

# The prevalence of premenstrual syndrome and its relationship with food intake, anxiety and digestive disorders in university student girls

## Abstract

Premenstrual syndrome (PMS) including physical, psychological and behavioral symptoms that occur one to two weeks before of the menstrual period, and several factors may play a role in this regard. Therefore, the aim of this study was to investigate the prevalence of premenstrual syndrome and its relationship with anxiety, digestive disorders such as irritable bowel syndrome (IBS) and constipation, as well as food intake in female students. This cross-sectional study was conducted on 200 university student girls resident in dormitories of Ahvaz Jundishapur University of Medical Sciences. General, anxiety, digestive disorder and dietary intake questionnaires were used. For investigation of PMS, a validated questionnaire was used. In this study the prevalence of PMS was 47.5%. There was a significant relationship between PMS and IBS ( $p=0.009$ ) and constipation ( $p=0.034$ ). Also, it was determined a significant relationship between PMS and obvious anxiety ( $p=0.024$ ) and hidden anxiety ( $p=0.001$ ). Intake of meats ( $p=0.021$ ) and fast foods ( $p=0.002$ ) were significantly higher in subjects with PMS symptoms and intake of carbohydrate sources were significantly lower compare with subjects without symptoms ( $p=0.006$ ). It was found that there is an association between PMS and anxiety, IBS and food intake. Therefore by presentation appropriate psychological and nutritional consultation, it could be taken a positive step to improve these factors and reduce PMS symptoms among affected girls.

**Keywords:** premenstrual syndrome, anxiety, irritable bowel syndrome, constipation, food intake

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**Abbreviations:** PMS, premenstrual syndrome; IBS, irritable bowel syndrome; BMI, body mass index; WC, waist circumference; HC, hip circumference; STAI, spielberg's state-trait anxiety inventory; ACOG, american college of obstetrics and gynecologic disease; SD, standard deviation; FFQ, food frequency questionnaire

## Introduction

Premenstrual syndrome (PMS) involves physical, psychological, and behavioral symptoms that occur one to two weeks before the onset of menstruation in women. The symptoms of this syndrome and their severity often vary between individuals and between successive cycles and reduce to the onset of bleeding.<sup>1</sup> In most women, there is no relatively predictable pattern for symptoms.<sup>2</sup> Epidemiological findings suggest that the frequency of PMS in women is more than 80 to 90%.<sup>3</sup> Almost 5% of women have symptoms that are so severe that disrupt their individual and social activities and are called premenstrual dysphoric disorder (PMDD).<sup>4,5</sup> In a survey in Iran, women 18 to 45years old were studied between 2009 and 2011 and the results showed that the prevalence of PMS was 52.9%, while 34.5% suffering from severe forms.<sup>6</sup> Feeling of fragmentation, craving for food, insomnia and/or swallowing, headache, sadness, pelvic pain, breast tenderness, joint pain, and bloating are important symptoms and irritability, anxiety, depression, mood swings, hostility, weak concentration, confusion, social disturbance, and interpersonal conflicts are the common psychological and emotional symptoms of PMS.<sup>7,8</sup> There is also a number of other PMS symptoms such as constipation, muscle cramps, drowsiness, loss of libido, swelling of the face, forgetfulness, fatigue, headache, herpes outbreaks, hot

flashes, light and sound sensation, palpitations, restlessness, weak memory, sore throat, vomiting, and weight gain.<sup>9</sup> The exact cause of PMS remains unclear and various factors are thought to be involved, therefore it is suggested that PMS be considered as a multi-factor problem.<sup>10</sup> On the other hand, possible reasons may include hormonal changes, neurotransmitter changes, diet, stress and lifestyle.<sup>11</sup> Women with PMS suffer from disruption of their social and economic performance,<sup>12</sup> in addition, their job performance is reduced, thereby, a remarkable decline in economic efficiency will occur.<sup>13</sup>

Different risk factors that affect PMS include high caffeine intake,<sup>14</sup> stress, age, history of depression, family history, and nutritional factors such as low levels of vitamins and minerals such as vitamin B6, magnesium,<sup>15</sup> Zinc, manganese,<sup>16</sup> vitamin E and vitamin D as well. Common therapeutic recommendations include medications (antidepressants and anti-anxiety drugs), oral supplements (such as bromocriptine, calcium and magnesium), the consumption of natural products (such as herbal extracts and oils such as primrose oil), lifestyle changes (exercise and diet) and behavioral therapy.<sup>17</sup>

Chronic stress and anxiety are among the external factors that affects PMS. A study showed that higher stress levels are associated with a higher risk of PMDD in women.<sup>18</sup> In addition, women suffering from PMS experience more stressful situations than healthy people.<sup>19,20</sup> It has also been reported that women with severe PMDD or PMS have a higher anxiety level than those with mild PMS or no PMS.<sup>21</sup> It has been shown that 31% of women with PMS have behavioral disorders,<sup>22</sup> of which 25% have anxiety disorder.<sup>23,24</sup>

Like PMS, irritable bowel syndrome (IBS) is also a common disorder with psychotic symptoms among these women,<sup>25</sup> which is a common disorder in the gastrointestinal tract, often associated with diarrhea, constipation, chronic abdominal pain and bloating and covers the majority of the population and has a prevalence of approximately 15-10% in Europe, North Africa, Australia and other developed countries. The prevalence of IBS in Asia and other developing countries has also increased.<sup>26</sup> This disorder, like PMS, can significantly reduce the quality of life and increase medical costs. Scientists such as Heitkemper et al.,<sup>27</sup> who examined the effect of gender on IBS showed that women suffered from IBS at higher rates than men and their intestinal symptoms worsen before menstruation.<sup>27</sup> Other studies also reported that women with IBS who had history of menstrual disorder and PMS had a higher incidence of abdominal pain and discomfort in this area than women with IBS and without PMS. In general, it has been shown that a significant proportion of women with IBS has PMS symptoms or suffered from PMS in the past.<sup>28</sup>

Previous studies reported that nutritional factors may also play an important role in the development of PMS.<sup>29,30</sup> It has been shown that extra consumption of sweet-tasting food items, fried, fast food, caffeine, alcohol and low intake of vegetables and fruits is significantly associated with the prevalence of PMS.<sup>31,32</sup> It has been recommended that women with PMS experience, especially those who have a sensitivity to touch the nipple, should refrain from caffeine intake completely.<sup>25</sup> Since anxiety, IBS and constipation are common factors associated with PMS, the combination of these factors together worsens the physical and psychological symptoms of PMS patients and, due to the that few studies on the relationship between PMS and anxiety, IBS, and constipation has been done, therefore, the aim of this study was to investigate the prevalence of PMS and its association with the level of anxiety, IBS, constipation and diet in girl students.

## Materials and methods

In this cross-sectional study, 200 female students resident in dormitories at Ahvaz Jundishapur University of Medical Sciences were selected randomly. This study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (IR. AJUMS.REC.1396.218), and all the subjects completed the consent form for participation in the study and all information was kept confidential. Inclusion criteria included age range 18 to 35, residence in the dormitory, lack of specific treatment for PMS and regular menstruation. Exclusion criteria included pregnancy and lactation, women with irregular menstrual cycle, girls who had a recent medical or psychological problem, those who received any type of hormone replacement therapy, subjects with thyroid dysfunction, polycystic ovaries syndrome and those who did not complete the questionnaire correctly. At the beginning of the work, after completing the informed consent form, a multi-part questionnaire was used to collect the data. This included a demographic and basic information questionnaire [height in centimeters (cm), weight in kilograms, body mass index (BMI) in kg/m<sup>2</sup>, waist circumference (WC) (cm), hip circumference (HC) (cm), gender, marital status, ethnicity and history of the disease], the questionnaire for detecting PMS and its severity, the questionnaire of obvious and hidden anxiety symptoms, the IBS symptoms and constipation questionnaire, and the dietary intake questionnaire. In this study, weight was measured using a digital balance scale (Omron, Japan) with a precision of 0.1 kilograms without shoes and with the lowest possible clothes. Height was measured using a tape measurement with a precision of 0.5 cm.

Spielberg's State-Trait Anxiety Inventory (STAI) is widely used in clinical research and practices. The emergence of obvious anxiety is devoted to stressful situations such as talking and discussion, loss of social status, and similar situations. However, hidden anxiety has been shown in the context of individual differences in response to stressful situations. Validity and reliability of this questionnaire have been shown in various studies in Iran.<sup>33,34</sup>

PMS was evaluated using validated Rossignol and Bonlander questionnaire that retrospectively assessed the existence and severity of premenstrual syndrome. To assess the frequency and severity of symptoms of premenstrual syndrome, the American College of obstetrics and Gynecologic Disease (ACOG) diagnostic criteria was used, which is at least one emotional sign and a physical symptom that occurs a few days before menstruation and after beginning of the cycle, its symptoms are discontinued without any medication.<sup>35</sup> In this study, moderate, severe and very severe grades were considered as PMS and the mild grade was ignored. Irritable bowel syndrome and constipation were determined according to the Rome criteria III.<sup>36</sup>

The dietary intake questionnaire used in this study included 22 food items, indicating the amount of consumption of each food item in the last 3 months. The questionnaire is based on the pyramid of Persian food guide, and the questions include the amount of servings eaten from each subgroup (which is in the main Iranian diet). In general, foods were divided into the following groups in this questionnaire: cereals (rice, pasta, breads), milk and dairy products [milk, yogurt, dough (an Iranian dairy drink), ice cream, cheese and whey], protein and meat products (fish, chicken, calves and sheep, legumes and eggs), fruits, vegetables, fats and oils and miscellaneous foods include a variety of fast food (pizza, sandwich, fried potatoes, falafel, samosa), soft drinks, and Sweets. This questionnaire was prepared and adjusted by Iranian researchers and had appropriate validity and reliability.<sup>37</sup>

## Statistical analysis

Independent t-test was used to compare the quantitative variables between two groups of girls with PMS symptoms and without symptoms and Chi-square test was used to examine the qualitative variables between the two groups. All quantitative data were expressed as mean±standard deviation (SD) and qualitative data as percentages. SPSS software version 17.0 was used to analyze the data. P<0.05 was considered as a significant level.

## Results and discussion

The mean age of participants in this study was 23±2 years. The findings showed that among 200 participants in the study, 95 subjects had PMS and 105 had no symptoms, therefore the prevalence of PMS in this study was 47.5% while the highest was observed in the Arab girls and the lowest was found in the Kurdish and Persian ethnicities. On the other hand, 51% of girls also had a history of PMS. PMS was also reported among married subjects more than others (Table 1). Subjects with PMS differed in terms of anthropometric indices with those without symptoms, as the BMI in these girls was significantly higher than those without symptoms (p=0.03) (Table 1).

By assessment the levels of obvious and hidden anxiety, the subjects were divided into 5 groups: mild, low- moderate, high-moderate, severe and very severe, with 17%, 38%, 26%, 16% and 3% respectively in the obvious anxiety group, and as 13%, 48.5%, 26%, 10.5%, and 2% respectively in the hidden anxiety group. Chi-square test showed a significant correlation between PMS with

obvious anxiety levels ( $p=0.024$ ) and hidden anxiety levels ( $p=0.001$ ). Also, this test showed a significant correlation between PMS and IBS ( $p=0.009$ ) and constipation ( $p=0.034$ ) (Table 2). Constipation was 64% in total for girls and the rate of IBS during menstruation was 73.5% and this rate was specifically reported in subjects with PMS as 37.5% and 53.1% (Table 2).

The results showed that the mean intake protein sources and meats ( $p=0.021$ ), as well as fast foods ( $p=0.002$ ), were significantly higher in individuals with PMS than without PMS. Also, the mean intake of carbohydrate in these individuals was significantly lower than those without PMS symptoms ( $p=0.006$ ). The mean intake in other food groups was not statistically significant (Table 3).

**Table 1** Demographic characteristics of individuals with PMS and without symptoms of PMS

Variable	PMS		P-Value	
	Yes	No		
Age (years)*	23.02±2.19	23.21±2.01	0.13 <sup>a</sup>	
Weight (kg)*	56.14±8.27	57.9±8.39	0.21 <sup>a</sup>	
Height (cm)*	160.16±5.1	161.13±5.5	0.5 <sup>a</sup>	
BMI (kg /m <sup>2</sup> )*	22.56± 3.6	21.62±2.98	0.03 <sup>a</sup>	
Waist to hip circumference (cm)*	0.76±0.04	0.75±0.04	0.5 <sup>a</sup>	
Age at first menstruation (years)*	13.1±1.46	13.2±1.42	0.68 <sup>a</sup>	
Sleep hours during the 24-hour day*	8.24±1.4	7.97±1.29	0.15 <sup>a</sup>	
Ethnicity <sup>#</sup>	Arab	9(75%)	3(25%)	0.143 <sup>b</sup>
	Lor	15(45.5%)	18(54.5%)	
	Bakhtiari	20(45.5%)	24(54.5%)	
	Kurdish	8(40%)	12(60%)	
	Turkish	14(70%)	6(30%)	
	Persian	29(40.85%)	42(59.15%)	
Marital <sup>#</sup> status	Married	13(68.4%)	6(31.6%)	0.24 <sup>b</sup>
	Single	84(46.4%)	97(53.6%)	

\*The data are expressed as mean±standard deviation.

#Data are expressed in terms of number and percentage.

a: Independent t-test.

b: Chi-square test.

**Table 2** Evaluation of the relationship between PMS and anxiety levels and digestive disorders

Variable		PMS		P-Value <sup>a</sup>
		Yes	No	
		Number (Percentage)	Number (Percentage)	
Obvious anxiety	Mild	9(9.4)	25(23.8)	0.024
	Low-moderate	36(37.9)	40(48.1)	
	High-moderate	26(27.4)	26(24.8)	
	Severe	21(22.1)	11(10.5)	
	Very severe	3(3.2)	3(2.9)	
Hidden anxiety	Mild	7(7.4)	19(18.1)	0.001
	Low-moderate	41(43.2)	56(53.3)	
	High-moderate	32(33.7)	20(19)	
	Severe	15(15.8)	6 5.7)	
	Very severe	0(0)	4(3.8)	
Constipation	Yes	68(53.1)	27(37.5)	0.034
	No	60(46.9)	45(62.5)	
Irritable bowel syndrome	Yes	78(53.1)	69(46.9)	0.009
	No	17(32.1)	36(67.9)	

a, chi- square test.

**Table 3** Comparison of the mean of dietary intake per day in the two groups with and without PMS

Food groups(Serving/Day)	PMS		P-Value*
	With	Without	
	Mean±SD	Mean±SD	
Bread and cereals	7.38±2.65	8.5±3.11	0.006*
Milk and dairy products	1.94±1.1	2.04±1.32	0.58
Animal proteins	2.33±0.91	2.02±0.88	0.017*
Herbal proteins	0.25±0.12	0.26±0.21	0.65
Vegetables	0.75±0.67	0.83±0.72	0.43
Fruits	1.65±1.28	1.48±1.07	0.3
Oils	10.13±2.27	9.45±2.53	0.08
Sweets	2.14±1.36	1.8±1.33	0.07
Fast foods <sup>d</sup> (Per week)	1.2±1.16	0.75±0.79	0.002*

\*Independent t- test.

The prevalence of PMS in this study was reported 47.5%, which was more prevalent among Arabic and Turkish girls, and less prevalent among Persian girls. The causes of this can be described as heritable backgrounds, different lifestyles and special customs. In a similar study conducted by Badkur D et al.<sup>38</sup> and colleagues in the female college student in India in 2016, the prevalence of PMS was reported as 39.6%, which was almost near the outcome of this study.<sup>38</sup>

By analyzing BMI in this study, it was found that this index was significantly higher in girls with PMS than in non-symptomatic subjects. Therefore, it can be said that high BMI may play a role in the development and progress of PMS. However, BMI and high anthropometric indices may be the cause of many chronic disorders, which is recommended on the basis of proper weight maintenance. Although the participants in this study had normal anthropometric indices in both with and without PMS symptoms subjects, but even a slight increase in body mass (which could lead to an increase in body fat percentage) can affect the symptoms of this disorder.

The results of this study showed that there is a significant relationship between PMS with IBS and its symptoms as well as constipation. In a case-control study by Zhang et al.<sup>26</sup> assessed stress levels, menstrual periods, intestinal and psychotic symptoms of reproductive women who have experienced both PMS and IBS; they found that in comparison with patients with IBS alone, stress levels and menstrual disorders were increased in patients with IBS and PMS, and intestinal and psychotic symptoms were more severe and the combination of these diseases prolonged the menstrual period and delayed recovery.<sup>26</sup> The researchers also found a significant relationship between PMS and constipation, suggesting that constipation may also occur at the same time as PMS, and can lead to stool excretion in subjects with difficulty. One of the possible reasons for this is the diet of individuals. Fruits, vegetables, and legumes are a major source of fiber, and reducing their intake can cause constipation. The results of this study showed that the intake of these foods, especially vegetables, in patients with constipation and PMS was significantly lower than those without PMS symptoms. It should be noted that in the present study, the dietary intake of both groups was lower than the recommended daily intake. The results of this study showed that consumption of high-carbohydrate foods, milk

and dairy products, legumes and vegetables in patients with PMS was lower than those without PMS, but the intake of animal protein sources, oils, sweets and fast foods in the group with PMS symptoms was significantly more than those without symptoms. Therefore, it may be argued that carbohydrate sources, milk and dairy products, plant proteins, and vegetables may play a preventative role. In a similar study in 2013, Cheng et al.<sup>31</sup> showed that consumption sweet foods, fried, fast foods, caffeine, alcohol and low intake of vegetables and fruits are significantly associated with the prevalence of PMS.<sup>31</sup>

Mahmoodi et al.<sup>39</sup> and colleagues in 2010 showed that the intake of supplements and diets with high-carbohydrate reduced PMS and its symptoms (physical, mental and behavioral) significantly.<sup>39</sup> Another similar study by Farasati et al.<sup>32</sup> in 2015 in Iran was carried out to examine the relationship between different food patterns and PMS. The dietary pattern of 320 nurses with and without PMS was measured using the food frequency questionnaire (FFQ) and three Western, traditional and healthy food patterns were investigated using the factor analysis. The findings showed that subjects with a western food pattern experienced more PMS than the two other groups.<sup>32</sup> The mentioned reason in this study was imbalance between estrogen and progesterone, which can cause PMS, and a low-fat diet with high fiber significantly reduces the level of estrogen phosphate and reduces the symptoms of the disease.<sup>40</sup> This study showed girls who suffered from PMS symptoms had more anxiety levels. It seems serotonin levels are effective for psychiatric symptoms. High glycemic index carbohydrates increase the plasma ratio of tryptophan to neutral amino acids which lead to increases serotonin levels.<sup>32</sup> Other possible food-related mechanisms include the role of some vitamins such as B1. This vitamin may reduce PMS symptoms by acting as a coenzyme and affecting the metabolism of carbohydrates, fats, proteins, and in particular amino acids that contribute to the development of PMS physical and psychosomatic symptoms.<sup>35</sup> Since vegetarian food sources (such as bread and cereals) are one of the good sources of this vitamin, anxiety in patients with PMS may have been due to the lower consumption of carbohydrates in these individuals.

## Conclusion

The results of this study showed that there is a relationship between

premenstrual syndrome and anxiety, IBS, constipation, and diet. Food intake may have an indirect effect on PMS symptoms, therefore, an appropriate diet, such as increasing the intake of fruits, vegetables, low-fat dairy products, cereals, whole-wheat carbohydrate products, and reduced intake of oils and fast foods may help to reduce the physical and mental problems of these individuals.

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## Conflicts of interest

The author declares no conflict of interest.

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