II (NHS II) have determined that total consumption of fat, carbohydrates, fiber, and protein does not affect the development of PMS. Higher vitamin B_6 and lower vitamin D consumption of individuals with PMS compared to those without PMS is a common result obtained from the studies (20-22).

A study conducted in Turkey compared the diet quality of individuals with and without PMS (16); however, no study comparing their nutrition habits was found. It is important to determine risk factors related to PMS and nutrition habits of individuals suffering from PMS, take measures against PMS, and offer nutrition suggestions to relieve its symptoms for improving the quality of life. This study aims to compare the food consumption of individuals with and without PMS and determine risk factors for PMS.

Methods

Design and Population of the Study

This cross-sectional study was conducted with students at Erciyes University between September and December 2019. The population of the study consisted of female students (N=21,191) studying in different faculties and schools at Erciyes University. After the first participant was reached, volunteers were included in the study through the snowball method.

Sample

In calculating sample size, results of the study conducted by Cross et al. were considered (23). Accordingly, the mean amounts of carbohydrate consumption of the groups with and without PMS were taken as 245±50.1 g/day and 220±50.0 g/day, respectively, and considering α=0.05 and β=0.80, it was calculated that there should be at least 85 people in each group. The study was conducted with university students because they have similar social environments that can be mentally affected by the same conditions. While determining inclusion criteria, confounding factors that can affect the detection of PMS were taken into consideration (24). Students aged 19-25, who had regular menstruation (every 22-35 days), who had no diagnosed chronic disease, gynecological, or psychological/psychiatric problems, who had no history of pregnancy, who did not take regular medication, and who volunteered (237 students: with PMS n=131, without PMS n=106) were included in the study.

Data Collection

Study data were collected through face-to-face interviews using a questionnaire form that included questions about sociodemographic characteristics of students (15 questions), their menstruation cycles and gynecological histories (6 questions), use of nutritional supplements in the past year (4 questions), the International Physical Activity Questionnaire-Short Form (IPAQ-SF), Premenstrual Syndrome Scale (PMSS), and a Food Frequency Questionnaire (FFQ). Participants' consecutive 3-day food consumption was recorded and their anthropometric measurements were taken.

Participants' height was measured with a stadiometer, their waist and hip circumference were measured with non-stretch tape, and their weight, resting metabolic rate (RMR), and body composition were measured using a bipolar bioelectrical impedance analyzer (Tanita SC-330 Tanita Inc, Tokyo-Japan) (25). Measurements were made in the morning on an empty stomach, without having performed any heavy physical activity 48 hours before, and after defecation and urination, removing metal objects, and taking off shoes and excess clothes.

Physical activity levels of the participants were determined using the IPAQ-SF whose validity and reliability study of the Turkish version (26) was conducted (27). Based on the results of the IPAQ-SF, the participants were classified into three groups: inactive, minimally active, and very active.

Several tools/scales have been developed to determine the presence of PMS/PMDD (1). The presence of PMS in the participating students was determined using the PMSS, developed by Gençdoğan in 2006 in accordance with the Diagnostic and Statistical Manual of Mental Disorders (DSM)-III and DSM-IV, which was determined to be valid and reliable among university students with a Cronbach's alpha coefficient value of 0.75 (28). While completing this five-point Likert type scale, on which responses to the items are given using "never, very rarely, sometimes, very often, and always," the participant is required to consider the one-week period prior to menstruation. Subscales of the PMSS are depressive affect (7 items), anxiety (7 items), fatigue (6 items), irritation (5 items), depressive thoughts (7 items), pain (3 items), appetitive changes (3 items), sleep changes (3 items), and bloating (3 items). The minimum and maximum scores on the scale are 44 and 220, respectively, and if the highest total score obtained is more than half of the total, the presence of PMS is indicated. Accordingly, those who scored 111 and higher were regarded to have PMS and those who scored 110 and lower were regarded not to have PMS. For this study, the Cronbach's alpha coefficient of the scale was 0.927. This value shows that the scale is quite reliable in detecting PMS status.

Dietary Assessment

To determine the eating habits of the students, an unstructured FFQ form consisting of 51 foods and food groups, and 11 categories of frequency between "two times a day" and "never consume" was used. Food frequency in the last month was investigated. Foods and food groups were divided into two and evaluated considering the frequency of consumption suggested in the Turkey Dietary Guidelines (Table 2) (29). The participants' consecutive 3-day food consumption—about one week before the onset of menstruation in the luteal phase of the menstrual cycle, 2 weekdays and 1 day on the weekend—was recorded. The students were given guidance on how to complete the food consumption recording form and a food photo catalog was used to determine the portion sizes (30). Consumption records were checked by the researcher and missing or unclear parts, if any, they were corrected by asking the participant. Food consumption records were entered in the 7.2 version of the Computer Aided Nutrition Information System (BeBiS, version 7.2, 2011) software, and the daily amount of energy and nutrients consumed by the individuals was calculated (31).

Statistical Analysis

Statistical analysis of the data was made using the SPSS 16 program. Descriptive statistics were given using number (n), percentage (%), mean ± standard deviation ($\bar{x} \pm SD$), and median (M) 25-75 percentile ($Q1$-$Q3$). The homogeneity of the data was analyzed using the Shapiro-Wilk normality test. Comparisons of two groups were made using the Independent Samples t test and Mann-Whitney U test. The relationship between categorical variables was examined using the Fisher Exact test, Continuity Correction test, and Pearson's Exact Chi-square test. Test results in Table 1, Table 2, and Table 3 and variables with $p<0.10$

Table 1. Comparison of characteristics of the groups*

Characteristic	**PMS (n=131)**	**Non-PMS (n=106)**	*test statistics*
Age (year)	20.47±1.62	20.29±1.59	t= 0.859 p= 0.391
Mother's education (high school and over)	43 (32.8)	35 (33.0)	x^2= 1,891 p=0.756
Mother's job (housewife)	114 (87.0)	89 (84.0)	x^2= 2.813 p= 0.729
Family type (nuclear)	104 (79.4)	83 (78.3)	x^2= 0.42 p= 0.838
Family income level (income equal to expenses)	99 (75.5)	75 (70.8)	x^2= 4.831 p= 0.089
Dorm residents	96 (73.3)	86 (81.3)	x^2= 3.502 p=0.478
Smokers	6 (4.6)	0 (0.0)	x^2= 4.981 **p=0.026**
Age of menarche (year)	13.27±1.16	13.09±1.22	t= 1.112 p= 0.615
Dysmenorrhea	112 (85.5)	71 (67.0)	x^2= 11.85 **p= 0.003**
Taking nutritional supplements	50 (38.2)	42 (39.6)	x^2= 0.052 p= 0.819
Height (m)	1.62±0.05	1.62±0.05	*t= 0.216* *p=0.829*
Weight (kg)	57.7±8.58	58.7±10.93	*t= 0.784* *p=0.434*
BMI (kg/m^2)	21.83±2.85	22.16±3.66	*t= 0.776* *p=0.439*
Waist circumference (cm)	72.18±7.35	73.90±9.30	*t= 1.592* *p=0.113*
Waist/hip ratio	0.74±0.04	0.75±0.05	*t= 1.774* *p=0.077*
RMR (kcal)	1390.61±106.71	1396.61±141.58	*t= 0.372* *p=0.710*
Body fat ratio (%)	23.98±6.91	24.3±8.02	*t= 0.*397 *p*=0.692
Lean body mass (kg)	43.32±3.42	43.78±4.05	*t= 0.944* *p=0.346*
Body water ratio (%)	52.54±7.23	51.34±9.85	*t= 1.081* *p=0.281*
Physical activity level (inactive)	104 (79.4)	93 (87.7)	x^2=4.441 p=0.109
PMSS score	138.59±19.57	92.22±17.99	t=18.795 **p<0.001**

*Values are given as $\bar{x}$ ± SD and n (%). Mean scores were compared using the Independent *t* test; ratios were compared using the chi-square test. BMI: body mass index; PMSS: premenstrual syndrome scale; RMR: Resting metabolic rate

Table 2. Comparison of food consumption frequencies of the groups

Food/Food group	PMS (n=131)	Non-PMS (n=106)	x^2	p^*
Milk 5-6 times/week or more	27 (20.6)	25 (23.6)	.303	0.637
Yogurt, Ayran, Kefir 5-6 times/week or more	44 (33.6)	30 (28.3)	.762	0.401
Cheese 5-6 times/week or more	86 (65.6)	57 (53.8)	3.453	0.082
Egg Every other day or more	54 (41.2)	50 (47.2)	.842	0.430
Red meat 1-2 times/week	75 (57.3)	49 (46.2)	3.994	0.136
Chicken/Turkey 1-2 times/week	73 (55.7)	50 (47.2)	4.359	0.113
Fish 1-2 times/week or more	10 (7.6)	10 (9.4)	.964	0.618
Legumes 3-4 times/week or more	32 (24.4)	24 (22.6)	.104	0.761
Nuts 5-6 times/week or more	17 (13.0)	11 (10.4)	.380	0.686
White bread 5-6 times/week or more	105 (80.2)	81 (76.4)	.485	0.527
Whole grain bread 5-6 times/week or more	21 (16.0)	16 (15.1)	.039	0.860
Rice/Pasta Every other day or more	91 (69.5)	67 (63.2)	1.033	0.334
Green-leafy vegetables 5-6 times/week or more	35 (26.7)	29 (27.4)	.012	1.000
Yellow and red vegetables 5-6 times/week or more	25 (19.1)	22 (20.8)	.103	0.747
Potatoes Every other day or more	63 (48.1)	40 (37.7)	2.557	0.116
Fresh fruit 5-6 times/week or more	59 (45.0)	41 (38.7)	.971	0.356
Dry fruit Every other day or more	26 (19.8)	14 (13.2)	1.841	0.222
Milk puddings/ice cream 1-2 times/week or more	99 (75.6)	60 (56.6)	9.548	**0.002**
Pastry (bun, etc.) 1-2 times/month or less	34 (26.0)	34 (32.1)	1.073	0.315
Biscuits, cracker varieties 5-6 times/week or more	49 (37.4)	24 (22.6)	5.991	**0.016**
Chocolate/hazelnut/ peanut butter 3-4 times/week or more	10 (7.6)	2 (1.9)	4.025	**0.045**
Honey, jam, molasses 5-6 times/week or more	48 (36.6)	21 (19.8)	8.041	**0.006**

Table 2 (*Continued*)

Food/Food group	PMS (n=131)	Non-PMS (n=106)	x^2	p^*
Sugar 5-6 times/week or more	68 (51.9)	36 (34.0)	7.663	**0.006**
Tea 5-6 times/week or more	111 (84.7)	84 (79.2)	1.210	0.307
Coffee 5-6 times/week or more	49 (37.4)	25 (23.6)	5.211	**0.025**
Carbonated and cola drinks 3-4 times/week or more	16 (21.0)	8 (7.5)	3.926	**0.048**

*Values in the cells are given as n (%). Ratios were compared using the chi-square test.

Table 3. Comparison of the mean daily intake of energy and nutrients of the groups*

Energy/Nutrient	PMS (n=131)	Non-PMS (n=106)	*test statistics*
Energy (kcal)	1447 (1220-1713)	1339 (1173. -1569)	*Z*=-1.951 p=0.051
Protein(g)	47.7 (40.0-59.0)	45.2 (37.6-57.0)	*Z*=-.974 p=0.330
Fat (g)	62.2 (51.3-76.6)	58.0 (48.4-74.0)	*Z*=-.970 p=0.332
Carbohydrates (g)	167 (128-203)	149 (127-177)	*Z*=-2.102 **p=0.036**
Fiber (g)	14.6 (12.1-18.1)	14.5 (10.9-17.3)	*Z*=-.971 p=0.332
Saturated fat (g)	20.5 (16.6-25.5)	19.8 (16.1-24.5)	*Z*=-.806 p=0.420
PUFA (g)	15.2 (9.9-20.9)	15.5 (10.7-21.0)	*Z*=-.210 p=0.834
Omega 3 (g)	0.9 (0.7-1.7)	0.9 (0.7-1.6)	*Z*=-.236 p=0.813
Omega 6 (g)	13.7 (8.1-20.7)	14.1 (9.5-19.8)	*Z*=-.254 p=0.799
Cholesterol (mg)	200 (135-269)	206 (133-280)	*Z*=-.624 p=0.533
Vitamin A (mg)	609 (462-794)	590 (452-942)	*Z*=-.112 p=0.910
Vitamin E (mg)	13.4 (9.8-19.4)	14.0 (10.0-19.6)	*Z*=-.412 p=0.681
Vitamin B1 (mg)	0.5 (0.4-0.7)	0.5 (0.49-0.6)	*Z*=-.069 p=0.945
Vitamin B2 (mg)	0.8 (0.7-1.0)	0.8 (0.70-1.0)	*Z*=-.271 p=0.787
Vitamin B6 (mg)	0.8 (0.7-1.0)	0.8 (0.68-1.0)	*Z*=-.035 p=0.972
Folic acid (µg)	189 (161-217)	188 (152-225)	*Z*=-.114 p=0.909

Energy/Nutrient	PMS (n=131)	Non-PMS (n=106)	*test statistics*
Vitamin C (mg)	66.2 (43.1-103.3)	64.5 (44.5-98.5)	*Z*=-.087 p=0.931
Sodium (mg)	2923 (2361-3822)	2982 (2283-3776)	*Z*=-.099 p=0.921
Potassium (mg)	1680 (1366-2085)	1653 (1414-2004)	*Z*=-.313 p=0.755
Calcium (mg)	497 (427-630)	491 (400-618)	*Z*=-.255 p=0.798
Magnesium (mg)	189 (160-225)	190 (155-222)	*Z*=-.206 p=0.837
Phosphorous (mg)	756 (647-893)	767 (633-918)	*Z*=-.225 p=0.822
Iron (mg)	7.4 (6.2-9.0)	7.4 (6.1-8.7)	*Z*=-.075 p=0.940
Zinc (mg)	6.7 (5.3-8.1)	6.5 (5.4-7.8)	*Z*=-.246 p=0.806

*Values in the cells are given as median (M) 25-75 percentile (Q1-Q3). Medians were compared using the Mann-Whitney U test. PUFA: Poly unsaturated fatty acids.

Table 4. Binary logistic regression analysis results for factors thought to affect PMS status*

Variable	Odds Ratio	95% Confidence limits of Odds Ratio	Wald Statistic	*p*
Milk pudding/ice cream				
Other group	1			
1-2 times/week or more	2.903	1.595-5.281	12.179	**<0.001**
Honey, jam, molasses				
Other group	1			
5-6 times/week or more	2.468	1.301-4.681	7.650	**0.006**
Sugar				
Other group	1			
5-6 times/week or more	2.270	1.284-4.014	7.946	**0.005**
Income level of family				
Income > expenses	1			
Income = expenses	2.488	1.172-5.283	5.626	**0.018**
Income < expenses	4.997	1.502-16.626	6.879	**0.009**
Stable	0.148	-	16.290	**<0.001**

*Variables included in the model: milk puddings, biscuits/cracker varieties, chocolate/hazelnut/peanut butter, honey/jam/molasses, sugar, coffee, carbonated/cola drinks, family income, cheese, energy, carbohydrates, waist/hip ratio.

were used in the binary logistic regression model. The results obtained using backward elimination (Wald's test) are presented in Table 4. The threshold of significance level was accepted as $p<0.05$.

Ethical Consideration

Ethical approval to perform the study was obtained from Erciyes University Ethics Committee

of Clinical Research (Decision no: 2019/398, Decision date: 22.05.2019). Institutional approval was obtained from The Rectorate of Erciyes University. The participants were informed about the study and their consent was obtained using an informed consent form.

Results

The frequency of PMS was found to be 55.28%. Smoking rate (4.6%), presence of dysmenorrhea (85.5%), and mean PMS score (138.59±19.57) among individuals with PMS were significantly higher than those without PMS (smoking rate 0.0%, dysmenorrhea 67.0%, and PMS score 92.22±17.99) ($p<0.05$). There was no significant difference between the groups in the other characteristics ($p>0.05$, Table 1).

The rates of those in the group with PMS who consumed milk pudding/ice cream 1-2 times a week or more (75.6%), biscuit/cracker varieties (37.4%), honey/jam/molasses (36.6%), sugar (51.9%), and coffee (37.4%) 5-6 times a week or more, and chocolate/hazelnut-peanut butter (7.6%) and carbonated and cola drinks (21.0%) 3-4 times a week or more were significantly higher than those in the group without PMS ($p<0.05$, Table 2).

The daily energy consumption of the group with PMS [1447kcal (1220-1713)] was higher than that without PMS [1339kcal (1173-1569)], which was a marginally significant ($p=0.051$, Table 3). The daily carbohydrate median consumption of the group with PMS and without PMS was 167.43 g (128.68-203.74) and 149.65 g (127.23-177.56), respectively, and this difference between the groups was statistically significant ($p=0.036$, Table 3).

According to Table 4, the risk factors affecting PMS were milk puddings/ice cream, honey/jam/molasses, and sugar consumption and income status of the family. PMS risk of those who consumed milk puddings/ice cream 1-2 times a week or more often was 2.90 fold higher than those who consumed less frequently; the PMS risk of those who consumed honey/jam/molasses or sugar 5-6 times a week or more compared to those who consumed less frequently was 2.46 and 2.27 fold higher, respectively. The PMS risk of those whose income was equal to expenses was 2.48 fold higher than those whose income was higher than expenses; the PMS risk of those whose income was less than expenses was 4.99 fold higher than those whose income was higher than expenses. According to the Wald statistics results, the factor with the highest effect on PMS was milk puddings/ice cream consumption frequency.

Discussion

The frequency rate of PMS in this study (55.28%) was close to the results in other studies (52.1% and 58.1%) conducted with university students in Turkey which used the same scale to detect PMS (17, 18).

Women experiencing PMS problems are extremely sensitive to the usual hormone fluctuations in the menstrual cycle. Decreases in estrogen levels in the luteal phase and the sudden decrease in progesterone levels in the late luteal phase affect serotonin and GABA levels (1, 3). Decreases in brain serotonin and GABA levels during PMS may lead to the emergence of symptoms such as irritability, sadness, and depressed mood and a desire to eat to cope with these symptoms, especially an increased fondness for food containing carbohydrates (3, 21). The increase in the intake of complex carbohydrates can lead to an increase in serotonin synthesis by allowing the serotonin precursor tryptophan to be transported more to the brain (2, 3). Women's RMR is higher in the luteal phase compared to the follicular phase (32). The increase in RMR in the luteal phase can increase the daily energy intake by increasing the total daily energy expenditure. However, in this study, the frequency of consumption of foods containing simple carbohydrates ($p<0.05$, Table 2), daily carbohydrate intake ($p<0.05$), and energy intake ($p=0.051$, Table 3) in the group with PMS was higher than those without PMS. Similarly, studies carried out with university students in Taiwan and Egypt found that consumption of drinks containing sugar and eating sweets were higher in the groups with PMS (12,13). However, the NHS II subgroup study found that carbohydrate consumption did not play a role in PMS development and that the daily energy intake of

individuals with or without PMS was similar (21). No difference was found between women with and without PMS in daily energy intake and macronutrients in two different studies conducted with nurses and adolescents (11, 33). In our study the reason there was a difference between the groups in the daily amount of carbohydrates and energy intakes could be due to food consumption records that were recorded during the luteal phase.

Different studies have found fast food or western diets habits with a poor-quality diet lacking enough vegetables, fruits, whole grains, seafood, and vegetable protein and consisting of empty calories, sodium, saturated fat, and refined grains may increase the risk of PMS (11, 14, 16-18). The current study found that the high frequency of consumption of foods with a high sugar content (ice cream, jam, etc.) and a low socioeconomic level increased the risk of PMS ($p<0.05$,Table 4). Similarly, two different studies have also reported that a low socioeconomic level increases the risk of PMS (17, 18). Having a low-income level can negatively affect attempting to eat a healthy diet and lead to a tendency to consume cheap foods with low nutritional value.

The NHS II subgroup study also found that caffeine intake and frequency of coffee did not affect PMS development. In the same study, smoking was the most important confounding factor, and caffeine consumption was higher in smokers than non-smokers (34). In current study, the rate of smoking among the participants with PMS was 4.6% and no participant without PMS smoked. By antagonizing the effect of the inhibitory neurotransmitter adenosine, caffeine causes vasoconstriction as well as stimulating effects (34). Excessive caffeine consumption has side effects such as headache, insomnia, and tachycardia (35). Some studies have found that the frequency of coffee consumption is higher in the group with PMS than without PMS (13, 19). Similar to these findings, the frequency of coffee consumption and the number of smokers were higher in the PMS group in this study ($p <0.05$ Table 2, Table 1), which may suggest that the participants may have experienced PMS symptoms more intense due to physiological side effects of caffeine and nicotine.

This study found that participants experiencing the problem of PMS consumed foods with high sugar content more frequently and the increased consumption of milk puddings/ice cream and honey/jam/molasses that include high amounts of sugar and simple carbohydrate content increased the risk of PMS ($p <0.05$ Table 2, Table 4). In line with these results, a healthy diet rich in complex carbohydrates and with limited consumption of simple carbohydrates is suggested to decrease the risk of PMS.

The strengths of our study included recording the participants' food consumption for three days during the luteal phase when PMS symptoms began to appear, using a scale to determine PMS whose Turkish validity and reliability study was performed (28) and that is practical, inexpensive, and used in many studies (6, 17-19). However, the fact that the results cannot be generalized to different age groups because the study was conducted with a homogeneous group including university students is the limitation of the study. Another limitation of the study is the scale used in the study which was a subjective diagnostic tool based on individuals' responses.

Conflict of Interests: No potential conflict of interest relevant to this article was reported by the authors.

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