ORIGINAL ARTICLE

Exploring the physical activity levels of Egyptian women with premenstrual syndrome: a preliminary study

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Abstract

Background and Study Aim: Premenstrual syndrome (PMS) affects a significant proportion of women, impacting their daily lives and well-being. The association between physical activity levels, the prevalence of premenstrual syndrome (PMS), and the severity of PMS remains debatable. Therefore, this study aimed to identify physical activity levels among a cohort of Egyptian females with PMS.

Material and Methods: This study included one hundred females with PMS. Physical activity levels, anaerobic power, aerobic capacity, BMI, and dysmenorrhea were investigated. PMS severity was assessed using the Premenstrual Syndrome Scale (PMSS), and the females' physical activity was evaluated using the International Physical Activity Questionnaire (IPAQ). The 1-mile submaximal test and the Running-Based Anaerobic Sprint Test (RAST) were used to assess aerobic capacity and anaerobic power, respectively.

Results: The findings revealed a significant association between PMS severity and physical activity ($p < 0.05$). There was no significant difference in aerobic capacity among those with mild, moderate, and severe PMS ($p > 0.05$). There was no significant association between PMS severity and marital status ($p > 0.05$), whereas there was a significant association with dysmenorrhea ($p < 0.05$), especially among moderate and severe PMS sufferers. Females with severe PMS had a significantly higher BMI than those with mild PMS ($p < 0.05$) and those with moderate PMS ($p < 0.05$). Mild and moderate PMS females showed no significant difference in BMI ($p > 0.05$).

Conclusions: It can be concluded that physical activity levels and BMI may affect PMS. Therefore, being physically active and maintaining a normal-range BMI might reduce PMS severity.

Keywords: aerobic capacity, anaerobic power, physical activity, premenstrual syndrome.

ABBREVIATIONS
PMS: Premenstrual syndrome
PMSS: Premenstrual Syndrome Scale
BMI: Body Mass Index
IPAQ: International Physical Activity Questionnaire
RAST: Running-Based Anaerobic Sprint Test

Introduction

Premenstrual syndrome (PMS) is a widespread condition that significantly affects the quality of life of many women worldwide. To better understand PMS in the context of Egyptian women, additional research is essential. This effort can contribute to more effective management strategies and support systems for those affected [1].

PMS is a recurrent pattern of symptoms occurring during the luteal phase of the menstrual cycle, with a global prevalence of 48% [1]. It is characterized by significant psychological and somatic manifestations that greatly impact women's daily lives, including work and everyday activities, resulting in considerable distress and impairment in functional ability [2]. Furthermore, PMS is more likely to affect sexual life, leading to higher levels of sexual distress and relationship problems. It also contributes to psychological issues, such as an increased risk of suicide in hormone-sensitive females [3, 4]. The cause of PMS remains uncertain; however, hormone imbalance, thyroid disorders, fluid retention, hypoglycemia, genetics, stress, and psychological factors are recognized as risk factors for PMS [5].

Physical activity is observed to reduce the severity of PMS by increasing endorphin levels, improving mood and psychological well-being, reducing steroid hormones, and enhancing oxygen transport to muscles [6]. However, there is a debate in the literature regarding this observation, as some researchers reported a relieving effect of exercise on

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PMS [6, 7], while others found no association [8,9], and some indicated that females who exercised more had increased severity of PMS compared to those who exercised less. This conflict can be interpreted by the belief and awareness of women with severe PMS that exercise may attenuate their symptoms, prompting them to initiate exercise for that reason. Additionally, high-intensity activities have been proven to be related to increased stress, fatigue, and menstrual abnormalities, which may aggravate PMS symptoms [10, 11]. Thus, it remains difficult to determine whether exercise is a cause of or response to their symptoms. Because of these contradictory results, further studies are needed, considering the confounding factors regarding the BMI of affected women, dysmenorrhea, and the type and extent of physical activity, which were not previously tracked among the Egyptian population. We hypothesized a relationship between physical activity and PMS severity.

A prior study has shown that menstrual irregularities, such as intermenstrual bleeding, frequent menstruation, menorrhagia, prolonged menstruation, hypomenorrhea, and irregular menstruation, negatively affect anaerobic performance by impacting the extensibility of ligaments and tendons [10]. However, studies on the correlation between PMS and anaerobic power are scarce. Therefore, a conclusive assumption concerning the relationship between anaerobic power, aerobic fitness, and PMS symptoms requires more thorough investigation [12]. To our knowledge, no study has tracked this association among the Egyptian population. Thus, this study aimed to investigate the association between physical activity levels and the severity of PMS among a cohort of Egyptian females.

Materials and Methods

Participants

This study was designed as a cross-sectional study. One hundred females suffering from PMS participated. They were aged between 20 and 35, with a mean age of 27.1 ± 4.98 years. Their menstrual cycle had a mean duration of 27.5 ± 2.52 days. Participants were excluded if they were taking oral contraceptives or hormonal therapy, smoking, or suffering from chronic disorders such as diabetes, renal or thyroid dysfunction, or psychiatric or gynecological diseases (including a history of polycystic ovarian syndrome).

Before commencing the research, the Ethical Committee of the Faculty of Physical Therapy at Cairo University granted ethical approval (No.: 012/003220).

Before taking part in the study, all participants were given an informed consent form to sign after receiving a thorough explanation of the study protocol.

Sample size determination

The sample size was calculated using G*POWER statistical software (version 3.1.9.2; Universitat Kiel, Franz Faul, Germany), assuming a modest association between physical activity level and PMS, resulting in a minimum sample size of N=84. The number was increased to 100 to account for potential dropouts. The calculation used α=0.05, β=0.2, and a moderate effect size of 0.3.

Procedure

Females were recruited from social media platforms. Once a female contacted the study coordinator (the third author), an interview was scheduled with a gynecologist to assess her eligibility specific to PMS. The average menstrual cycle length was computed to estimate the late luteal phase, after asking all participants to keep a calendar record of their menstrual cycle for the previous three months [13]. Aerobic power, anaerobic power, and fatigue index were assessed during the late luteal phase. Before starting the study, participants were given a detailed description of the study. They were required to sign a letter of consent before the interview.

According to Figure 1, one hundred and eighteen females were recruited. Eighteen were excluded: nine were diagnosed with polycystic ovarian syndrome, six were taking oral contraceptive drugs, two did not complete the evaluative procedures, and one refused to participate. Thus, one hundred females participated (Fig. 1). To be diagnosed with PMS, participants were instructed to complete the questionnaire at the first appointment with the gynecologist. They were asked to fill out a data collection sheet with their age, menarche age, menstrual cycle frequency, duration, dysmenorrhea, marital status, and employment status. Weight and height were measured to calculate BMI. After confirming their eligibility to join the study, a second appointment was scheduled 2-3 days before the expected date of menstruation in the morning to assess aerobic power, anaerobic power, and fatigue index, and to complete the IPAQ.

Outcome measures

Assessment of premenstrual syndrome

We used the PMSS, which consists of forty questions, including three subscales (physiological, psychological, and behavioral symptoms). It is a 5-point Likert-type scale: never scored as 1, rarely as 2, sometimes as 3, very often as 4, and always as 5 points. The total score obtained from the subscales establishes the PMSS total score, which ranges from 40 as the minimum to 200 as the highest score. PMS symptoms are graded into four classifications as follows: no symptoms (1–40), mild (41–80), moderate (81–120), severe (121–160), and very severe (161–200). A total score of 80 or higher indicates the presence of PMS. The scale's inter-rater reliability (Cronbach's Alpha) is 0.97 [14].

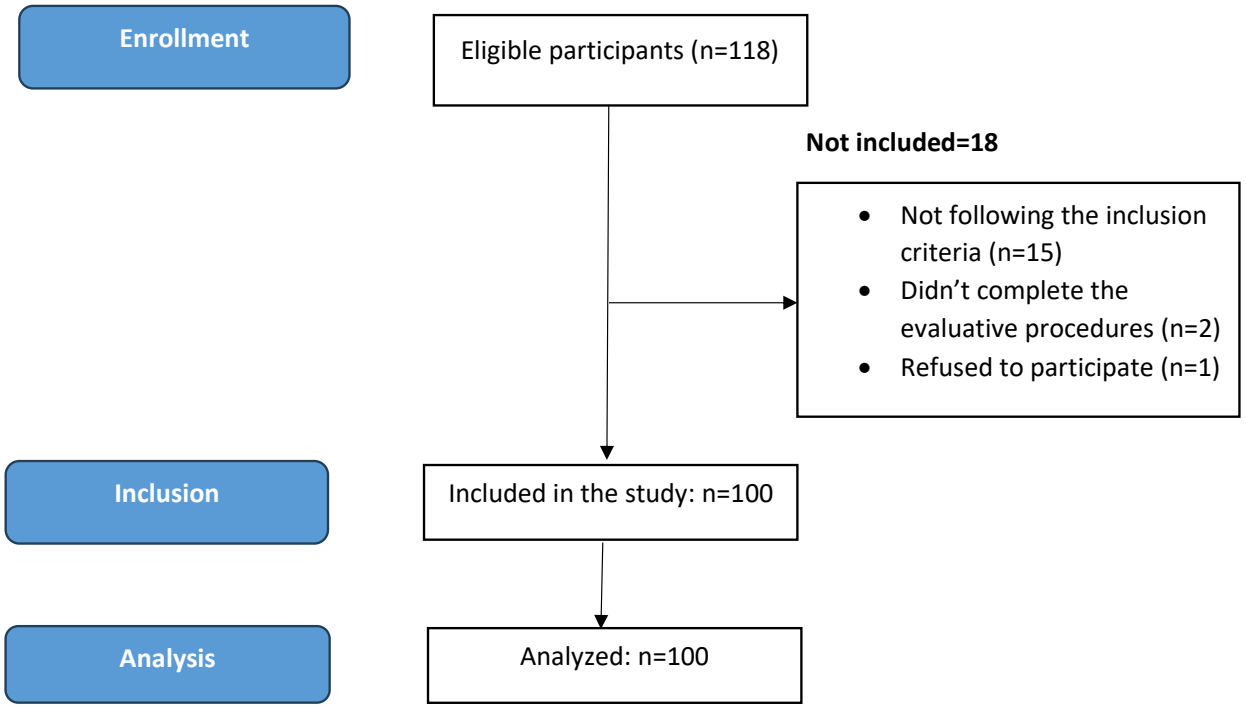

Figure 1. Flow diagram of the study

Assessment of physical activity

Physical activity level was evaluated using the International Physical Activity Questionnaire (IPAQ) [15]. The IPAQ is a self-administered assessment tool comprising 27 items to evaluate physical activity levels among adults aged 15 to 69. Participants were asked to recall the types of physical exercises they performed, how often (days per week), and for how long (hours and minutes per day) they engaged in these activities over the past week. The evaluation is based on the intensity of the activities, categorized as vigorous (such as aerobic walking, running, and jogging), moderate (such as general home exercises, brisk walking, and recreational swimming), and everyday walking. Physical activity levels are classified as low, moderate, or high based on metabolic energy expenditure (metabolic equivalent of task, or MET) per minute per week.

The intensity of physical activity was expressed using metabolic equivalents (METs). MET equals the metabolic rate at work divided by the metabolic rate at rest. One MET equals one kcal/kg/hour and represents the energy required to sit quietly. Moderately active individuals require four times more calories, whereas vigorously active individuals require eight times more. Hence, time spent on moderate activities was assigned 4 METs, whereas time spent on vigorous activities was assigned 8 METs [16].

The MET-minute score is calculated by multiplying the MET value by the duration in minutes and the number of days. The walking duration is multiplied by a metabolic equivalent of 3.3 to obtain the walking score. A value of 4 METs is used for moderate physical activity, while 8 METs are used for vigorous physical activity.

Total MET-minutes of physical activity per week = MET-minutes of walking + MET-minutes of moderate activity + MET-minutes of vigorous activity

The levels of physical activity were then classified into three categories [16]:

1. Low level of physical activity (< 600 MET-min/week);
2. Moderate level of physical activity (600-3000 MET-min/week);
3. High level of physical activity (> 3000 MET-min/week).

Assessment of aerobic power

A one-mile submaximal test was used to evaluate the aerobic power of the participants. Their weight was recorded first. They were then instructed to walk for five minutes to warm up. After that, they were instructed to jog a mile (1609 meters) on a track with maximal effort. A smartwatch monitored their heart rate. Their heart rate should not exceed 180 beats per minute during the test, which lasted at least 9 minutes. They started once the instructor said "go" and started the stopwatch. Once the participant stopped, the heart rate was measured, and the jog time was recorded to calculate the aerobic power (mL/kg/min) using the following equation [17].

100.5- (0.1636× weight in kg)- (1.438× the time it takes to jog 1 mile lightly)- (0.1928× heart rate at the end of the jog)

Assessment of anaerobic power

The Running-Based Anaerobic Sprint Test (RAST) is a method for measuring anaerobic power and capacity. It comprises six 35-meter sprints separated by a 10-second recovery period [18]. Before starting the test, each participant performed a warm-up for 10 to 15 minutes, followed by a sufficient recovery period of 10 minutes. The test was conducted as follows: each participant was asked to sprint back and forth six times at full pace over 35 meters on a flat, hard surface, pausing for 10 seconds after each sprint. Cones were used to mark out a 35-meter straight on the track. The duration of each sprint was recorded using a stopwatch. Then, the following equation was used to calculate anaerobic power:

$$\text{Power output (Watts)} = \text{Weight (Kilograms)} \times (\text{Distance (meters)})^2 \div \text{Time (Seconds)}^3.$$

- Maximum power: the highest value
- Minimum power: the lowest value
- Average power: is equal to the sum of all six values ÷ 6

Assessment of fatigue index

The fatigue index is the rate of power decline in the participant's performance. The fatigue index was assessed using the RAST test according to the following equation:

$$\text{Fatigue Index} = (\text{maximum power} - \text{minimum power}) \div \text{Total time of 6 sprints}$$

All measurements were taken in the late luteal phase to avoid variance among subjects. The session began with an assessment of aerobic power, followed by an assessment of anaerobic power, with a 20-minute break in between.

Statistical analysis

Descriptive statistics, including mean, standard deviation, minimum, maximum, median, interquartile range, and frequency, were used to present the measured variables. As the data were not normally distributed, non-parametric statistics were applied. A chi-squared test was used to investigate the association between PMS severity, physical activity, and dysmenorrhea. The Kruskal-Wallis test compared the median BMI values between females with mild, moderate, and severe PMS. This was followed by a Mann–Whitney U test to identify significant differences between each pair of categories. Spearman's rank correlation coefficient was used to evaluate the correlation between PMS severity and other variables. The significance level was set at $p < 0.05$. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 25, for Windows (IBM SPSS, Chicago, IL, United States).

Results

One hundred females with premenstrual syndrome participated in this study, with a mean age of 27.1 ± 4.98 years and a mean BMI of 26.4 ± 4.5 kg/m². Their mean age of menarche was 12.34 ± 1.33 years, and the duration of their menses was 5.33 ± 1.24 days. Fifty-three percent had dysmenorrhea, and 60% of participants were single. Twenty-nine percent were students, while 71% were employees.

Regarding PMS, 16%, 60%, and 24% of participants had mild, moderate, and severe PMS, respectively. For the physical activity (PA) level, 51% of females had low PA, 39% had moderate PA, and 10% had high PA. There was a significant association ($p < 0.05$) between PA and PMS severity. Severe PMS was associated with a low PA level compared to subjects with moderate or high physical activity. There was also a significant association ($p < 0.05$) between dysmenorrhea and PMS and no significant association ($p > 0.05$) with marital status (Table 1).

Females with severe PMS have a median BMI of 28.02 with an interquartile range of 32.91-25.77. Females with moderate PMS have a median BMI of 25.31 with an interquartile range of 26.89-23.11. Females with mild PMS have a median BMI of 25.04 with an interquartile range of 28.21-23. Subjects with severe premenstrual syndrome had a significantly higher BMI than subjects with mild premenstrual syndrome ($p = 0.04$) and moderate premenstrual syndrome ($p = 0.003$). At the same time, females with mild and moderate PMS showed no significant difference ($p = 0.82$).

Regarding aerobic capacity, the mean difference between mild and moderate PMS was -1.81, the mean difference between mild and severe PMS was 0.82, and the mean difference between moderate and severe PMS was 2.63. There was no significant difference in aerobic capacity among mild, moderate, and severe PMS groups ($F = 2.89$, $p > 0.05$) (Table 2).

Females with mild, moderate, and severe PMS showed no significant difference in average anaerobic power ($p > 0.05$) (Table 3).

Regarding the fatigue index, our results revealed a significant difference among females with mild, moderate, and severe PMS ($p < 0.05$). Table 4 shows a non-significant correlation (rho = 0.001, $p > 0.05$) between PMS severity and the fatigue index.

Discussion

This study investigated the relationship between lifestyle factors and PMS severity among Egyptian females. Regarding physical activity (PA), our results showed a significant association ($p < 0.05$) between physical activity and PMS severity. A larger percentage of females suffering from severe PMS exhibited low physical activity levels (79.2%)

Table 1. Association of premenstrual syndrome severity, physical activity, marital status, working status, and dysmenorrhea

Variables		Premenstrual syndrome			χ^2 value	p-value
		Mild (N= 16)	Moderate (N = 60)	Severe (N = 24)		
Physical activity	Low	4 (25%)	28 (46.7%)	19 (79.2%)	16.1	0.002*
	Moderate	8 (50%)	28 (46.7%)	3 (12.5%)		
	High	4 (25%)	4 (6.7%)	2 (8.3%)		
Marital status	Single	12 (75%)	37 (61.7%)	11 (45.8%)	3.57	0.16NS
	Married	4 (25%)	23 (38.3%)	13 (54.2%)		
Working status	Student	4 (25%)	21 (35%)	4 (16.7%)	2.94	0.23NS
	Employee	12 (75%)	39 (65%)	20 (83.3%)		
Dysmenorrhea	Yes	0 (0%)	32 (53.3%)	21 (87.5%)	29.51	0.001*
	No	16 (100%)	28 (46.7%)	3 (12.5%)		

χ^2, Chi-squared value; *p-value < 0.05; NS: non-significant; *: significant

Table 2. The aerobic capacity among different PMS categories

Premenstrual syndrome	Mean± SD	Min.	Max.	MD		95%, CI	p-value
Mild (n=16)	29.53 (± 4.41)	23.62	39.31	Mild-Moderate	-1.81	-5.29 to 1.67	0.63
Moderate (n=60)	31.25 (±5.34)	21.49	43.23	Mild-severe	0 .82	-3.02 to 4.65	1.00
Severe (n=24)	28.56 (±4.24)	21.79	38.57	Moderate-severe	2.63	- 0.15 to 5.40	0.07

SD: Standard deviation; Min, Minimum; Max: Maximum; MD: Mean difference; CI: Confidence interval; * p-value < 0.05

Table 3. Descriptive statistics of the power of the study group

Power (Watt)	Mean ±SD	Maximum	Minimum	Median	IQR
Maximum	3.83 ± 3.34	12.8	0.5	2.1	6.2-1.15
Minimum	2.11 ± 1.76	6.3	0.3	1.2	3-0.8
Average	2.87 ± 2.41	9.3	0.4	1.6	4.75-1
Median (IQR)					
Power (Watt)	**Mild premenstrual syndrome**	**Moderate premenstrual syndrome**	**Severe premenstrual syndrome**	**Kruskal-Wallis H**	**p-value**
Maximum	5.3 (8.9-1.32)	1.5 (4.52-1.1)	4.15 (6.2-1.4)	4.22	0.12NS
Minimum	1.9 (4.05-0.72)	1.2 (2.3-0.8)	2.45 (4.1-0.9)	4.36	0.11NS
Average	2.85 (6.05-1.02)	1.4 (2.8-0.9)	3.4 (4.9-1.02)	5.14	0.07NS

* p-value < 0.05; NS: non-significant; SD, Standard Deviation; IQR, Interquartile range

compared to those with moderate and high physical activity levels (12.5% and 8.3%, respectively). A lower percentage of subjects with moderate and severe PMS had high physical activity levels (6.7% and 8.3%, respectively).

The results can be explained by PA improving circulation and venous return, which is associated with decreased water retention and reduced local concentrations of inflammatory substances and prostaglandin levels. These effects may relieve

Table 4. Comparison between median values of fatigue index between mild, moderate as well as severe premenstrual syndrome

Fatigue index				
Median (IQR)			**Kruskal-Wallis H**	**p-value**
Mild premenstrual syndrome	**Moderate premenstrual syndrome**	**Severe premenstrual syndrome**		
0.013 (0.045-0.002)	0.002 (0.014-0.001)	0.012 (0.015-0.003)	7.19	0.02*
Mann–Whitney U test				
Premenstrual syndrome	**U-value**	**p-value**		
Mild - Moderate	308	0.02*		
Mild – Severe	170.5	0.55NS		
Moderate – Severe	521	0.04*		

U-value: Mann- Whitney test value; *p-value: < 0.05; IQR: Interquartile range; Kruskal-Wallis H: Kruskal-Wallis test value

PMS symptoms such as abdominal and pelvic pain and backache [19]. Exercise boosts muscle oxygenation and endorphin levels, improving mood and emotional status [6]. The current study's results are supported by Pearce et al., who concluded that PMS incidence was high in the low physical activity group, attributing this to the development of new technologies that deprived females of the benefits of exercise [20]. Colenso et al. found that exercising women had fewer PMS symptoms than sedentary women [21]. Additionally, Kawabe et al. concluded that women with high PA had lower PMS symptom scores [22].

In contrast, previous studies concluded that high-intensity activities contributed to menstrual-related disorders and a high prevalence of PMS symptoms in female athletes due to increased stress and fatigue related to high-level activities [11, 12]. While Sanchez et al. reported no relation between physical activity and either the prevalence or severity of PMS, they interpreted their results as indicating that the correlation between premenstrual symptoms and physical activity level is complex and multifactorial [23]. Our study also showed no significant difference in aerobic capacity among females suffering from mild, moderate, and severe PMS ($F = 2.89$, $p > 0.05$). Sabaei et al. contradicted the current study, revealing a significant negative correlation between the incidence of PMS and aerobic power ($r = -0.71$; $p < 0.05$). The discrepancy can be attributed to individual differences, cultural variations, and negative attitudes towards menstruation. Consequently, limitations on how women respond to their menstrual cycles can explain the results [13].

Regarding anaerobic power, there was a non-significant difference ($r = 0.076$, $p > 0.05$) between females with mild, moderate, and severe PMS. This result could be due to the fact that all participants were non-athletes. This finding aligns with studies by Chen et al. [12] and Carmichael et al. [24], who concluded that there is no statistically significant correlation between anaerobic power and PMS.

Regarding the fatigue index, our results revealed a non-significant correlation (rho = 0.001, $p > 0.05$) between the fatigue index and PMS severity. This result may be explained by the non-significant difference in anaerobic power between females suffering from mild, moderate, and severe PMS.

Current results revealed a significant association between dysmenorrhea and PMS, with 53% of women with PMS suffering from dysmenorrhea. This finding aligns with previously reported prevalence rates of 65.9% [25] and 71% [26]. Our study also concurs with a study that showed the scoring of dysmenorrheal pain severity in relation to premenstrual symptoms was highly significant ($p < 0.001$). The strong association between PMS and dysmenorrhea might be due to disturbances in steroid production [27]. Dysmenorrhea and PMS may have shared biochemical etiologies, including prostaglandins, which could explain why many women experience both conditions [28].

For BMI, females with severe PMS had higher BMI values compared to females with mild and moderate PMS ($p < 0.05$). These findings may be explained by the fact that adipose tissue converts androgens into estrogens. Additionally, there is a decreased ability of estrogens to attach to sex hormone-binding globulin (SHBG) in obese women, leading to increased serum-free estradiol levels [29]. Increased adiposity may also contribute to vitamin D deficiency [30], which can lead to dysregulation of the renin-angiotensin-aldosterone system (RAAS), potentially causing fluid retention [31]. Conversely, PMS may be considered one of the causes of a sedentary lifestyle and isolation, leading to increased obesity [32]. These points require further research for clarification.

There was agreement with the current results in previous studies [33, 34, 35]. Other studies, on the other hand, found a poor correlation [36] or no association [37] between BMI and PMS, or even the waist-to-hip ratio (WHR) and waist-to-height ratio (WTHR) [38]. Furthermore, Shamnani et al. reported a higher PMS prevalence (67.8%) among students with a normal BMI [39].

Our results revealed no significant association between marital status and PMS severity ($p > 0.05$). These findings are supported by Sadr et al., who reported no statistical difference in PMS between married and single groups ($p > 0.05$). They concluded that marital status is not a significant social factor in this syndrome [40].

This study has several strengths. Aerobic and anaerobic power measurements were conducted during the late luteal phase and at the same time of day (morning) to avoid time-of-day differences in anaerobic performance, ensuring more precise results. Valid and reliable questionnaires were used for the evaluative procedures. Additionally, the calculated power analysis is another strength of the study.

However, some factors limit this study. Pain tolerance varies between individuals, and psychological status and environmental factors may affect the evaluative procedures and participants' responses.

Conclusions

This study highlighted the physical activity level and demographic profile of a cohort of Egyptian females suffering from PMS. The results showed that lower physical activity and a higher BMI are associated with severe PMS. Furthermore, dysmenorrhea is associated with PMS. Therefore, being physically active and maintaining a BMI within a normal range can effectively decrease the severity of PMS. Additionally, there is a need for awareness programs about PMS and its associated factors, as well as holistic coping strategies to manage such cases.

Data Availability Statement

The data are available on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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