

Exercise addiction as a risk factor for pre-menstrual syndrome among early adult varsity elite sportswomen

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Abstract

Background and Study Aim Menstrual issues are increasingly reported among female athletes, particularly those competing at elite levels. Premenstrual syndrome (PMS) has emerged as one of the conditions that may affect their wellbeing and athletic performance. Despite the use of various approaches to manage PMS, their relative effectiveness in mitigating its detrimental effects remains a matter of practical interest. This study examined the relationship between exercise addiction (EA) and PMS among early adult varsity elite sportswomen.

Material and Methods Participants were recruited from university sports teams through coordination with official varsity sports departments, resulting in a final sample of 161 early adult varsity elite sportswomen (Mage = 22.0, SD = 1.609) who met all eligibility criteria. Data were collected in person using a demographic information form together with two validated measurement instruments, the Premenstrual Symptoms Screening Tool (PSST) and the Exercise Addiction Inventory (EAI), which were administered in their original English versions to assess PMS symptoms and tendencies toward exercise addiction.

Results Descriptive analyses indicated that symptoms of exercise addiction were highly prevalent in the sample, with 80.1 percent of participants reporting some symptoms and 19.9 percent classified as at risk, while PMS levels were similarly elevated, with 94.4 percent of athletes experiencing severe PMS and 5.6 percent reporting moderate PMS. Hierarchical regression showed a strong positive association between EA and PMS, indicating that higher EA levels were linked to more severe PMS symptoms even after controlling for financial status.

Conclusions These findings highlight the need for more sustainable training strategies. Such strategies may support healthier menstrual wellbeing in early adult varsity elite sportswomen and help prevent addictive exercise patterns.

Keywords: early adult, elite athletes, exercise addiction, premenstrual syndrome, students.

Introduction

Menstrual problems among the female athlete population have become widespread. They have disrupted various aspects of athletes' lives and have influenced their general well-being. Irregularities or disturbances in menstruation have also gained significant attention from many researchers over the past few decades. Some researchers have focused on premenstrual syndrome (PMS) among female athletes because of its potential impact on their overall health and performance. PMS can be characterized as a combination of bodily and psychological symptoms accompanied by behavioral changes that may occur in the luteal phase of the menstrual cycle [1]. Previous studies on female menstrual health described PMS as a sequence of physical and emotional disturbances that may occur consistently with the menstrual cycle [2]. Several prominent symptoms may appear as a result of PMS, including mood swings, fatigue,

headaches, bloating, and changes in appetite [3]. PMS does not remain constant in its intensity. It may range from mild to severe. Mild cases may show less intense symptoms, whereas severe cases may exhibit extremely intense and long-lasting symptoms [4].

Among female athletes, PMS has been suggested to give rise to multiple adverse physical and psychological consequences [5, 6]. In terms of physical influences, PMS may increase muscle fatigue and reduce muscular endurance among female athletes [7]. Psychologically, it may elevate stress levels and reduce cognitive functioning [8]. This compromise in psychological health may reduce social interactions and eventually disrupt athletes' social lives [9]. Compared to other categories of female athletes, elite varsity athletes may be at higher risk of experiencing PMS. Along with academic stress, they are consistently exposed to extreme pressures from sports competitions [10]. To achieve success in both academic and athletic domains, they may work tirelessly, leaving little to no opportunity for recovery. This hindrance in the

recovery process may lead to extreme physical and psychological burnout and increase the risk of injury among elite varsity female athletes [11].

Based on the available literature, no existing study has specifically examined the prevalence of PMS among elite female varsity athletes. However, several studies have investigated PMS among elite athletes and varsity athletes separately. A recent systematic review by Granda and Szmidt [12] evaluated the prevalence of PMS among elite female athletes. The outcomes showed that athletes involved in highly intense training regimens reported higher PMS levels, with prevalence ranging from 8.6% to 65.8%. Yi and Bae [13] conducted a similar study on elite female athletes residing in Korea. As the participants were exclusively elite athletes, data were collected from the National Training Center of Korea. The results indicated that about 14.5% of the elite female participants experienced moderate or severe PMS. Studies examining PMS among varsity athletes have revealed comparable trends. Research from Iran reported that about 41% of varsity athletes experienced PMS [14]. These consistently high rates across regions suggest that PMS is a widespread menstrual health challenge among female athletes worldwide.

Because of this widespread issue, identifying effective preventive strategies has become increasingly important. Highlighting preventive strategies or interventions may support global efforts aimed at promoting gender equality in sports. The outcomes may also provide important practical implications for creating safer sports environments for females in line with the WHO's Sustainable Development Goals [15]. However, before determining potential preventive measures for any health issue, it is necessary to first identify its contributing factors [16]. In the context of PMS, a large body of research has emphasized that controlling or reducing the factors that worsen PMS may be an effective approach [16, 17, 18]. For example, Yi and Kim [8] suggested that reducing disturbances in psychological health and improving eating attitudes among female athletes may help mitigate PMS. However, addictive behavior toward exercise, or Exercise Addiction (EA), is one contributing factor that has consistently been overlooked in previous research.

Exercise addiction (EA) is defined as a behavioral disorder in which a person develops an intense obsession with exercising or engaging in excessive physical activity [19]. It can also be described as abnormal behavior in which the desire to prioritize physical activity takes precedence over other important aspects of life [20]. People with EA are frequently at risk for several health issues, including hormone imbalances, overuse injuries, chronic fatigue, and a compromised immune system [21]. They may also experience psychological risks such

as social isolation, loneliness, and anxiety [22]. These health issues associated with EA are similar to those that significantly influence PMS in female athletes [23]. EA is also common among varsity elite sportswomen in their early adult years, underscoring its relevance within this demographic [24].

Analysis of research findings has shown that PMS is a prevalent and clinically significant concern among both elite and varsity female athletes, with its severity influenced by training load, psychological factors, and overall health status. Researchers emphasize that PMS can adversely affect well-being, athletic performance, and social functioning, while related factors such as exercise addiction may further intensify its impact. At the same time, several aspects of this issue remain insufficiently clarified, particularly regarding the interaction between behavioral patterns and menstrual health in highly demanding athletic contexts. This gap continues to hinder a more complete characterization of the factors that may shape PMS outcomes among early adult varsity elite sportswomen.

Although both exercise addiction (EA) and premenstrual syndrome (PMS) are increasingly recognized as important concerns in female athletes, limited work has examined whether these two conditions may be related. Existing studies have typically addressed EA and PMS separately, and most available evidence originates from Western or non-elite athletic populations. Previous research has reported notable levels of EA among elite and sub-elite female athletes, high PMS prevalence in collegiate athletes, and indications of a positive association between EA and PMS in female athlete samples [25, 26, 27]. Examining both factors within the same cohort may provide a more integrated view of behavioral and physiological stress processes relevant to female athletes.

In South Asian contexts, female athletes often face additional cultural, social, and environmental constraints that may influence both training experiences and overall well-being. Prolonged psychological stress, limited recovery, and context-specific barriers may contribute to hormonal dysregulation and emotional strain, which could plausibly affect vulnerability to PMS symptoms and tendencies toward EA. Elite varsity sportswomen in Pakistan represent a population in which these influences may intersect.

The present study aimed to examine the relationship between exercise addiction and premenstrual syndrome among early adult varsity elite sportswomen in Pakistan.

Based on this aim, the study addressed the following hypotheses:

- H1: EA would demonstrate measurable prevalence in early adult female varsity athletes.
- H2: PMS would also be present in this population.

• H3: EA and PMS would show a positive association.

Materials and Methods

Participants

Women's participation in sports remains a global concern, and this issue is particularly pronounced in South Asia, where cultural, religious, and social restrictions often limit athletic opportunities for females [28]. Although some women succeed in entering competitive sports, progression to higher performance levels is frequently constrained by limited encouragement and insufficient institutional support [29]. Within this context, identifying a suitable population of early adult varsity elite sportswomen required careful and targeted recruitment. All athletes who met the study's eligibility requirements and were available during data collection were included through a convenience sampling approach.

Inclusion and Exclusion Criteria

To be eligible, participants were required to:

- be female athletes competing at the national or international level;
- be enrolled in a bachelor's or equivalent academic program in a Higher Education Commission (HEC)-recognized university;
- be active members of their university sports team;
- be 18–25 years of age.

Exclusion applied to individuals who did not meet the inclusion criteria or whose returned questionnaires contained more than 10% missing responses on the Premenstrual Symptoms Screening Tool (PSST) or the Exercise Addiction Inventory (EAI).

Recruitment and Sample Characteristics

Participants were contacted through official varsity sports departments in coordination with university sports officials. Data were collected in person at university sports venues. Questionnaires, which included demographic items and the required measurement tools, were administered under supervision. Trained data collectors remained present to provide clarification and ensure response accuracy.

A total of 180 questionnaires were initially obtained. All forms were screened for completeness. In line with standard psychometric procedures, forms with more than 10% missing data were excluded, while isolated missing items ($\leq 10\%$) were replaced using mean substitution within the corresponding scale. After removing 19 incomplete forms, the final sample consisted of 161 participants (Mage = 22.0, SD = 1.609), yielding an 89% response rate.

Of the participants, 73.9% were individual-sport athletes and 26.1% were team-sport athletes. Additionally, 92.5% competed at the national level and 7.5% at the international level. Financially,

94.4% received scholarship support, whereas 5.6% were self-financed (Table 1).

Table 1. Descriptive statistics of early adult varsity elite sportswomen

Variables	Minimum	Maximum	M	SD
Age	18	25	22	1.609
Sports Type	Frequency (f)	%		
Individual sports	119	73.9		
Team sports	42	26.1		
Playing Level	Frequency (f)	%		
National	149	92.5		
International	12	7.5		
Financial Status	Frequency (f)	%		
Self-financed	9	5.6		
Scholarship	152	94.4		

Note: N = 161; M = Mean; SD = Standard Deviation

Research Design

Data Collection Tools

Since the medium of instruction at higher education institutions in Pakistan is English, all participants were able to understand the language. Therefore, both the Premenstrual Symptoms Screening Tool (PSST) and the Exercise Addiction Inventory (EAI) were administered in their original English versions without modification. The tools consisted of three sections, described below.

Section 1: Demographic Information

The first section comprised eight items focused on general and personal information of the participants. These items included age, university, current academic program, sports type, playing level, financial status, weight (kg), and height.

Section 2: PMS Screening

The second section included a 19-item tool, the Premenstrual Symptoms Screening Tool (PSST), developed by Steiner and Macdougall [30]. This instrument was specifically designed to assess PMS symptoms among females. According to the tool description, the PSST is suitable for measuring PMS in women aged 18 to 55. Its use in the present study was supported by evidence showing that it has been consistently employed in previous research involving female varsity students and sportswomen [31, 32]. The PSST has also demonstrated a Cronbach's alpha value of 0.93 in several studies [7, 33]. In the current study, the tool achieved a Cronbach's alpha of 0.81, further supporting its reliability.

Section 3: EA Screening

The third section of the tool consisted of a six-

item questionnaire designed to assess exercise addiction. This instrument, known as the Exercise Addiction Inventory (EAI), was developed by Terry and Szabo [34]. Its suitability for similar populations is supported by previous studies that have used the EAI to assess exercise addiction among female students and elite athletes [24, 25]. Strong validity and reliability have been reported in earlier research, with Cronbach's alpha values ranging from 0.73 to 0.84 [34, 35]. In the present study, the EAI also demonstrated acceptable internal consistency, with Cronbach's alpha = 0.75.

Procedure

Ethical approval was obtained from the Government College University's bioethics board before data collection. All information was kept confidential, and no names or identifying details were attached to any responses or completed questionnaires. Each participant provided informed consent and received a clear explanation of the study purpose to ensure full understanding of the agreement. All instructions were explained individually, and participants were encouraged to ask questions if anything was unclear. On average, it took about 20 to 25 minutes for each participant to complete the full form, which consisted of three sections.

Statistical Analysis

After the collection of completed questionnaires, all responses were entered into Excel and then transferred to SPSS (version 22) for analysis. Descriptive statistics were first computed to provide an overview of the prevalence of EA and PMS symptoms among elite varsity sportswomen. A hierarchical multiple regression was then conducted to examine the relationship between the two variables, using a significance level of .05. Preliminary checks were performed before the main analyses to confirm the assumptions of linearity, homoscedasticity, normality, and multicollinearity. Details of these outputs, including Shapiro-Wilk tests, Q-Q plots, residual plots, tolerance values, and VIF scores, are provided in the Supplementary Materials to ensure transparency and replicability.

Results

Descriptive analyses were conducted to assess the prevalence of both EA and PMS among early adult varsity elite sportswomen (Tables 2 and 3).

Table 2. Descriptive analysis of EA

EA and its categories	F	%
No symptoms of EA	0	0
Some symptoms of EA	129	80.1
At risk of EA	32	19.9

Note. N = 161; f = frequency; % = percentage; EA = Exercise Addiction.

Table 2 shows that none of the participants reported an absence of EA symptoms. A total of 80.1% demonstrated some symptoms of EA, while 19.9% were classified as being at risk of EA.

Table 3. Descriptive analysis of PMS

PMS and its categories	F	%
Low PMS	0	0
Moderate PMS	9	5.6
Severe PMS	152	94.4

Note. N = 161; f = frequency; % = percentage; PMS = Premenstrual Syndrome.

Table 3 shows that PMS prevalence was similarly high. A total of 94.4% of participants reported severe PMS, whereas 5.6% reported moderate PMS. None of the participants showed low or no PMS symptoms.

To identify the potential connection between EA and PMS, a two-step hierarchical multiple regression analysis was performed. The decision to apply this analysis was based on the results of the Pearson correlation matrix obtained during the preliminary analysis. As shown in Table 4, among the potential confounding factors, financial status was the only variable significantly correlated with PMS.

Therefore, to control the effect of the confounding variable on the dependent variable, financial status was entered in the first step of the regression model, whereas the independent variable EA was inserted in the second step. As shown in Table 5, the results from step 1 demonstrated that financial status significantly and positively predicted PMS among early adult varsity elite sportswomen ($B = 5.755$, $\beta = .216$, $p = .006$). This result indicated that athletes with a stable financial status (i.e., scholarship recipients) were more likely to experience PMS. However, the relatively small R^2 value of .047, which accounted for only 4.7% of the variance in PMS, showed that financial status alone had a limited influence on PMS.

In step 2 of the regression, EA was added to the model, which significantly improved the prediction of PMS ($\Delta R^2 = .880$, $p = .000$). The overall regression model explained 92.7% of the variance in PMS ($R^2 = .927$, $p = .000$). EA emerged as the strongest positive predictor of PMS ($B = 2.568$, $\beta = .950$, $p = .000$), indicating that higher EA levels were associated with increased PMS symptoms among early adult varsity elite sportswomen (Table 5). Notably, after EA was included in the model, the influence of financial status on PMS was substantially reduced ($B = 1.807$, $\beta = .068$, $p = .002$). These findings suggest that EA plays a major role in explaining the variance in PMS that initially appeared to be associated with financial status.

Table 4. Pearson Correlation analysis

Variable	Statistic	Age	Spors Type	Playing Level	Financial Status
PMS	Pearson Correlation	-.130	-.129	-.110	.216**
	Sig. (2-tailed)	.099	.103	.164	.006

Note: N = 161, ** < 0.01 level (2-tailed)

Table 5. Hierarchical Multiple Regression Analysis

Dependent variable	Predictors	B	β	t	p	95% CI		R ²	ΔR^2	p
						Low	Up			
PMS	Step 1							.047	.047	.006 ^b
	Financial Status	5.755	.216	2.787	.006	1.677	9.833			
	Step 2							.927	.880	.000 ^c
	Financial Status	1.807	.068	3.124	.002	.685	2.967			
	EA	2.568	.950	43.797	.000	2.432	2.670			

Note: b = Predictors: (Constant), Financial Status; c = Predictors: (Constant), Financial Status, EA

Discussions

The main objective of this study was to examine the relationship between exercise addiction (EA) and premenstrual syndrome (PMS) among early adult varsity elite sportswomen. The results indicated that symptoms of EA were highly prevalent in this population. PMS levels were also notably elevated, with a majority of athletes reporting moderate to severe symptoms. In addition, the findings showed a strong positive association between EA and PMS, suggesting that higher levels of EA were linked to more intense PMS symptoms among early adult varsity elite sportswomen. These results underscore the need to consider behavioral factors when addressing menstrual health in athletic settings and highlight the importance of balanced training approaches that support the physiological well-being of female athletes.

The descriptive analysis showed that nearly all early adult female varsity athletes experienced some level of EA, reflecting patterns consistent with earlier research. Landolfi [36] reported that female varsity athletes were three times more likely to develop EA compared to males. Similar findings were observed in studies on elite female athletes, where EA was more common among those participating in higher levels of competitive sport [25]. Although the present study focused on determining EA prevalence rather than identifying its specific causes, it is plausible that strong competitive pressure may contribute to excessive training behaviors. Additionally, some athletes may use intense exercise as a coping strategy for managing emotional states. Further research is needed to clarify the underlying factors that may influence these tendencies.

The analysis also showed a high prevalence of PMS among early adult female varsity athletes. These findings were consistent with results reported in studies on Korean female elite athletes [13] and

collegiate athletes [26]. One possible explanation is the dual burden faced by university athletes, who must balance the demands of high-level sports participation with academic requirements. The combined pressures may contribute to both psychological and physical fatigue. In addition, female athletes often engage in intensive strength and conditioning programs to maintain competitive performance. Sustained physical exertion increases their energy needs, and the added academic workload may occasionally lead to irregular eating patterns. Insufficient energy intake can disrupt hormonal regulation, potentially exacerbating PMS symptoms.

The hierarchical multiple regression analysis was conducted to determine the association between EA and PMS. In the initial step of the regression model, the confounding variable “financial status” showed a significant but small positive association with PMS. This indicated that varsity athletes receiving scholarships reported higher PMS levels. One possible explanation is that the financial support of female varsity athletes is often tied to their athletic performance [37], which may impose additional performance-related pressure. However, this effect was substantially reduced after EA was added to the model in the second step. The results demonstrated a strong positive association between EA and PMS, suggesting that early adult varsity elite sportswomen with higher EA levels may experience considerably more severe PMS.

Current evidence suggests that the association between EA and PMS among early adult varsity elite sportswomen has not been explicitly investigated. However, earlier research on female athletes evaluating the link between dysfunctional exercise and irregular menstruation reported partially similar findings. That study indicated that dysfunctional exercise was one of the contributing

factors to menstrual dysfunction among female athletes [27]. In a related context, another study on female exercisers assessing the association between exercise dependence and abnormal menstruation produced comparable outcomes [38]. Although the present study focused solely on examining the association between EA and PMS without investigating potential causal pathways, it is plausible that early adult varsity elite female athletes may consume insufficient calories to meet the demands of vigorous training [39]. Reduced energy intake may influence the hypothalamic–pituitary–ovarian (HPO) axis and contribute to low energy availability (LEA) [40]. Among early adult varsity elite sportswomen, disturbances in the HPO axis may exacerbate PMS symptoms and further disrupt hormonal regulation. Nonetheless, additional research is required to better understand the potential mechanisms underlying the association between EA and PMS. These findings point to the need for support programs that monitor menstrual health, provide regular psychological assistance, and ensure access to adequate training and recovery facilities. This need is particularly pronounced in developing countries, where many universities lack sufficient sports science resources to support female athletes effectively.

Limitations and Areas for Future Exploration

The study employed a cross-sectional design, which limits the ability to draw causal inferences when compared with longitudinal or randomized controlled approaches. Future research would benefit from utilizing stronger designs, including longitudinal, observational, quasi-experimental, or randomized controlled trials. Additionally, the present study included varsity elite female athletes from various sport types, although the prevalence of PMS and EA may differ across specific athletic disciplines. Future investigations should therefore consider focusing on particular sports to better understand how distinct physiological and training demands may influence the prevalence and interaction of EA and PMS.

Practical Implications

Several practical measures may help university sports programs, particularly in developing countries, provide more effective support for

female athletes. Monitoring early indicators of PMS, overtraining, or exercise-related difficulties may enable timely intervention before symptoms intensify. Providing athletes with fundamental guidance on menstrual health, nutrition, and stress-management strategies may also facilitate healthier training adaptation. Incorporating brief psychological skills or emotional-regulation exercises into routine training sessions could assist athletes in managing performance-related pressure and reduce tendencies toward excessive training.

In addition, coordinated collaboration among coaches, physiotherapists, psychologists, and academic staff may contribute to improved athlete well-being, more sustainable performance trajectories, and a reduction in maladaptive training behaviors. Collectively, these strategies offer practical approaches for strengthening support systems for female athletes in resource-limited environments. Finally, adopting more sustainable training practices may help lower the risk of exercise-addictive behaviors while supporting healthier menstrual cycles among early adult varsity elite sportswomen.

Conclusions

The study examined the prevalence of, and the association between, EA and PMS among early adult varsity elite sportswomen. The findings indicated a high prevalence of both EA and PMS in this population. The results also demonstrated a strong positive association between EA and PMS, suggesting that athletes with higher EA levels may experience more pronounced PMS symptoms. These outcomes underline the importance of adopting more sustainable training practices that may help reduce the risk of exercise addiction while supporting healthier menstrual functioning among early adult varsity elite sportswomen.

Additional Information

Use of the Pre-Menstrual Symptoms Screening Tool (PSST-19), authored by Steiner and Macdougall [30], was made under license.

Conflict of Interest

The authors declare no conflict of interest.

References

- Itriyeva K. Premenstrual syndrome and premenstrual dysphoric disorder in adolescents. *Current Problems in Pediatric and Adolescent Health Care*, 2022;52(5): 101187. <https://doi.org/10.1016/j.cppeds.2022.101187>
- Gao M, Gao D, Sun H, Cheng X, An L, Qiao M. Trends in Research Related to Premenstrual Syndrome and Premenstrual Dysphoric Disorder From 1945 to 2018: A Bibliometric Analysis. *Frontiers in Public Health*, 2021;9: 596128. <https://doi.org/10.3389/fpubh.2021.596128>
- Prado RCR, Willett HN, Takito MY, Hackney AC. Impact of Premenstrual Syndrome Symptoms on Sport Routines in Nonelite Athlete Participants of Summer Olympic Sports. *International Journal of Sports Physiology and Performance*, 2022; 1–6. <https://doi.org/10.1123/ijspp.2022-0218>
- Babapour F, Elyasi F, Shahhosseini Z, Hosseini Tabaghdehi M. The prevalence of moderate–severe premenstrual syndrome and premenstrual dysphoric disorder and the related factors in high school students: A cross-sectional study. *Neuropsychopharmacology Reports*, 2023;43(2): 249–254. <https://doi.org/10.1002/npr2.12338>
- Ayyub S, Agrawal M, Sharma V, Aravind A. The Effect of Physical Activity on Premenstrual Syndrome: A Systematic Review. *Annals of Neurosciences*, 2025;32(4): 315–320. <https://doi.org/10.1177/09727531241297012>
- Brown D, Smith DM, Osborn E, Wittkowski A. The experiences and psychological impact of living with premenstrual disorders: a systematic review and thematic synthesis. *Frontiers in Psychiatry*, 2024;15: 1440690. <https://doi.org/10.3389/fpsy.2024.1440690>
- Lin PC, Ko CH, Lin YJ, Yen JY. Insomnia, Inattention and Fatigue Symptoms of Women with Premenstrual Dysphoric Disorder. *International Journal of Environmental Research and Public Health*, 2021;18(12): 6192. <https://doi.org/10.3390/ijerph18126192>
- Yi SJ, Kim M, Park I. Investigating influencing factors on premenstrual syndrome (PMS) among female college students. *BMC Women's Health*, 2023;23(1): 592. <https://doi.org/10.1186/s12905-023-02752-y>
- Prasad D, Wollenhaupt-Aguiar B, Kidd KN, De Azevedo Cardoso T, Frey BN. Suicidal Risk in Women with Premenstrual Syndrome and Premenstrual Dysphoric Disorder: A Systematic Review and Meta-Analysis. *Journal of Women's Health*, 2021;30(12): 1693–1707. <https://doi.org/10.1089/jwh.2021.0185>
- Taim BC, Ó Catháin C, Renard M, Elliott-Sale KJ, Madigan S, Ní Chéilleachair N. The Prevalence of Menstrual Cycle Disorders and Menstrual Cycle-Related Symptoms in Female Athletes: A Systematic Literature Review. *Sports Medicine*, 2023;53(10): 1963–1984. <https://doi.org/10.1007/s40279-023-01871-8>
- Moro S, Holopainen E, Kosola S. Associations of adolescent academic performance, sports, disordered eating, and menstrual dysfunction. *European Journal of Public Health*, 2024;34(Supplement_3): ckae144.2111. <https://doi.org/10.1093/eurpub/ckae144.2111>
- Granda D, Szmidt MK, Surała O, Malczewska-Lenczowska J. Prevalence of premenstrual syndrome and premenstrual dysphoric disorder among highly trained and elite female athletes: a systematic review and meta-analysis. *Biology of Sport*, 2025;42(3): 211–225. <https://doi.org/10.5114/biolport.2025.148542>
- Yi T, Bae M. Prevalence of Premenstrual Syndrome in Korean Female National Athletes and Associated Risk Factors. *The Korean Journal of Sports Medicine*, 2021;39(1): 10–18. <https://doi.org/10.5763/kjms.2021.39.1.10>
- Rezaeian N. Comparison of prevalence of premenstrual syndrome in athlete and non-athlete students. *International Journal of Public Health Research*, 2015;3:234–8.
- Leal Filho W, Kovaleva M, Tsani S, Țircă DM, Shiel C, Dinis MAP, et al. Promoting gender equality across the sustainable development goals. *Environment, Development and Sustainability*, 2023;25(12): 14177–14198. <https://doi.org/10.1007/s10668-022-02656-1>
- Eshetu N, Abebe H, Fikadu E, Getaye S, Jemal S, Geze S, et al. Premenstrual syndrome, coping mechanisms and associated factors among Wolkite university female regular students, Ethiopia, 2021. *BMC Women's Health*, 2022;22(1): 88. <https://doi.org/10.1186/s12905-022-01658-5>
- Lee W, Lee S, Ahn J, Lee RS, Kang SK. Premenstrual syndrome incidence rate and risk factors among the working population in the Republic of Korea: a prospective cohort study. *BMC Women's Health*, 2022;22(1): 265. <https://doi.org/10.1186/s12905-022-01852-5>
- Al-Shahrani AM, Miskeen E, Shroff F, Elnour S, Algahtani R, Youssry I, et al. Premenstrual Syndrome and Its Impact on the Quality of Life of Female Medical Students at Bisha University, Saudi Arabia. *Journal of Multidisciplinary Healthcare*, 2021;14: 2373–2379. <https://doi.org/10.2147/JMDH.S327893>
- Weinstein A, Szabo A. Exercise addiction: A narrative overview of research issues. *Dialogues in Clinical Neuroscience*, 2023;25(1): 1–13. <https://doi.org/10.1080/19585969.2023.2164841>
- Juwono ID, Tolnai N, Szabo A. Exercise Addiction in Athletes: a Systematic Review of the Literature. *International Journal of Mental Health and Addiction*, 2022;20(5): 3113–3127. <https://doi.org/10.1007/s11469-021-00568-1>
- Godoy-Izquierdo D, Navarrón E, López-Mora C, González-Hernández J. Exercise Addiction in the Sports Context: What Is Known and What Is Yet to Be Known. *International Journal of Mental Health and Addiction*, 2023;21(2): 1057–1074. <https://doi.org/10.1007/s11469-021-00641-9>
- Back J, Josefsson T, Ivarsson A, Gustafsson H. Psychological risk factors for exercise dependence. *International Journal of Sport and Exercise Psychology*, 2021;19(4): 461–472. <https://doi.org/10.1080/1612197X.2019.1674902>

23. Scully D, Kremer J, Meade MM, Graham R, Dudgeon K. Physical exercise and psychological well being: a critical review. *British Journal of Sports Medicine*, 1998;32(2): 111–120. <https://doi.org/10.1136/bjsm.32.2.111>
24. Griffiths MD, Urbán R, Demetrovics Z, Lichtenstein MB, De La Vega R, Kun B, et al. A cross-cultural re-evaluation of the Exercise Addiction Inventory (EAI) in five countries. *Sports Medicine - Open*, 2015;1(1): 5. <https://doi.org/10.1186/s40798-014-0005-5>
25. Lichtenstein MB, Melin AK, Szabo A, Holm L. The Prevalence of Exercise Addiction Symptoms in a Sample of National Level Elite Athletes. *Frontiers in Sports and Active Living*, 2021;3: 635418. <https://doi.org/10.3389/fspor.2021.635418>
26. Takeda T, Imoto Y, Nagasawa H, Muroya M, Shiina M. Premenstrual Syndrome and Premenstrual Dysphoric Disorder in Japanese Collegiate Athletes. *Journal of Pediatric and Adolescent Gynecology*, 2015;28(4): 215–218. <https://doi.org/10.1016/j.jpog.2014.07.006>
27. Fernandez-del-Valle M, Quesnel DA, Mitchell JJ, Robert-McComb JJ. Screening for Eating Disorders, Dysfunctional Exercise, and Menstrual Dysfunction in Female Athletes. In: Robert-McComb JJ, Zumwalt M, Fernandez-del-Valle M (eds) *The Active Female*, Cham: Springer International Publishing; 2023. p. 183–210. https://doi.org/10.1007/978-3-031-15485-0_12
28. Laar RA, Shi S, Ashraf MA. Participation of Pakistani Female Students in Physical Activities: Religious, Cultural, and Socioeconomic Factors. *Religions*, 2019;10(11): 617. <https://doi.org/10.3390/rel10110617>
29. Yousra A-S, Al-Wahaibi A, Benn T. Women's participation in physical education, physical activity, and sport in Oman. In: De D'Amico RL, Jahromi MK, Guinto MLM, [eds]. *Women and Sport in Asia*. 1st edn Routledge; 2021. P. 136-47. <https://doi.org/10.4324/9781003131885>
30. Steiner M, Macdougall M, Brown E. The premenstrual symptoms screening tool (PSST) for clinicians. *Archives of Women's Mental Health*, 2003;6(3): 203–209. <https://doi.org/10.1007/s00737-003-0018-4>
31. Gallon CW, Ferreira CF, Henz A, Oderich CL, Conzatti M, Ritondale Sodré De Castro J, et al. Leptin, ghrelin, & insulin levels and food intake in premenstrual syndrome: A case-control study. *Appetite*, 2022;168: 105750. <https://doi.org/10.1016/j.appet.2021.105750>
32. Silva EAD, Pires DA. Prevalence of premenstrual syndrome and its psychological effects among university students who participate and do not participate in resistance training. *Revista Brasileira de Ciências do Esporte*, 2021;43: e007420. <https://doi.org/10.1590/rbce.43.e007420>
33. Boyacıoğlu NE, Gökdemir F, Keser Özcan N. Investigation of Factors Related to Menstrual and Premenstrual Symptoms. *Archives of Health Science and Research*, 2021;8(1): 46–55. <https://doi.org/10.5152/ArcHealthSciRes.2021.20057>
34. Terry A, Szabo A, Griffiths M. The Exercise Addiction Inventory: A New Brief Screening Tool. *Addiction Research & Theory*, 2004;12(5): 489–499. <https://doi.org/10.1080/16066350310001637363>
35. Lev Arey D, Sagi A, Blatt A. The relationship between exercise addiction, eating disorders, and insecure attachment styles among recreational exercisers. *Journal of Eating Disorders*, 2023;11(1): 131. <https://doi.org/10.1186/s40337-023-00855-3>
36. Landolfi E. An Investigation of Exercise Behaviour Patterns Amongst Varsity Athletes. *Journal of Concurrent Disorders*, 2022; <https://doi.org/10.54127/HHDT5954>
37. Wicker P, Dallmeyer S, Breuer C. Elite Athlete Well-Being: The Role of Socioeconomic Factors and Comparisons With the Resident Population. *Journal of Sport Management*, 2020;34(4): 341–353. <https://doi.org/10.1123/jsm.2019-0365>
38. Bamber D, Cockerill IM, Carroll D. The pathological status of exercise dependence. *British Journal of Sports Medicine*, 2000;34(2): 125–132. <https://doi.org/10.1136/bjsm.34.2.125>
39. Maharam N, Mohamad Shalan NAA, Abdullah NF. Nutritional Knowledge and Calorie Intake Among University Athlete with Risk of Female Athlete Triad. *Jurnal Sains Sukan & Pendidikan Jasmani*, 2022;(11): 82–87. <https://doi.org/10.37134/jsspj.vol11.sp.10.2022>
40. Heikura IA, Stellingwerff T, Areta JL. Low energy availability in female athletes: From the lab to the field. *European Journal of Sport Science*, 2022;22(5): 709–719. <https://doi.org/10.1080/17461391.2021.1915391>

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