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Relationship between menstruation period, nutrients intake and appetite with premenstrual syndrome[1]

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Abstract

Aim: This study was undertaken to evaluate the macronutrient intake and appetite status of women aged 18-40 before, during, and after menstruation and to examine the relationships of those variables with premenstrual syndrome.

Method: In this observational study, three days nutritional intake record, "Simplified Nutritional Appetite Questionnaire (SNAQ)", and "Premenstrual Syndrome Scale (PMS)" were administered to 410 women who applied to the nutrition and diet polyclinic of Kocaeli Derince Training and Research Hospital. All data were analyzed using IBM SPSS Statistics 26.

Results: As the women's intake of macronutrients such as carbohydrates (g), protein (g), and fat (g), saturated fat (g) increased, scores for the PMS factors of Anxiety, Irritability, Depressive Affect and Thoughts, Pain, Fatigue, Changes in Appetite and Sleep increased as well, as did total scores ($p<0.01$ for all). As participants' scores for the SNAQ increased, the Depressive Affect, Fatigue, Changes in Sleep, Bloating, and Changes in Appetite factor scores and the total scores of the PMS Scale increased ($p<0.05$).

Conclusion: Women's macronutrient intake varies before, during, and after menstruation and PMS affects macronutrient intake and appetite.

Keywords: Premenstrual syndrome, nutrients, macronutrients, hunger, menstruation.

1. Introduction

Due to the cyclical nature of the female reproductive system as a natural part of life, various physical and psychological changes are experienced (Taşkın, Çelik, Soyal & Taşkın, 2019). The period from the first day of menstrual bleeding to the day that it next starts again is called the menstrual cycle (Özçelik, 2019). Certain psychological and physiological differences have been reported due to hormone fluctuations during the menstrual cycle, which may be characterized by different symptoms experienced before or during menstruation (Aksoy Derya, Erdemoğlu & Özşahin, 2019). Hormonal alterations that shape during the menstrual period can affect appetite control and eating behaviors (Ongan, Songür Bozdağ, Kuleli, Ünsal & Yıldırım, 2021), and this can

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cause significant differences in the amounts of energy intake and appetite levels of women during menstruation (Özçiftçi & Kızıltan, 2021). Studies on macronutrient intake during menstruation have produced inconsistent results (Fukushima, Fukushima, Sato, Yokota & Uchida, 2020; Güngördü, 2019). Macronutrient intake may be affected by sex hormones that fluctuate between phases of the cycle (Handy, Greenfield, Yonkers & Payne, 2022). Towards the end of the luteal phase, cyclical changes in serotonin and decreases in amino acid concentrations and lipid metabolites can affect caloric intake, resulting in higher energy and protein intake to meet increased anabolic requirements (Draper et al., 2018). When nutrient intake levels in the follicular and luteal phases were compared, it was observed that total energy intake was lower in the follicular phase than in the luteal phase (Gallon et al., 2022). Similarly, previous studies showed that fat, protein, and carbonhydrate intake levels were highest during the luteal phase (Souza et al., 2018; Nowak et al.,2022). When changes in appetite occurring in the menstrual cycle were investigated, it was reported that nutrient intake generally decreased during the follicular period when estrogen was increased and progesterone was decreased, and it was possibly increased during the period in which progesterone was dominant following ovulation (Ma et al., 2020; Heuberger et al., 2022).

Menstrual cycle problems are emerging as negative conditions affecting a majority of women around the world with effects on society and public health (Sönmez, Çapık & Akkaş, 2019). Premenstrual syndrome (PMS), dysmenorrhea, amenorrhea, and abnormal uterine bleeding are the most important symptoms related to menstruation and are among the serious problems that negatively affect the daily lives of women (Saka & Okuyucu, 2020). Among those disorders, PMS is particularly common in many women during the fertile period (Yorulmaz & Karadeniz, 2021; Akmalı, Özerdoğan & Gürsoy, 2020) and it is characterized by the physical, psychological, behavioral, and symptoms repetitions that begin towards the end of luteal phase of the menstrual cycle and end in the next follicular phase or at the end of the menstrual cycle (Lee, Lee, Ahn, Lee & Kang, 2022). The pathophysiology or etiology of PMS is still not fully understood and some studies suggest that factors such as genetics, hormones, and changes in neurotransmitters and the central nervous system may play roles in PMS (Zendehdel & Elyasi, 2018; Gudipally & Sharma, 2022). Other studies have shown that consumption rates of foods containing high energy, carbohydrates, and fats such as chocolate, pastries, other snacks, fast food, fried foods, and desserts are higher among women with PMS (Hashim et al., 2019; Dehnavi, Rad & Sabzevary, 2018). In a cohort study, when PMS symptoms were examined, it was observed that scores related to increased appetite and craving behaviors were high (Frankel et al., 2021).

2. Purpose

This study was undertaken to appraise, the macronutrient intake and appetite status of women aged 18-40 before, during, and after menstruation and to examine the relationships of those variables with premenstrual syndrome.

3. Method and Material,

3.1. The place and time of the study

The research was based on the principle of volunteerism and the study was begun after obtaining the approval of the"Üsküdar University Non-Interventional Research Ethics Committee (decision no.61351342/September 2022-23, dated 30.09.2022)". The study was conducted between October 2022 and March 2023 at Kocaeli Derince Training and Research Hospital.

3.2. Population and sample selection

The population of this observational study was women between the ages of 18 and 40 years who applied to the "Nutrition and Diet Polyclinic of Kocaeli Derince Training and Research Hospital". While calculating the sample size of this study, the R 3.6.1 program was used for power

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analysis, an alpha error was taken as 5%, a beta error was taken as 20%, and the minimum number of samples was determined to be 74 considering that there would be a difference between variables as a result of the planned research period (Süt, 2011; Champely, 2020). The study was conducted with the participation of 410 women aged 18-40 who had applied to the aforementioned nutrition and diet polyclinic.

3.3. Type of study

This study is an observational research.

3.4. Data collection

3.4.1. Data collection method

Data were collected via face-to-face interview method.

3.4.2. Data collection tools

3.4.2.1. Body Mass Index (BMI) Values of Participants

Anthropometric measurements were performed and BMI values were computed by the researcher.

3.4.2.2. Nutrition Intake Record

Participants were asked to record the foods they consumed in the previous 24 hours three times, one day before menstruation, one day during menstruation, and one day after menstruation, to allow the determination of the energy and macronutrients consumed by the participants. The BeBiS 9 Nutrition Information System was used to evaluate the obtained data. BeBiS is a computer software program for nutrient analysis that provides detailed information on nutrition for applications such as nutrient analysis, diet therapy, or menu planning based on up-to-date data. Nutrient analysis can be conducted by having participants record the amount of foods consumed (grams) or the number of servings. In addition, values such as energy and macronutrients can be calculated (BEBIS, 2023).

3.4.2.3. Premenstrual Syndrome Scale

This scale is a 44-clause, five-point ("never," "very rarely," "sometimes," "frequently," or "constantly") Likert-type scale developed by Gençdoğan (2006) to determine the severity of PMS (Gençdoğan, 2006). Participants provided answers according to "within one week before menstruation." As the score increases, the density of PMS symptoms is considered to be higher. Exceeding 50% of the maximum possible score in the assessment, i.e., obtaining a score of >110 points, indicates the presence of PMS. The scale consists of nine factors: "Depressive Affect" reflects depressive emotions such as boredom, sadness, crying, anhedonia, and pessimism (items 1, 2, 3, 4, 5, 6, and 7). "Anxiety" reflects anxiety, worries, and fears (items 8, 9, 10, 11, 13, 15, and 16). "Fatigue" reflects tiredness and the desire to sleep (items 12, 14, 17, 18, 25, and 37). "Irritability" reflects irritability and the inability to control anger (items 19, 20, 21, 22, and 23). "Depressive Thoughts" reflects thoughts of worthlessness and distraction (items 24, 26, 27, 28, 29, 30, and 44). "Pain" reflects various bodily pains (items 31, 32, and 33). "Changes in appetite" reflects changes in appetite and particularly cravings for baked goods and sweet foods (items 34, 35, and 36). "Changes in Sleep" reflects sleep-related changes such as interrupted sleep, waking up tired, and difficulty falling asleep (items 38, 39, and 40). Finally, "Bloating" reflects breast swelling and tenderness (items 41, 42, and 43) (Gençdoğan, 2006).

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3.4.2.4. Simplified Nutritional Appetite Questionnaire (SNAQ)

This scale was developed by Wilson et al. (2005) and the reliability of the Turkish version of the scale was confirmed by Tatar et al. (2021) with a reliability coefficient of 0.86 (Wilson et al., 2005; Kutlu Tatar, Sivritepe & Uçak Basat, 2021). The SNAQ consists of 4 questions for a total of 20 points, addressing the number of meals in a day, general appetite status; when the feeling of satiety occurs after beginning a meal, and the taste sensations of foods. Each question is scored from "a" to "e" (a=1, b=2, c=3, d=4, and e=5 points). In line with the answers provided by the individual, it is stated that individuals with total scores of ≤14 are at risk of losing 5% of their body weight within the next 6 months, while those with scores of >14 do not have that risk (Kutlu Tatar, Sivritepe & Uçak Basat, 2021).

3.4.3. Data collection time

The study was conducted between October 2022 and March 2023 at Kocaeli S.S.E. Derince Training and Research Hospital.

3.5. Limitations of the study

This study was limited to the women who applied nutrition and diet polyclinic of Kocaeli S.S.E. Derince Training and Research Hospital in the Kocaeli provincial center.

3.6. Research ethics

This study was directed in conformity with the Declaration of Helsinki and approved by the "Non-Interventional Research Ethics Committee of Üsküdar University, Turkey (approval number: 61351342/September 2022-23)". Each participant was known completely concerning the research protocol and the purposes of the research were clarified to them. Every partici-pant signed a written informed consent. Participation was voluntary and participant's information was kept confidential.

3.7. Evaluation of data

The Shapiro-Wilk test was utilized to specify whether the numerical variables indicated normal dispersion. The Cochran Q test was utilized to compare two categorical groups over time. In the comparison of quantitative variables over time, the Friedman test was utilized for data that did not show normal dispersion. The Mann-Whitney U test was utilized for comparisons of two independent categories that did not show normal dispersion and the Kruskal-Wallis H test was utilized for comparisons of more than two independent groups. The significance of the results of multiple comparison tests are shown in tables with letters next to the median values. Connections between the scales were evaluated with Spearman rank-order correlation coefficients for data that did not show normal distribution (Choi, Peters & Mueller, 2010). Effects between variables were tested using regression analysis. In all calculations and interpretations performed in this study, statistical significance levels were accepted as $p<0.05$, $p<0.01$, and $p<0.001$, and hypotheses were set bi-directionally. Statistical analysis of the data was enforced using IBM SPSS Statistics 26 (IBM, 2023).

4. Results

A significant distinction was found between the occurrence of appetite change ($Q=319.568$; $p<0.001$) and the appetite change direction ($Q=70.542$; $p<0.001$) for the participants before, during, and after menstruation. When the results were examined, it was found that these rates were higher before menstruation compared to during or after, and the rates during menstruation were higher compared to those after menstruation. Appetite changes were more common before menstruation than during or after menstruation (Table 1).

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Table 1. Descriptive statistics for findings before, during, and after menstruation and comparison of the results for appetite change and direction of appetite change among the participants

	Before menstruation		During menstruation		After menstruation	
	n	**%**	**n**	**%**	**n**	**%**
Appetite Change						
Yes	299	72.9[c]	250	61.0[b]	70	17.1[a]
No	111	27.1	160	39.0	340	82.9
Q			**319.568**			
p			**<0.001*** **			
Appetite Change Direction						
Increased	288	96.7[c]	191	76.4[b]	17	24.3[a]
Decreased	10	3.3	59	23.6	53	75.7
Q			**70.542**			
p			**<0.001*** **			

Q: Cochran Q test
***: p<0.001
[a, b, c]: In all tables, the differences between values marked with different superscripted letters are significant (p<0.05)

When comparisons of the energy and macronutrients consumed by the participating women before, during, and after menstruation were examined, the energy (kcal) (F=36.693; p<0.001), carbohydrate (g) (F=28.895; p<0.001), protein (g) (F=14.951; p<0.01), fat (g) (F=18.642; p<0.001) and saturated fat (g) (F=10.625; p<0.01) values before menstruation were found to be statistically higher than those recorded after menstruation. The value obtained for cholesterol (mg) during menstruation was also statistically higher than that obtained for the period after menstruation (F=9.818; p<0.01) (Table 2).

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Table 2. Statistical results and comparisons of energy, macronutrients, and other nutritional values for the participants

	Before menstruation		During menstruation		After menstruation			
	Mean±SD	**Median (min-max)**	**Mean±SD**	**Median (min-max)**	**Mean±SD**	**Median (min-max)**	**F**	**p**
Energy (kcal)	1536.25±440.76	1471.5^{b} (836.1-4164.7)	1562.27±582.10	1480^{b} (677.8-841.6)	1394.37±359.24	1321.6^{a} (668.7-2737.7)	**36.693**	**<0.001*** **
Carbohydrates (g)	153.08±59.06	148.2^{b} (37.8-467.5)	158.45±93.35	148.5^{b} (21.9-1482.4)	135.77±48.19	127.8^{a} (21-313.4)	**28.895**	**<0.001*** **
Carbohydrates (%)	40.43±9.22	40 (13-71)	40.48±9.39	41 (8-77)	39.59±8.75	40 (11-66)	2.363	0.307
Protein (g)	60.63±22.65	58^{b} (19.1-143.4)	62.12±22.85	58.5^{b} (17.5-223.2)	55.74±19.44	52^{a} (13.7-133.7)	**14.951**	**0.001****
Protein (%)	16.32±4.82	16 (7-37)	16.59±3.46	16 (6-38)	16.55±4.80	16 (5-37)	1.747	0.418
Fat (g)	74.21±24.25	70.3^{b} (20-179.6)	74.06±34.47	70.2^{b} (23.4-168.8)	68.68±21.60	65.3^{a} (23.4-156.4)	**18.642**	**<0.001*** **
Fat (%)	43.20±8.23	43 (18-68)	42.88±8.28	43 (11-69)	43.89±8.09	44 (21-79)	2.512	0.285
Saturated Fat (g)	25.41±9.46	23.7^{b} (6.2-62.4)	25.59±9.91	23.9^{b} (7-66.6)	23.76±9.11	22.5^{a} (5.5-83)	**10.625**	**0.005****
Omega-3 (g)	2.15±1.24	1.9 (0.3-12.1)	2.14±1.51	1.9 (0.5-18.7)	2.03±1.30	1.8 (0.3-14)	4.338	0.114
Omega-6 (g)	15.38±8.22	14.1 (1.8-58)	15.28±8.26	14 (2.1-49.4)	14.48±7.88	13.4 (2.1-46.9)	2.615	0.270
Cholesterol (mg)	274.56±181.00	241.7^{ab} (3.6-1054.2)	288.25±199.58	252.4^{b} (0-1073.5)	240.59±164.38	193.1^{a} (0-863.9)	**9.818**	**0.007****

F: Freidman test
**: p<0.01; ***: p<0.001

As the participants' intake of energy (kcal) increased, their scores for the factors of Depressive Affect (s=0.149; p<0.01), Anxiety (s=0.155; p<0.01), Fatigue (s=0.223; p<0.001), Irritability (s=0.144; p<0.01), Depressive Thoughts (s=0.194; p<0.001), Pain (s=0.099; p<0.05), Changes in Appetite (s=0.208; p<0.001), and Changes in Sleep (s=0.244; p<0.001) and the PMSS total score (s=0.195; p<0.001) also increased. As carbohydrate (g) intake increased, scores for Depressive Affect (s=0.110; p<0.05), Anxiety (s=0.130; p<0.01), Fatigue (s=0.180; p<0.001), Irritability (s=0.151; p<0.01), Depressive Thoughts (s=0.176; p<0.001), Pain (s=0.124; p<0.05), Changes in Appetite (s=0.162; p<0.01), Changes in Sleep (s=0.172; p<0.001), and the total PMSS (s=0.161; p<0.01) also increased. As protein (g) intake increased, scores for Depressive Affect (s=0.110; p<0.05), Anxiety (s=0.122; p<0.05), Fatigue (s=0.170; p<0.01), Depressive Thoughts (s=0.152; p<0.01), Changes in Appetite (s=0.133; p<0.01), Changes in Sleep (s=0.196; p<0.001), and the total PMSS (s=0.147; p<0.01) also increased. As fat (g) intake increased, scores for Depressive Affect (s=0.121; p<0.05), Anxiety (s=0.104; p<0.05), Fatigue (s=0.157; p<0.001), Depressive Thoughts (s=0.101; p<0.05), Changes in Appetite (s=0.154; p<0.01), Changes in Sleep (s=0.189; p<0.001), and the total PMSS (s=0.130; p<0.01) also increased. As cholesterol (mg) intake increased, the score for Changes in Sleep (s=0.164; p<0.01) also increased. As saturated fat (g) intake increased, the scores for Fatigue (s=0.137; p<0.01), Depressive Thoughts (s=0.099; p<0.05), Changes in Appetite (s=0.145; p<0.01), Changes in Sleep (s=0.157; p<0.01), Bloating (s=0.122; p<0.05), and the total PMSS (s=0.119; p<0.05) also increased (Table 3)

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Table 3. Correlation coefficients between PMSS factors and total scores and the energy, macronutrient, and other nutritional values of the participants

		PMSS-1	PMSS-2	PMSS-3	PMSS-4	PMSS-5	PMSS-6	PMSS-7	PMSS-8	PMSS-9	PMSS-T
Energy (kcal)	s	**0.149**	**0.155**	**0.223**	**0.144**	**0.194**	**0.099**	**0.208**	**0.244**	0.089	**0.195**
	p	**0.003****	**0.002****	**<0.001*****	**0.004****	**<0.001*****	**0.045***	**<0.001*****	**<0.001*****	0.071	**<0.001*****
Carbohydrates (g)	s	**0.110**	**0.130**	**0.180**	**0.151**	**0.176**	**0.124**	**0.162**	**0.172**	0.036	**0.161**
	p	**0.025***	**0.008****	**<0.001*****	**0.002****	**<0.001*****	**0.012***	**0.001****	**<0.001*****	0.470	**0.001****
Carbohydrates (%)	s	0.016	0.023	0.034	0.079	0.063	0.081	0.027	0.003	-0.028	0.036
	p	0.748	0.642	0.495	0.112	0.205	0.103	0.592	0.949	0.565	0.472
Protein (g)	s	**0.110**	**0.122**	**0.170**	0.093	**0.152**	0.050	**0.133**	**0.196**	0.060	**0.147**
	p	**0.026***	**0.014***	**0.001****	0.061	**0.002****	0.310	**0.007****	**<0.001*****	0.225	**0.003****
Protein (%)	s	0.001	0.019	0.021	0.016	0.028	-0.015	0.005	0.043	-0.001	0.023
	p	0.984	0.695	0.674	0.743	0.569	0.761	0.925	0.383	0.978	0.645
Fat (g)	s	**0.121**	**0.104**	**0.157**	0.066	**0.101**	0.033	**0.154**	**0.189**	0.096	**0.130**
	p	**0.014***	**0.034***	**0.001****	0.179	**0.041***	0.510	**0.002****	**<0.001*****	0.051	**0.008****
Fat (%)	s	-0.014	-0.039	-0.058	-0.084	-0.087	-0.082	-0.035	-0.024	0.040	-0.054
	p	0.783	0.434	0.240	0.089	0.077	0.098	0.480	0.631	0.425	0.277
Saturated fat (g)	s	0.090	0.093	**0.137**	0.080	**0.099**	0.024	**0.145**	**0.157**	**0.122**	**0.119**
	p	0.067	0.060	**0.005****	0.108	**0.046***	0.622	**0.003****	**0.001****	**0.013***	**0.016***
Omega-3 (g)	s	0.047	0.081	0.087	0.084	0.056	0.003	0.036	0.065	0.053	0.069
	p	0.341	0.101	0.079	0.090	0.260	0.959	0.466	0.190	0.282	0.163
Omega-6 (g)	s	0.060	0.037	0.054	-0.055	0.020	0.041	0.061	0.096	0.011	0.033
	p	0.224	0.449	0.273	0.267	0.689	0.408	0.220	0.053	0.827	0.508
Cholesterol (mg)	s	0.052	0.055	0.089	0.041	0.011	0.051	0.088	**0.164**	0.067	0.072
	p	0.296	0.264	0.072	0.403	0.828	0.307	0.075	**0.001****	0.178	0.143

PMSS-1: Depressive Affect; PMSS-2: Anxiety; PMSS-3: Fatigue; PMSS-4: Irritability; PMSS-5: Depressive Thoughts; PMSS-6: Pain; PMSS-7: Changes in Appetite; PMSS-8: Changes in Sleep; PMSS-9: Bloating; PMSS-T: Premenstrual Syndrome Scale total score

s: Spearman rank-order correlation coefficient

*: $p<0.05$; **: $p<0.01$; ***: $p<0.001$

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As the participants' SNAQ scores increased, there was a 12.3% increase in the factor score for Depressive Affect (s=0.123; p<0.05), a 10.7% increase in the factor score for Fatigue (s=0.107; p<0.05), a 10.5% increase in the factor score for Changes in Appetite (s=0.105; p<0.05), a 20.4% increase in the factor score for Changes in Sleep (s=0.204; p<0.001), a 17.1% increase in the factor score for Bloating (s=0.171; p<0.01), and a 11.7% increase in the total PMSS score (s=0.117; p<0.05) (Table 4).

Table 4. Correlation coefficients between participants' SNAQ scores and PMSS factor and total scores

	SNAQ	
PMSS	**s**	**p**
Depressive Affect	**0.123**	**0.013***
Anxiety	0.061	0.216
Fatigue	**0.107**	**0.030***
Irritability	0.095	0.054
Depressive Thoughts	0.071	0.151
Pain	0.083	0.092
Changes in Appetite	**0.105**	**0.033***
Changes in Sleep	**0.204**	**<0.001*****
Bloating	**0.171**	**0.001****
Total PMSS	**0.117**	**0.018***

s: Spearman rank-order correlation coefficient
*: p<0.05; **: p<0.01; ***: p<0.001
SNAQ: Simplified Nutritional Appetite Questionnaire; PMSS: Premenstrual Syndrome Scale

5. Discussion

In this study, changes in appetite before, during, and after menstruation were seen in the majority of participants, with appetite increases in those whose appetites changed before and during menstruation and decreases in those whose appetites changed after menstruation. Similarly, in previous studies, while most participants experienced an increase in appetite before and during menstruation, there was no change in appetite after menstruation (Albayrak, 2019; Yukie, Aoi, Mizuki & Toshiyuki, 2020). In another study, it was found that the majority of participants did not eat more than they normally consumed before and during menstruation (Özkarslı, 2022). This may be due to increased progesterone levels in the premenstrual period. Since progesterone increases biosynthesis and energy expenditure by regulating cell growth and cell cycles, increased appetite and increased food intake occur to compensate (Dang et al., 2022). Ovarian steroids affecting energy balance and non-homeostatic digestive behaviors, hormonal fluctuations triggering emotional eating, shifts in sex hormones regulating insulin response, and efforts to cope with emotional changes that may occur due to hormones may also generate different behaviors in different individuals (Lima et al., 2023). While some prefer eating to cope with such emotions, others prefer other behaviors such as physical or social activities and suppressing their appetites (Lima et al., 2023), and this may also explain differences between individuals and between studies in the literature.

In the present study, values of energy (kcal), protein (g), carbohydrates (g), fat (g), and saturated fat (g) were found to be statistically higher before and during menstruation compared to the period after menstruation. Cholesterol (mg) values during menstruation appeared to be statistically higher than post- menstrual values. Similarly, previous studies showed increases in energy (kcal) intake in the premenstrual period (Çukurovalı Saykurt, 2016; Kammoun et al., 2017). It was previously observed that there was no difference between menstrual phases in terms of energy (kcal), protein (g), carbohydrates (g), fat (g), or saturated fat (g), intake (Özkarslı,2022) but a different study concluded that carbohydrate intake was lowest before menstruation (Arı, 2017).

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This may be explained by increased interest in foods high in carbohydrates (g) due to cyclical changes in serotonin towards the end of the luteal phase, decreases in amino acid concentrations and lipid metabolites that may affect calorie intake, and, consequently, higher levels of energy and protein intake to meet the increased anabolic requirements (Draper et al., 2018; Gallon et al., 2022).

In this research, as the participants' intake levels of energy (kcal), carbohydrates (g), protein (g), and fat (g) increased, their factor scores for Irritability, Anxiety, Fatigue, Depressive Thoughts, Depressive Affect, Pain, Changes in Appetite as well as Sleep and their total PMSS scores increased. In recent studies, it was observed that participants with high levels of PMS had high levels of energy, carbohydrate, and protein intake (Gallon et al., 2022; Taheri, Mesbah Ardekani, Raeisi Shahraki, Heidarzadeh-Esfahani & Hajiahmadi, 2020). Furthermore, it was previously observed that as women's protein intake increased, their total PMSS scores and Fatigue and Depressive Thoughts factor scores increased, and as protein and energy intake increased, Anxiety factor scores increased (Candan, 2023). In another study, it was observed that as women's energy (kcal) intake increased, their Pain factor scores increased (Albayrak, 2019). In the period before menstruation, progesterone levels increase, and progesterone increases biosynthesis and energy expenditure by regulating cell growth and cell cycles. To compensate for this, appetite and food intake increase (Dang et al., 2022). High concentrations of allopregnanolone, a 5α-reduced metabolite of progesterone, in the luteal phase can cause depression and mood changes in women, and serotonergic neurons are also involved in mood regulation (Hernández-Hernández, Martínez-Mota, Herrera-Pérez & Jiménez-Rubio, 2019). Serotonin can also have an analgesic effect by affecting the noradrenergic system (Inaltekin & Kivrak, 2021). Thus, the findings presented here may be explained by the fact that participants consumed more sweets and sugary foods to increase their serotonin levels and that these foods are rich in energy (kcal), carbohydrates (g), and fat (g) (Eskici, 2020).

In this study, as the intake of saturated fat (g) increased, scores for Depressive Affect, Fatigue, Changes in Sleep, Bloating scores, Changes in Appetite, and total PMSS increased. A similarly study observed that most participants with high PMSS total scores had high intake levels of fast foods, sugary drinks, and fried foods high in saturated fat (Dehnavi et al., 2018). In a study conducted in 2017, however, it was shown that there was no significant relationship between total fat consumption and PMS (Houghton et al., 2017).Saturated fats can affect estrogen levels, estrogen increases aldosterone release by inducing angiotensinogen synthesis in the liver, and this can cause fluid retention as well as bloating (Işgın & Büyüktuncer, 2017). High-fat diets trigger obesity, which initiates cell cycle arrest and apoptosis of growth cycles and has a negative impact on ovarian function (Taheri, Mesbah Ardekani, Raeisi Shahraki, Heidarzadeh-Esfahani & Hajiahmadi, 2020). In this case, foods with high-fat levels are a risk factor for PMS, and as the consumption of these foods increases, fatigue, depressive moods, and changes in sleep may occur in parallel with increases in PMS symptoms such as bloating and increased appetite (Sharifan et al., 2023).

In this study, as cholesterol (mg) intake increased, factor scores for Changes in Sleep increased. Positive findings may be explained by the fact that estrogen affects the patterns of sleep by affecting both the circadian and homeostatic regulation of sleep, high intake of dietary fats causes aromatase levels to increase, and increasing estrogen synthesis and fluctuations in estrogen levels can trigger changes in sleep duration and quality (Pengo, Won & Bourjeily, 2018).

In this study, it was found that as participants' SNAQ scores increased, scores for Depressive Affect, Fatigue, Changes in Appetite, Changes in Sleep, Bloating, and total PMSS increased. Previous studies showed appetite increases before menstruation (Nowak et al., 2020; Arı, 2017). Genetic factors, sex hormones, and changes in neurotransmitters cause PMS symptoms and may lead to increased appetite by affecting the hormones and cytokines that signal hunger and satiety (Shiota, Shime, Nakai & Kageyama, 2021). In the premenstrual period, plasma progesterone levels increase and progesterone stimulates nutrient intake (Rogan & Black, 2023). In parallel with hormonal changes before menstruation, carbohydrates and foods that are high in fat are preferred

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more, which may lead to an increase in total PMSS scores and some factor scores (Souza et al., 2018).

This study has some limitations. This study calculated the nutrient intake from a nutrition intake record based on a self-reported dietary recall. Moreover, since this is a study based on questionnaire surveys, it is not possible to explain the underlying contraptions and further research is essential. Nevertheless, these data are consistent with previous studies showing that premenstrual syndromes are associated with nutritional intake.

6. Conclusion

Women's macronutrient intake varies before, during, and after menstruation and premenstrual syndrome affects macronutrient intake and appetite. In order to protect women's health throughout life, further research are necessity to investigate the connection between premenstrual syndromes and related nutrients.

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