

# Correlation between premenstrual syndrome and body mass index among reproductive females

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**ABSTRACT**

**Background:** Premenstrual disorders are characterized by emotional and physical symptoms. Millions of women around the globe who are of reproductive age experience premenstrual symptoms. Premenstrual syndrome (PMS) and premenstrual dysphoric disorder are two examples of these illnesses (PMDD) which have insightful effects on quality of life and major health consequences. **Objective:** This research set out to evaluate the occurrence and intensity of premenstrual syndrome (PMS) and to find the correlation between PMS and the body mass index (BMI) among reproductive females in Al-Madinah Al-Munawwara, Saudi Arabia. **Methods:** A cross-sectional study was carried out on 392 females in the reproductive period. The diagnostic and statistical standards for measuring PMS served as the foundation for the Premenstrual Syndrome Scale (PSS). PMS was diagnosed when five or more symptoms were present. PMS subsided after menstruation (adapted from the American Psychiatric Association). The data were analyzed descriptively using (SPSS). **Results:** 77% and 55% of the 392 participants reported emotional or physical PMS, respectively. Also, there was a statistically significant link ( $p=0.048$ ) between increasing BMI and increasing the severity of the emotional and psycho-behavioral symptoms. **Conclusion:** According to the findings of the current study, there was a direct relationship between PMS and BMI among reproductive females in Al-Madinah Al-Munawwara, Saudi Arabia. Obesity should be incorporated into the PMS management plan as a modifiable risk factor, especially for those with severe symptoms that impair their quality of life.

**Keywords:** Saudi Arabia, PMS, Emotional, Physical, Quality of life

**1. INTRODUCTION**

The term "reproductive health" refers to a holistic state of physical, mental and social well-being regarding the reproductive system and its operations, rather than simply the absence of diseases and infirmity. The development of

reproductive health and its various components at the national and international levels is a significant step toward providing public and family health (Talabi and Clowse, 2021). In contrast to men, the reproductive system of females' experiences regular cyclic changes that might be viewed as periodic preparation for pregnancy and fertilization. The menstrual cycle is distinguished by recurrent vaginal bleeding due to the loss of the uterine mucosa. Although the cycle's length varies widely, it usually lasts 28 days from the onset of one menstrual period to the onset of the next (Thiyagarajan et al., 2022). The cycle begins during puberty, which takes place between the ages of 10 and 16 and stops at menopause at the average age of 51 (Pan and Li, 2019).

Premenstrual syndrome (PMS) is a clinical illness characterized by the recurrence of debilitating behavioral and physical symptoms during the luteal phase of the menstrual cycle. The timing of the symptoms is more important than the symptoms themselves in defining the disease because the symptoms frequently coincide with those of other physical and psychological disorders (Reid and Yen, 1981). The World Health Organization classifies PMS as a genitourinary system condition, emphasizing the importance of the ovary and its hormones in the disorder's pathophysiology (WHO, 2022). PMS is claimed to affect 30%-40% of the female reproductive population (Baker and O'Brien, 2012).

Premenstrual syndrome affects up to 80% of reproductive-age women. Such symptoms are so common that they are regarded as a marker of normal ovarian function in the gynecologic literature (Hantsoo and Epperson, 2015). This symptom constellation is appropriately referred to as "premenstrual molimina" and it should be regarded as a normal, albeit often uncomfortable, physiologic event (Reid and Yen, 2017). Obesity's gynecologic consequences can be apparent throughout a woman's reproductive lifespan. Beginning with the earlier beginning of puberty and menarche can harm women's mental health and psychological well-being. Obesity was linked to a higher premenstrual symptoms burden than normal BMI for age. The link between obesity and symptoms remained strong (Lu et al., 2022).

Women who were obese at baseline had a significantly higher risk of developing PMS over 10 years of follow-up than lean women. BMI was also linked to an increased risk of certain physical and emotional symptoms such as extremity edema, backache, abdominal cramping, diarrhea/constipation, mood changes and food cravings. Accordingly, maintaining a healthy lifestyle and preserving average body weight may be important for ameliorating the development of PMS (Lu et al., 2022). So, the goal of this study was to study the relationship between BMI and PMS, whether emotional or physical, as well as the impact of PMS on participants' quality of life among reproductive females in Al-Madinah Al-Munawara.

## 2. METHODS

### Study design

A cross-sectional, non-interventional survey was conducted among reproductive female participants from the general population in Al-Madinah Al-Munawara. It was carried out from October 2022 to December 2022.

### Study population

The inclusion criteria were reproductive females aged (18-45) years with regular menses. Meanwhile, the exclusion criteria included: females with absent menses for two consecutive months, irregular menstrual cycles and females with chronic diseases. Of the 620 responses, 392 met the above criteria and were used in the study. Those with absent menses (menopause, pregnancy and lactating women), irregular menstrual cycles and females with chronic diseases were excluded.

### Data source

We applied a random sampling technique; the minimum effective sample was 384 participants; the diagnostic and statistical standards for measuring PMS served as the foundation for the premenstrual syndrome scale (PSS). After five or more episodes of severe PMS had passed after menstruation, PMS was diagnosed (adapted from American Psychiatric Association). A self-administrated questionnaire was answered by each participant.

### Questionnaire

A structured questionnaire was designed after thorough literature searches, questions were adapted and modified from previously published studies as per the requirement and questions were added which were considered relevant (according to DSM-5). Data were collected using the self-administered anonymous questionnaire after obtaining informed consent. The questionnaire was comprised of six parts.

The first part included questions on sociodemographic data such as age, marital status and income.

The second part included questions on any changes in the menstrual cycle or any chronic diseases.

The third part included questions about height and weight.

The fourth part included menarche and menstrual cycle duration.

In the fifth part, participants were asked about the emotional and physical symptoms of PMS.

In the next section, participants were asked about symptoms interfering with their social life.

The last section included questions about seeking medical advice, medications taken during menses and smoking.

BMI was calculated by our research team. The criteria for PMS according to criteria of the American College of Obstetricians and Gynecologists, at least one of the emotional and somatic symptoms had to be present five days before menstruation for at least three menstrual periods in a row, stop within four days of the onset without recurring until at least day 13 of the cycle and persist in the absence of any pharmaceutical therapy, hormone consumption or medication. During the two prospective recording cycles, the symptoms must recur consistently. A recognizable malfunction in the patient's social, academic or professional performance is required.

### Statistical analysis

The sample size was calculated using Raosoft® software, in data analysis, we used IBM SPSS 25 and we applied T-test, ANOVA and Chi-square test in setting the associations and correlations between the different variables. Data outcomes shall be significant based on a p-value less than or equal to (0.05).

## 3. RESULTS

### Baseline characteristics (socio-demographic data)

In the current study, 392 participants enrolled in answering provided cross-sectional survey; the mean age was 24.3, the weight of 55.4 Kg and the mean average BMI of 22.27 Kg/m<sup>2</sup>, majority of the sample (58.67%) were students, (74.7%) were single and (88.3%) non-smokers (Table 1). Body mass index BMI classifications for the sampled participants revealed that 56.4% of the participants had a normal BMI between 18.5–25 Kg/m<sup>2</sup>, 25.2% were overweight/obese having a BMI more than 25 Kg/m<sup>2</sup> and 18.36% were underweight.

**Table 1** Socio-demographic data

Sociodemographic data(n=392)	
Age, Year	24.3 years SD: 7.37
Weight, Kg	55.54 Kg SD: 12.4
Height, m	1.57 m
BMI, Kg/m <sup>2</sup>	22.27 Kg/m <sup>2</sup>
≤18.5 Kg/m <sup>2</sup>	72 (18.36%)
18.5 - 24.9 Kg/m <sup>2</sup>	221 (56.4%)
≥25 Kg/m <sup>2</sup>	99 (25.2%)
Level of occupation	
Student	230 (58.67%)
Governmental worker	43 (10.9%)
Private worker	28 (7.1%)
Un-employed	91 (23.2%)
Marital status	
Single	293 (74.7%)
Married	92 (23.4%)
Divorced	6 (1.53%)
Widow	1 (0.25%)
Smoking	
Yes	46 (11.7%)
No	346 (88.3%)

### Periodic cycle nature and intervals

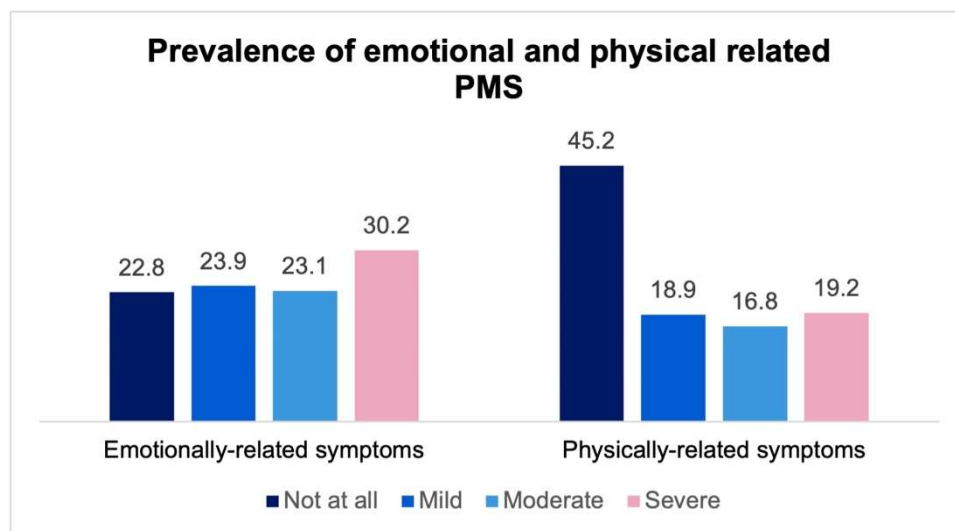
Among the 392 participants, inputs about the interval and nature of the periodic cycle were captured; out of the 392 participants, zero percent reported any changes during their current menstrual cycle (Table 2).

**Table 2** Nature of the periodic cycle

Nature of the periodic cycle (n=392)	
Menstrual cycle interval	
3-5 days	99 (25.2%)
5-7 days	252 (64.2%)
7-10 days	41 (10.4%)
Age at the first menstrual cycle	
≤11 years	70 (18%)
12 years	87 (22.2%)
13 years	94 (24%)
14 years	67 (17.1%)
≥15 years	73 (18.6%)
I don't remember	1 (0.25%)

### Prevalence and severity of PMS among participants

Across the 392 participants, 66% of participants complained of PMS either physically related (55%)  $p=0.032$  or emotionally related (77%)  $p=0.044$ , the severity of each symptom varied ranging from mild to moderate to severe and the breakout of each was for physically related PMS, 18.9% reported mild symptoms, 16.8% moderate and 19.2% for severe symptoms. While for the emotionally related symptoms, 23.9%, 23.1% and 30.2% reported mild, moderate and severe emotional PMS symptoms, respectively (Figure 1).

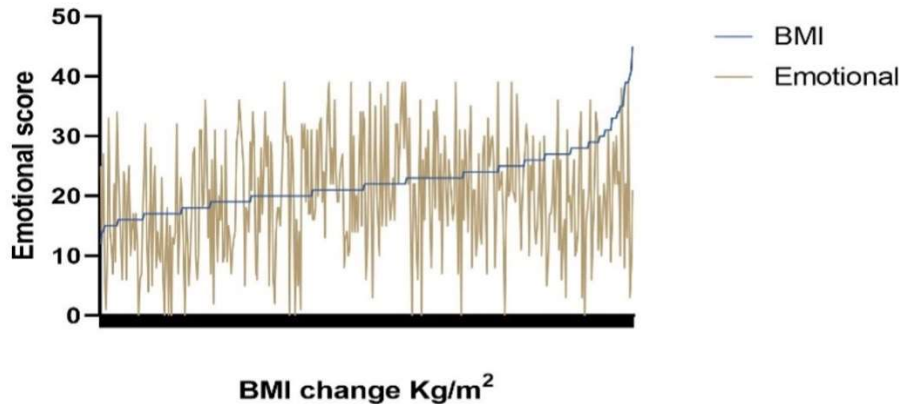


**Figure 1** Prevalence of emotional and physical related PMS

### Relation between BMI and PMS (Emotional-psych behavioral symptoms)

The relation between BMI and PMS with regards to emotional and psycho-behavioral symptoms was studied in the current study; participants were offered to rate themselves about 14 different emotional and psycho-behavioral symptoms and to address this symptom with PMS, the rating was either not at all, mild, moderate or severe symptoms, across the 392 participants, a statistically significant correlation existed ( $p=0.048$ ) between increasing weight and increasing the severity of the emotional and psycho-behavioral symptoms (Figure 2).

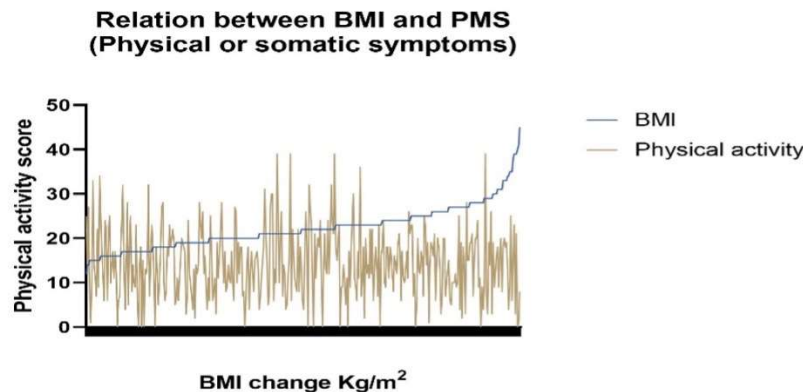
### Relation between BMI and PMS (Emotional, psycho-behavioral symptoms )



**Figure 2** Relation between BMI and PMS (emotional-psycho-behavioral symptoms)

### Relation between BMI and PMS (physical or somatic symptoms)

The poll further elaborated on the relationship between BMI and PMS in terms of physical or somatic symptoms; there was a direct association between increasing BMI and increasing the severity of the PMS in terms of physical or somatic symptoms ( $p=0.032$ ) in each disease stage symptoms, participants with overweight/obesity predominate the other groups with regards the incidence of PMS (Figure 3).

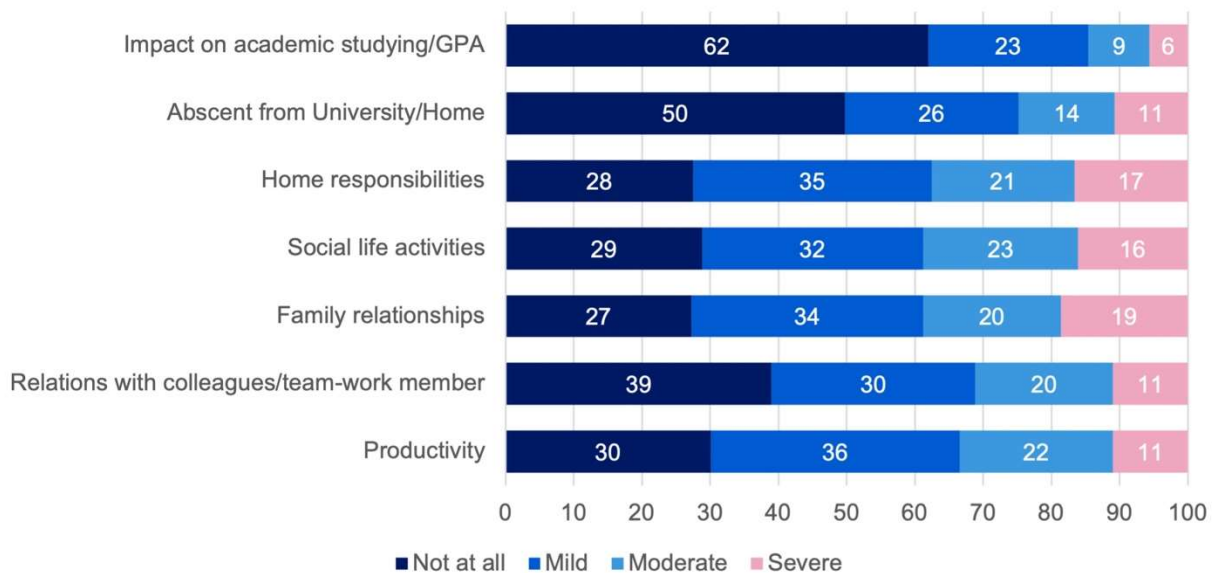


**Figure 3** Relation between BMI and PMS (physical or somatic symptoms)

### Association between BMS and quality of life

Quality of life was among the survey questionnaires shared among the participants, eight questions were asked to assess the influence of PMS on the participants' quality of life, representing interactions with family members, friends, college grades and other social components, the outcomes from the study had shown a negative association between obesity, PMS and quality of life of participants (Figure 4).

### Association between PMS and QoL



**Figure 4** Relation between PMS and QoL

#### Association between PMS and smoking

Among the 392 participants in the study, there were 46 (11.7%) participants reported being smokers, while 88.3% reported not. One of the study's objectives was to look at the relationship between smoking and PMS. However, there was no statistically significant correlation between smokers and non-smokers toward PMS.

## 4. DISCUSSION

Premenstrual syndrome (PMS) and its more severe variant, premenstrual dysphoric disorder (PMDD) is physical and/or behavioral changes that occur during the second half of the menstrual cycle (Bertone-Johnson et al., 2010). PMS and PMDD have an unknown etiology; however, it is likely complex and involves both physiological and psychological factors (Sattar et al., 2014). According to the findings, up to 90% of reproductive-age women encounter a variety of premenstrual symptoms ranging from mild to severe; 20-40% experience PMS and 2-8% experience premenstrual dysphoric disorder (PMDD) (Chumpalova et al., 2020).

Cross-cultural research on the incidence of premenstrual symptoms was conducted early according to Heidari et al., (2019) using retrospective surveys of Caucasian-American, Apache, Greek, Japanese, Nigerian and Turkish women discovered that Turkish and Nigerian women had the highest prevalence and severity of symptoms. On the other hand, Japanese women had the lowest rate of symptoms (Balaha et al., 2010). In all, 47.8% of people reported having PMS (95% CI: 32.6-62.9). Iran had the highest prevalence, at 98% (95% CI: 97-100) and France had the lowest, at 12% (95% CI: 11-13) (Majeed-Saidan et al., 2020).

In our study, we sought to evaluate the prevalence of PMS among participants in Al-Madinah, as well as to explore the risk-associated factors towards increasing the severity of PMS; 77% of participants complained of emotional symptoms ranging from mild, moderate and severe. Another hand 55% complained of physical symptoms. 25% of the participants suffered severe symptoms, 20% moderate and 21% mild.

These outcomes were in line with other published studies. A study at King Faisal University in Al-Ahsa, Saudi Arabia found the severity of PMS as follows: 45% mild, 32.6% moderate and 22.4% severe (Salem et al., 2020). Another study sought to ascertain female PMS prevalence among students at Riyadh's medical and non-medical colleges, the outcomes of this research revealed that most participants (59.4%) reported having moderate PMS while only 8% had severe PMS (Altamimi et al., 2022). A recent cross-sectional study among 400 female students in Jeddah city has shown that one-third of secondary school students suffer from PMS in Jeddah and has significant health problems with several implications in daily life (Al-Shahrani et al., 2021).

Another finding in our study revealed a strong association between increasing the BMI and increasing the PMS of psychological or physical nature with a high p-value of less than 0.01; this outcome was consistent with other local studies across KSA. In a study aimed at studying the prevalence of PMS and associated factors amongst women belonging to King Saud University in a cross-sectional study in Riyadh, Saudi Arabia, the adjusted odds ratio for PMS has increased to 1.22 in overweight participants vs normal

weight, the study found that lifestyle interventions focusing on body weight and income-generating initiatives could help reduce premenstrual symptoms.

This outcome was in line with several global studies, according to a study that looked at the incidence of premenstrual syndrome and teenage girls' weight status, the prevalence of PMS is higher in overweight adolescents (94.1%) and lower in healthy-weight adolescents (64%) compared to underweight (81.4%) and obese (91.7%). In a study conducted, the relationship between obesity and Premenstrual Syndrome (PMS) was investigated; obese women (BMI 30) had a nearly three-fold higher risk for PMS than non-obese women (OR = 2.8; 95% CI = 1.1, 7.2) (Masho et al., 2005).

In a prospective epidemiological study of 116,678 registered nurses aged 25-42 from 11 U.S. states if they had ever been diagnosed with PMS by a clinician, BMI at baseline was found to have a strong proportion with the incidence of incident PMS, risk of PMS was significantly higher in women with BMI  $\geq 27.5$  compared with women with BMI  $< 20.0$  kg/m<sup>2</sup>. For example, the RR in women with BMI  $\geq 35.0$  kg/m<sup>2</sup> was 1.66 (95% CI 1.06-2.59). In analyses of continuous BMI levels, a substantial 3% rise in PMS risk per 1 kg/m<sup>2</sup> increase was found (Lu et al., 2022).

Additionally, in our study, there was a strong association between BMI, PMS and deterioration in the quality of life for the participants; the family relationship was the most reported negatively associated with PMS, followed by productivity, social life and home responsibilities, while a minority observed a link between PMS and academic performance or GPA, as well as absenteeism from university or job.

The association outcomes in our study between PMS and QoL were in line with other local studies, which established the presence of a robust relationship between PMS and its major influence on the relevant quality of life subscales (Heidari et al., 2019). A study conducted among students showed that 82% of those reporting PMS were significantly associated with lifestyle factors, including physical activity and obesity (Hantsoo and Epperson, 2015).

The current investigation revealed a proportional association between increased body weight and PMS. This could be explained via several mechanisms, one of which is the dysregulation of the renin-angiotensin-aldosterone system (RAAS), which results in increased sodium and fluid retention and increased adiposity, which may be a factor in PMS symptoms of water retention (Reid and Yen, 1981).

Another supportive mechanism was explained by Olson who stated that the release of progesterone during the later luteal phase appears to offset the estrogenic effects, which stimulates the RAAS and causes more fluid retention. Because how estrogen and progesterone are affected by obesity, neurotransmitter activity may be changed. In several studies, compared to symptom-free controls, Serotonin, gamma-aminobutyric acid (GABA) and other systems were found to be aberrant in PMS and PMDD instances (Reid and Yen, 1981). There were some limitations in our study, self-reported survey outcomes, one city study which might not be like the national level population, a small sample and uneven sample distribution.

## 5. CONCLUSION

From the current study, we concluded that there was a robust relationship between increased BMI and increasing PMS among females in the reproductive era. This was related to mental and physical illnesses and their severe detrimental effects on quality of life.

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### Author contribution

The authors value the participants' input. Contributions of the authors: HE and AK developed the approach and wrote the text. The HE, AK, NK, MJ, FO and LJ were involved to collect samples. HE oversaw and participated in the project's planning, statistical evaluation and article preparation phases. The final draft was read by all writers before being approved.

### Informed consent

Informed consent was obtained from all individual participants included in the study.

**Ethical approval**

The official permission was approved by the Al-Rayan Research Ethics Committee (HA-03-M-122). Participation was voluntary and online written informed consent from all the participants after describing the aim of the study. Privacy and confidentiality were assured.

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**Conflict of interest**

The authors declare that there is no conflict of interests.

**Data and materials availability**

All data sets collected during this study are available upon reasonable request from the corresponding author.

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