Shiraz E-Med J. 2021 October; 22(10):e111338. doi: 10.5812/semj.111338.

Published online 2021 February 8. **Research Article**

Comparison of Blood Pressure in Women with and without Premenstrual Syndrome

Hadiseh Shabdini [1] and Akram Peyman [2, *]

[1] M. Sc. of Nursing, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran
[2] Department of Midwifery, Faculty of Nursing and Midwifery, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

[*] *Corresponding author*: Ph.D. of Reproductive Health, Department of Midwifery, Faculty of Nursing and Midwifery, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran. Email: apeiman@iautmu.ac.ir

Received 2020 November 17; **Revised** 2020 December 09; **Accepted** 2020 December 15.

Abstract

Background: Premenstrual syndrome is one of the common disorders in women, which occurs periodically in the luteal phase of the menstrual cycle. High blood pressure seems to be one of the problems that can occur with premenstrual syndrome.
Objectives: This study aimed to compare blood pressure changes in two groups with and without premenstrual syndrome.
Methods: This is a descriptive-comparative study. The population of the study was the students of Tehran Islamic Azad University of Medical Sciences. Data were collected using a premenstrual syndrome screening questionnaire and blood pressure measurement that were then analyzed with SPSS at a significance level of $\alpha = 0.05$.
Results: According to 1,408 questionnaires collected, 580 people had the premenstrual syndrome. Comparison of blood pressure before menstruation showed a significant difference between the two groups with and without premenstrual syndrome ($P < 0.001$).
Conclusions: An increase in blood pressure in the group with premenstrual syndrome requires investigating hypertension and planning for educational programs for preventing and controlling blood pressure in people with premenstrual syndrome.

Keywords: Premenstrual Syndrome, Students, Systolic Blood Pressure, Diastolic Blood Pressure

1. Background

According to the World Health Organization Constitution, health is one of the most obvious human rights and needs. All countries must consider different groups in society to achieve health (1). One of the most important problems of girls is the symptoms of the premenstrual syndrome after puberty (2). Premenstrual syndrome (PMS) is a set of physical and emotional symptoms usually occurring one week before menstruation. These symptoms significantly impair occupational, family, and academic responsibilities (3). According to a meta-analysis study, the prevalence of PMS was 48% in the world (4), 48% in Italy, 25% in Thailand, 61.4% in Turkey, and 25.7% in Brazil (5). According to the report from the World Health Organization, more than 100 million women in Asia suffer from monthly menstrual symptoms (6).

The definitive cause of PMS is unknown (7). Numerous studies have shown that fluctuations in estrogen and progesterone hormones, neurological disorders, endocrine disruption, diversity of estrogen receptor and prostaglandin synthesis, pyridoxine deficiency (vitamin B6), changes in glucose metabolism, and electrolyte imbalance in body fluids can affect the biological incidence of PMS (8, 9). These mechanisms can also affect blood pressure changes. In this regard, Dunne et al. (10) showed that blood pressure increased at the onset of menstruation and was lower on days 17 - 26 of the menstrual cycle (10, 11). The results of a prospective study conducted by Bertone-Johnson et al. (12) showed that women with PMS were 40% more likely to develop hypertension than women without PMS

Hypertension is a gender-sensitive disease, and its prevalence has increased three times among women aged 18 to 39, especially in recent years in a way that it has reached more than 7% (13, 14). Besides, the risk of heart attack, stroke, and kidney diseases has increased significantly among women suffering from hypertension, especially after menopause (15). However, there are different health care and effective treatments for controlling hypertension. Thus, identifying the syndromes associated with hypertension can have important implications for improving women's general health in the future.

2. Objectives

Therefore, we decided to compare the changes in hypertension in people with PMS and without PMS after analyzing the epidemiology of this disease.

3. Methods

This descriptive-comparative study was approved by the Ethics Committee of Islamic Azad University of Medical Sciences, Tehran, Iran, with identification code 081.1988. Sample collection began after getting permission from the research assistant of the university in 2019. The study population included all students studying at the Islamic Azad University of Medical Sciences, Tehran, Iran. The subjects were explained that they could withdraw from the study anytime they liked and were assured that the information obtained would remain confidential. The subjects were selected by a convenience sampling method. The inclusion criteria included ages of 18 - 30 years, no history of hypertension, no smoking, no pregnancy, no limitation of right arm blood pressure measurement such as right arm fistula or mastectomy, no history of ovariectomy, no kidney disease, no antihypertensive drugs, no medication to relieve PMS, including corticosteroids and propranolol.

Data were collected using a demographic questionnaire, a premenstrual syndrome screening tool, and a digital blood pressure monitor. The demographic information questionnaire included age, marital status, physical activity, education level, PMS history in the immediate family, age at menarche, regular menstruation, history of illnesses, and medication use. The premenstrual symptom screening tool (PSST) consisted of 19 questions in two sections. A four-point scale was considered for each question: not at all, mild, moderate, and severe, scored from one to four. Three conditions were required to diagnose moderate or severe PMS: (A) At least one of the first four questions should be moderate or severe; (B) In addition to the previous one, among questions 1 to 14, at least four should be moderate or severe; and (C) One question in the section on the symptoms of life (the last five questions) should be moderate or severe. The Likert-type response spectrum was 4-item, and each question was answered completely, no, mildly, moderately, with scores of 1, 2, 3, and 4, respectively. Accordingly, the severity of the symptoms was divided into three categories of mild (scores 1 to 33), moderate (scores 33 to 66), and severe (scores 66 or more) (16).

The validity of PSST was assessed by surveying 10 faculty members at Tehran Islamic Azad University of Medical Sciences and adjusting the tool according to their opinions. Before the study, 35 questionnaires were completed by the students to assess the reliability of the questionnaire. Cronbach's alpha was 0.98, which was calculated after re-testing the questionnaire. Hashemi et al. examined the psychometric properties of the Persian version of PSST. The sensitivity and specificity coefficients were 0.9 and 0.77, respectively. Cronbach's alpha was 0.91, and the test-retest reliability was 0.56 for the total scale (17).

Another tool used in this study was a Japanese OMRON M3 digital blood pressure monitor. Inter-rater reliability was used to check the measurement accuracy of the device. For this purpose, the blood pressure of 10 individuals was measured by a researcher once using the device and again with a Richter mercury sphygmomanometer. Then, the Pearson correlation coefficient was calculated. During the research period, the accuracy of the digital blood pressure monitor was assured by comparing it with the mercury sphygmomanometer, and their equivalence was assessed before the study.

At the beginning of sampling, 1,550 questionnaires were distributed to medical students. A total of 1,408 questionnaires were returned by the students. After examining the questionnaires, 580 students had the syndrome. At this point, no more questionnaires were distributed. After checking the questionnaires, 330 people with PMS who met the criteria for the second phase of the study were selected. The blood pressure in the right arm of them and 330 healthy volunteers was measured half an hour after rest while they were sitting. For this purpose, the cuff was closed one to two centimeters above the elbow. After deflating the cuff, the numbers displayed by the monitor were recorded as systolic and diastolic blood pressures, respectively. Blood pressure was measured two days before menstruation and two days after menstruation in the first and fourth cycles. The obtained data were analyzed by SPSS 23 using chi-square, independent *t*-test, and paired sample t-test at a significance level of $P < 0.05$.

4. Results

According to the results of this study, the prevalence of PMS was 37.4%. Out of 1,408 students, 82 had mild PMS, and 248 had moderate PMS, both having the inclusion criteria. There were no significant differences in age, marital status, physical activity, education level, age at menarche, regular menstruation, and menstrual cramp between the two groups with PMS and without PMS. However, there was a statistically significant difference in the history of PMS in the family ($P = 0.01$) (Table 1).

Table 1. The Frequency Distribution of Students in Two Groups with and without Premenstrual Syndrome According to Demographic Characteristics in 2019

Variable	Without PMS, No. (%)	With PMS, No. (%)	Chi-Square Test	P-Value
Age			2.97	0.23
18 - 20	106 (32.90)	127 (39.40)		
21 - 23	180 (55.90)	162 (50.30)		
> 24	36 (11.20)	33 (10.30)		
Marital status			3.05	0.22
Single	240 (74.50)	222 (68.90)		
Married	80 (25.50)	99 (31)		
Physical activity			0.46	0.50
Yes	179 (55.80)	171 (53.10)		
No	142 (44.20)	151 (46.90)		
Education level			0.04	0.85
BS	308 (95.70)	307 (95.30)		
MS	14 (4.30)	15 (4.70)		
History of PMS in the family			8.99	0.01
Yes	134 (41.60)	172 (53.40)		
No	188 (58.40)	150 (46.60)		
Age at menarche			0.05	0.81
< 12	156 (48.40)	153 (47.50)		
> 12	166 (51.60)	169 (52.50)		
Regular menstruation			2.01	0.16
Yes	230 (71.40)	212 (66.30)		
No	92 (28.60)	108 (33.80)		

According to the statistical analysis, systolic and diastolic blood pressures in all samples were higher before menstruation than after menstruation. Systolic blood pressure was higher in the group with PMS than in the group without PMS before and after menstruation. In the group with PMS, there were statistically significant changes in the premenstrual diastolic blood pressure in the first cycle and after menstruation in the fourth cycle ($P < 0.001$). However, in the group without PMS, the changes in diastolic blood pressure before menstruation in the first cycle and after menstruation in the fourth cycle were not statistically significant ($P = 0.055$). The main purpose of this study was to compare systolic and diastolic blood pressures between the two groups with and without PMS in the first and fourth menstrual cycles. According to the findings in Table 2, before menstruation, there was a significant difference between systolic blood pressure and diastolic blood pressure between the two groups, but after menstruation, in the fourth cycle of the study, there was no significant difference in systolic blood pressure ($P = 0.062$) and diastolic blood pressure ($P = 0.730$).

5. Discussion

Most women experience PMS-related mood and behavioral changes during their menstrual cycles. In 3% - 5% of women with ovulation, the symptoms are so severe that they need to be diagnosed with the premenstrual dysphoric disorder (7). In this study, the prevalence of PMS in 1,408 students was 37.4%. Nooh et al. (18) reported a 56% prevalence of PMS among female students in Egypt. Another study by Tolossa and Bekele (19) in Ethiopia on 258 students with a mean age of 21 years showed a PMS prevalence of 37% (19, 20). Ranjbaran et al. (4) estimated the prevalence of PMS in Iranian students to be 68.9%. Cheng et al. (21) estimated the prevalence of PMS in Taiwanese students to be 39.85%, and based on Raval et al. (22), the prevalence of PMS in Indian students was 18.4% (16, 22). A review of previous studies shows that the prevalence of PMS varies from country to country. This discrepancy may be due to

Table 2. Comparison of Blood Pressure Before and After Menstruation in Students[a]

Group	Time				P-Value
	After Menstruation	Before Menstruation	Mean Difference	Paired *t*-test	
Systolic blood pressure					
Without premenstrual syndrome	114.03 ± 12.46	128.61 ± 11.32	-14.57 ± 11.68	-22.392	< 0.001
With premenstrual syndrome	116.01 ± 12.47	133.23 ± 14.04	-17.22 ± 11.93	-25.902	< 0.001
t-test	1.873	3.602	-2.841	-	-
P-value	0.062	< 0.001	< 0.001	-	-
Diastolic blood pressure					
Without premenstrual syndrome	75.15 ± 9.99	76.11 ± 9.95	-0.96 ± 8.83	1.929	0.055
With premenstrual syndrome	75.85 ± 9.21	79.36 ± 10.29	-3.51 ± 9.73	-6.465	< 0.001
t-test	-0.341	-5.264	-3.483	-	-
P-value	0.730	< 0.001	< 0.001	-	-

[a]Valuues are expressed as mean ± SD.

differences in culture and lifestyles or the use of different tools to measure PMS. Because the study population was medical students, they would be familiar with the physiological characteristics of the menstrual cycle and related hormonal changes. In addition, they may have a less negative attitude toward menstruation. Therefore, they would consider changes in the menstrual cycle to be normal. According to the results of this study, systolic and diastolic blood pressure was higher before menstruation than after menstruation. In a study of the prevalence of PMS and blood pressure changes in students, Danborno et al. (23) showed that premenstrual arterial blood pressure was significantly higher than postmenstrual blood pressure. Deshpande and Mehvish (24) reported that premenstrual systolic and diastolic blood pressure increased compared to the postmenstrual period. The change in blood pressure may be due to changes in sex hormones during menstruation. Bertone-Johnson et al. (25) suggested that changes in estrogen and progesterone during the menstrual cycle can lead to renin-angiotensin-aldosterone (RAAS) disorders and micronutrient deficiencies.

The results also showed that premenstrual systolic blood pressure was significantly higher in the group with PMS than in the group without PMS. Rosenfeld et al. (26) found that luteal phase plasma levels and aldosterone activity were significantly higher in women with PMS than in women without PMS. A study by Stamatlopoulos et al. (27) showed that peripheral and central venous pressure and moderate arterial pressure increased in patients with PMS in the luteal phase, but no change was observed in patients without PMS.

In this study, in the group with PMS, the differences between diastolic blood pressure and systolic blood pressure were statistically significant before and after menstruation ($P < 0.001$). This finding is consistent with the results of an experiment by Okeahialam et al. (28). They reported that systolic and diastolic blood pressure of the luteal phase increased significantly in women with PMS but did not increase in women without PMS.

The main findings of this study showed that there was a statistically significant difference in premenstrual systolic and diastolic blood pressure between groups with PMS and without PMS ($P < 0.001$), but no significant difference was observed in postmenstrual systolic and diastolic blood pressure between the groups. According to Table 2, in the fourth month after menstruation, slight changes in diastolic and systolic blood pressure were observed between the groups with and without PMS, but ultimately diastolic and systolic blood pressures were always higher in the PMS group than in the group without PMS. Probably this slight increase may gradually lead to hypertension in the future. A case-control study (29) was conducted at a high blood pressure clinic in California, and women were asked about their history of PMS. Women in the control group had normal blood pressure compared to the case group. The results showed that PMS was higher in women with hypertension than in women of the control group ($P < 0.05$) (29). In a cohort study, women with this syndrome had

higher blood pressure than women without the syndrome (25). The difference between this study and the above-mentioned studies may be because the present study was conducted in one semester in students with an average age of 21.3 years, with a descriptive research method. In addition, systolic and diastolic blood pressures were studied separately in the present study. Therefore, it is suggested that a descriptive-comparative study be performed for several months in different age groups. It is also proposed to consider educational programs for girls and women of childbearing age, as well as appropriate treatments to reduce the effects of the syndrome.

5.1. Conclusions

Systolic and diastolic blood pressures were higher in all people in the premenstrual period than in the postmenstrual period, and people with PMS were more likely to have high blood pressure.

Acknowledgments

We would like to express our gratitude to the research assistant of the Islamic Azad University of Medical Sciences of Tehran and the students who patiently assisted us in carrying out this research.

Footnotes

Authors' Contribution: Study concept and design: AP and HS. Analysis and interpretation of data: HS and AP. Drafting of the manuscript: AP. Critical revision of the manuscript for important intellectual content: AP and HS. Statistical analysis: HS.

Conflict of Interests: This study did not pursue a conflict of interest for the authors.

Ethical Approval: This is a descriptive-comparative study approved by the Ethics Committee of Islamic Azad University of Medical Sciences, Tehran, Iran, with identification code 081.1988.

Funding/Support: This study was not provided with any financial support.

References

1. Kalantari R, Mazloumi A, Garussi E, Ahmadi Zirabi M. Risk assessment of the Manual Handling of Patients in remedial wards of Qazvin hospitals and its relationship with incidence of musculoskeletal disorders. *J Occup Hyg Engin*. 2014;**1**(3):29–36.
2. Amiri Farahani L, Heidari T, Narenji F, Asghari Jafarabadi M, Shirazi V. Relationship between pre menstrual syndrome with body mass index among university students. *J Hayat*. 2012;**17**(4):85–95.
3. Darabi F, Rasaie N, Jafarirad S. The Relationship Between Premenstrual Syndrome and Food Patterns in University Student Girls. *Jentashapir J Health Res*. 2014;**5**(6). doi: 10.5812/jjhr.26656.
4. Ranjbaran M, Omani Samani R, Almasi-Hashiani A, Matourypour P, Moini A. Prevalence of premenstrual syndrome in Iran: A systematic review and meta-analysis. *Int J Reprod Biomed*. 2017;**15**(11):679–86. [PubMed: 29404529]. [PubMed Central: PMC5780553].
5. Jafarnejad F, Shakeri Z, Najaf Najafi M, Salehi Fadardi J. Evaluation the relationship between stress and the risk of premenstrual syndrome. *Iran J Obstet Gynecol Infertil*. 2013;**16**(76):11–8.
6. Abdnejad R, Simbar M. A review on herbal medicines effective of premenstrual syndrome in Iran. *Iran J Obstet Gynecol Infertil*. 2016;**19**(11):18–30.
7. Berek SJ, Berek MM. *Novak's Gynecology*. North American Edition: LWW; Sixteenth, North American; 2020.
8. Matsuo K, Machida H, Shoupe D, Melamed A, Muderspach LI, Roman LD, et al. Ovarian Conservation and Overall Survival in Young Women With Early-Stage Cervical Cancer. *Obstet Gynecol*. 2017;**129**(1):139–51. doi: 10.1097/AOG.0000000000001754. [PubMed: 27926642]. [PubMed Central: PMC7528442].
9. Zendehdel M, Elyasi F. Biopsychosocial etiology of premenstrual syndrome: A narrative review. *J Family Med Prim Care*. 2018;**7**(2):346–56. doi: 10.4103/jfmpc.jfmpc_336_17. [PubMed: 30090776]. [PubMed Central: PMC6060935].
10. Dunne FP, Barry DG, Ferriss JB, Grealy G, Murphy D. Changes in blood pressure during the normal menstrual cycle. *Clin Sci (Lond)*. 1991;**81**(4):515–8. doi: 10.1042/cs0810515. [PubMed: 1657498].
11. Das P, Das PK. Comparative study of selected hysiologicaland biochemical variables during different phases of menstruation. *Indian J Phys Educ Sports Med Exercise Sci*. 2017;**17**(1and2):53–7.
12. Bertone-Johnson ER, Houghton SC, Whitcomb BW, Sievert LL, Zagarins SE, Ronnenberg AG. Association of Premenstrual Syndrome with Blood Pressure in Young Adult Women. *J Womens Health (Larchmt)*. 2016;**25**(11):1122–8. doi: 10.1089/jwh.2015.5636. [PubMed: 27420549]. [PubMed Central: PMC5116659].
13. Fottrell E, Ahmed N, Shaha SK, Jennings H, Kuddus A, Morrison J, et al. Distribution of diabetes, hypertension and non-communicable disease risk factors among adults in rural Bangladesh: a cross-sectional survey. *BMJ Glob Health*. 2018;**3**(6). e000787. doi: 10.1136/bmjgh-2018-000787. [PubMed: 30498584]. [PubMed Central: PMC6242007].
14. Zhang Y, Moran AE. Trends in the Prevalence, Awareness, Treatment, and Control of Hypertension Among Young Adults in the United States, 1999 to 2014. *Hypertension*. 2017;**70**(4):736–42. doi: 10.1161/HYPERTENSIONAHA.117.09801. [PubMed: 28847890]. [PubMed Central: PMC5657525].
15. Di Giosia P, Giorgini P, Stamerra CA, Petrarca M, Ferri C, Sahebkar A. Gender Differences in Epidemiology, Pathophysiology, and Treatment of Hypertension. *Curr Atheroscler Rep*. 2018;**20**(3):13. doi: 10.1007/s11883-018-0716-z. [PubMed: 29445908].
16. Henz A, Ferreira CF, Oderich CL, Gallon CW, Castro JRS, Conzatti M, et al. Premenstrual Syndrome Diagnosis: A Comparative Study between the Daily Record of Severity of Problems (DRSP) and the Premenstrual Symptoms Screening Tool (PSST). *Rev Bras Ginecol Obstet*. 2018;**40**(1):20–5. doi: 10.1055/s-0037-1608672. [PubMed: 29132173].
17. Hashemi Y, Talepasand S, Alavi K. [Psychometric properties of premenstrual symptoms screening tool among female students of Semnan University]. *J Hayat*. 2014;**20**(2):82–96. Persian.
18. Nooh AM, Abdul-Hady A, El-Attar N. Nature and Prevalence of Menstrual Disorders among Teenage Female Students at Zagazig University, Zagazig, Egypt. *J Pediatr Adolesc Gynecol*. 2016;**29**(2):137–42. doi: 10.1016/j.jpag.2015.08.008. [PubMed: 26343844].

19. Tolossa FW, Bekele ML. Prevalence, impacts and medical managements of premenstrual syndrome among female students: cross-sectional study in College of Health Sciences, Mekelle University, Mekelle, northern Ethiopia. *BMC Womens Health*. 2014;**14**:52. doi: 10.1186/1472-6874-14-52. [PubMed: 24678964]. [PubMed Central: PMC3994244].
20. Haq NU, Gill S, Nasim A, Tahir M, Yasmin R, Batool F. Prevalence and Impact of Premenstrual Syndrome among the Female Nursing Students of Quetta. *Age*. 2019;**16**(20):208.
21. Cheng SH, Shih CC, Yang YK, Chen KT, Chang YH, Yang YC. Factors associated with premenstrual syndrome - a survey of new female university students. *Kaohsiung J Med Sci*. 2013;**29**(2):100–5. doi: 10.1016/j.kjms.2012.08.017. [PubMed: 23347812].
22. Raval CM, Panchal BN, Tiwari DS, Vala AU, Bhatt RB. Prevalence of premenstrual syndrome and premenstrual dysphoric disorder among college students of Bhavnagar, Gujarat. *Indian J Psychiatry*. 2016;**58**(2):164–70. doi: 10.4103/0019-5545.183796. [PubMed: 27385849]. [PubMed Central: PMC4919960].
23. Danborno AM, Nwankwo M, Kure J, Eluwa C. Prevalence of Premenstrual Syndrome and Changes in Blood Pressure with Menstrual Cycle Among University Students. *Niger J Physiol Sci*. 2018;**33**(2):117–24. [PubMed: 30837763].
24. Deshpande A, Mehvish M. *Blood pressure, heart rate, premenstrual syndrome, weight. Effect of premenstrual syndrome on cardiovascular parameters and body weight in first year medical students*. 2016.
25. Bertone-Johnson ER, Whitcomb BW, Rich-Edwards JW, Hankinson SE, Manson JE. Premenstrual Syndrome and Subsequent Risk of Hypertension in a Prospective Study. *Am J Epidemiol*. 2015;**182**(12):1000–9. doi: 10.1093/aje/kwv159. [PubMed: 26601989]. [PubMed Central: PMC5014141].
26. Rosenfeld R, Livne D, Nevo O, Dayan L, Milloul V, Lavi S, et al. Hormonal and volume dysregulation in women with premenstrual syndrome. *Hypertension*. 2008;**51**(4):1225–30. doi: 10.1161/HYPERTENSIONAHA.107.107136. [PubMed: 18259015].
27. Stamatelopoulos KS, Georgiopoulos G, Papaioannou T, Lambrinoudaki I, Kouzoupis A, Vlachopoulos C, et al. Can premenstrual syndrome affect arterial stiffness or blood pressure? *Atherosclerosis*. 2012;**224**(1):170–6. doi: 10.1016/j.atherosclerosis.2012.05.037. [PubMed: 22840428].
28. Okeahialam BN, Obindo JT, Ogbonna C. Prevalence of premenstrual syndrome and its relationship with blood pressure in young adult females. *Afr J Med Med Sci*. 2008;**37**(4):361–7. [PubMed: 19301714].
29. Okeahialam BN. The Role of Premenstrual Syndrome in the Causation of Arterial Hypertension in Women. *Open J Obstet Gynecol*. 2014;**4**(14):817–21. doi: 10.4236/ojog.2014.414113.