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Original Article

Correlation of Physical Fitness with Sleep Quality and Perceived Stress Levels in Females with Premenstrual Syndrome

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ABSTRACT

Objective: To find out the correlation of physical fitness with sleep quality and perceived stress levels in females with Premenstrual Syndrome.
Study Design: Analytical cross-sectional study.
Place and Duration of Study: Shifa Tameer-e-Millat University Islamabad, Pakistan from May to Aug 2024.
Methodology: A total of 377 female students (18-28 years) were selected through non-probability convenience sampling. University students who were married, or using any other medications and those who did not fall under the criteria of Premenstrual Syndrome were excluded. A self-structured demographics questionnaire, Premenstrual Syndrome diagnostic criteria based on American College of Obstetrics and Gynecology guidelines, Perceived Sleep Quality Index and Perceived Stress Questionnaire were used in this study. For the assessment of cardiorespiratory fitness, 20 m shuttle run test was performed, while muscle strength was assessed through Manual Muscle Testing. Speed and flexibility were determined by 4×10 m running test and sit and reach test respectively.
Results: Of 377 females the mean age and BMI of the participants were 21.05±1.5 (years) and 21.13±3.6 (kg/m^2) respectively. The study found weak, non-significant correlations between VO2max and sleep quality (r=-0.03, *p*=0.63) and perceived stress (r=0.13, *p*=<0.01). Upper limb strength showed weak, non-significant correlations with sleep quality (r=-0.09, *p*=0.88) and perceived stress (r=0.06, *p*=0.23). Lower limb strength had very weak, non-significant correlations with sleep quality (r=-0.16, *p*=0.04) and perceived stress (r=-0.03, *p*=0.57). Agility had a weak, non-significant negative correlation with sleep quality (r=-0.04, *p*=0.49) and a weak, significant correlation with perceived stress (r=0.15, *p*=0.01). Flexibility showed weak, non-significant correlations with sleep quality (r=-0.10, *p*=0.05) and a weak, significant correlation with perceived stress (r=0.15, *p*=<0.01).
Conclusion: The study found that physical fitness had weak and statistically non-significant correlations with sleep quality and perceived stress in females with Premenstrual Syndrome.

Keywords: Perceived Stress, Physical Fitness, Premenstrual Syndrome, Sleep Quality, VO2max.

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INTRODUCTION

Premenstrual syndrome (PMS) encompasses a cyclic phenomenon of somatic and affective symptoms during the luteal phase and terminates within the 4 days of onset of menstruation. Common symptoms of PMS include breast tenderness, headache, abdominal bloating, swelling of extremities, depression, anxiety, anger, irritability, confusion and social withdrawal.[1] Studies have shown global prevalence of PMS to be 47.85%. In Pakistan, a study reported that nearly 80% females are affected by PMS symptoms in their reproductive years.[2]

The exact cause of PMS is unidentified but changes in hormones which take place during the menstrual cycle are thought to play an integral part.[3] Females experiencing PMS symptoms tend to have poorer overall quality of life, reduced work productivity and increased work absenteeism than those females without PMS.[1]

Physical fitness is a condition of well-being and health that refers to the person's capacity to engage in sports and daily activities.[4] Studies have found that the parameters of physical fitness remained concerningly low among females with menstrual disorders.[5]

Sleep is essential for one's physical and mental health. The prevalence of sleep disturbances in PMS is 66%.[6] Physical fitness can have a complex relationship with sleep in women with menstrual related disorders. Women who are physically fit may experience better sleep quality.[6]

Stress has been identified as a leading factor to exaggerate PMS symptoms.[7] Studies have consistently

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linked physical fitness with improved psychological resilience and overall quality of life in healthy individuals.[8]

Physical fitness has a significant beneficial effect on the body, and also prevents PMS.[9,10] It is an important aspect of wellbeing for everyone yet literature is limited in females with menstruation problems.

Therefore, this study aimed to determine the correlation between physical fitness, sleep quality, and perceived stress in females experiencing premenstrual syndrome.

METHODOLOGY

This analytical cross-sectional study was conducted at Shifa Tameer-e-Millat University Islamabad, Pakistan from May to Aug 2024, after taking approval from Institutional Review Board and Ethics Committee (IRB# 066-24).

Inclusion Criteria: Unmarried females with aged 18 to 28 years, with regular menstrual cycles and had a consistent pattern of PMS symptoms over at least two consecutive menstrual cycles were included.

Exclusion Criteria: Females using medications affecting their sleep, stress and fatigue, with any other menstrual problem, and females with history of psychiatric or sleep problems were excluded.

Females were diagnosed initially using the ACOG criteria for PMS as mentioned in Table-I.[11,12] To confirm the diagnosis, each participant underwent an assessment by a qualified gynecologist. The gynecologist reviewed the participants' medical history, symptoms, and menstrual cycle patterns to ensure the presence of PMS.

Sample size was calculated through Rao software using standard prevalence of 50%. This came to 377 females Data was collected using non-probability convenience sampling technique from different departments of the university, after obtaining informed consent.

Demographic data of the participants was obtained. Pittsburgh Sleep Quality Index Questionnaire (PSQI) and Perceived Stress Questionnaire (PSQ) were utilized to assess sleep quality and stress levels as they are highly valid and reliable tools for the said purpose.[13,14]

The 7 components of PSQI are habitual sleep activity, sleep delay, sleep duration, habitual sleep activity, disorder of sleep, sleeping pill utilization and daily function impairment. In addition to rating their overall sleep quality, respondents were asked how frequently they had encountered specific sleep difficulties over the previous month. PSQI Score from 0-21 represents good sleepers, whereas PSQI >5 represents poor sleepers.[13] PSQ is a 30-item self-reported questionnaire in which higher score suggests higher levels of stress. A total score was calculated by totaling each factor. A score between 0 and 1 which can be categorized as mild, moderate and severe, is obtained by deducting 30 from the initial value and dividing result by 90 to obtain final PSQ score.[14]

As per reported evidence physical fitness encompasses a range of components essential for overall health and well-being. These include cardiorespiratory fitness and endurance, muscular flexibility, strength and agility.4 20-meter Shuttle Run test was utilized to assess the cardiorespiratory fitness, the individuals were instructed to run between two lines 20 meters distant while following audio signals. The test was terminated when an individual failed to reach the end lines simultaneously with the audio signals. The beep test measures aerobic fitness by tracking how many 20 m shuttles a person can complete at increasing speeds. Participants score is the last full level they can finish before falling behind. The level score was translated into a VO_2max equivalent using a standardized conversion method outlined in the protocol of the 20-meter shuttle run test.[15] For sit-and-reach test to measure flexibility participants were instructed to sit without shoes, with knees fully bent, arms properly stretched, and palms down. With feet flat against the horizontal transverse bar of the tool and the inside edges of the soles placed 2 cm from the scale. Next, participants were instructed to bend and stretch forward without shaking while using their fingertips to push the slide marker as far as they could along the scale. The score is the farthest distance (in cm or inches) reached with the fingertips during the test. The test was recorded thrice the average.[16]

Manual Muscle Testing was used to assess the strength of the participants. Flexors, extensors, supinator, pronators, adductors and abductors of upper limb and lower limb were tested in grade 4 and grade 5 of manual muscle testing.[17] Agility was assessed through 4*10 m running test. This procedure consisted of four sets that involved running both ways between points A and B, which were 10 meters (33 feet) apart for an overall distance of 40 meters (4*10m) while measured. A stop watch was used to check how long the individual required to finish both the initial

and second sets of runs in seconds rounded to the closest one and compared with the normative values available for healthy adults.[18]

Data analysis was done using Statistical Package for Social Sciences (SPSS) version 23. Qualitative data was expressed as frequencies (%) along with bar charts. Whereas, quantitative data was expressed as means and standard deviation. To check the normality of data Shapiro-wilk test was applied on outcome variables data was found to be non-normally distributed, therefore, the test of choice was Spearman Correlation. A *p*-value ≤0.05 was considered statistically significant.

RESULTS

Out of total 377 the mean age and BMI of the participants were 21.0±1.5 (years) and 21.1±3.6 (kg/m2) respectively. Mean age of menarche of the participants was 13.1±1.3 (years).

On the assessment of VO_2max by 20-meter shuttle run test, majority 376(99.7%) of the participants reported having very poor VO_2max whereas only 1 (0.3%) participant reported poor VO_2max. The mean VO2max of the participants was 20.3±2.2 (ml/kg/min). Manual Muscle Testing (MMT) revealed that the mean strength of upper limb and lower limb was 4.6±0.4 and 4.6±0.5 respectively. The 4×10-meter run test reported that majority of females 162(43%) had good agility followed by 94(24.9%) participants with average agility. While 72(19.1%) participants reported excellent agility. Poor and fair agility was reported by 11(2.9%) and 38(10.1%) of the participants respectively. The mean agility of the participants was 1.7±0.3 (m/sec). The assessment of flexibility by sit and reach test reported that 310(82.20%) participants out of 377 have super flexibility while 59(15.6%) respondents reported excellent flexibility. On the other hand, very poor and good flexibility was equally reported by 4(1.10%) participants. The mean flexibility of the respondents was 13.5±2.8 (inches).

Pittsburgh sleep quality index (PSQI) showed that majority of females 198(52.5%) fell in to the category of good sleep followed by poor sleep as shown in Figure-1.

On the assessment of stress by perceived stress questionnaire (PSQ), 253(67.1%) respondents out of 377 reported moderate stress followed by mild and severe stress respectively.

The correlation between VO_2max with perceived stress was weak and statistically significant as shown in Table-II. Likewise, the relationship of lower limb muscle strength with sleep quality was weak and statistically significant.

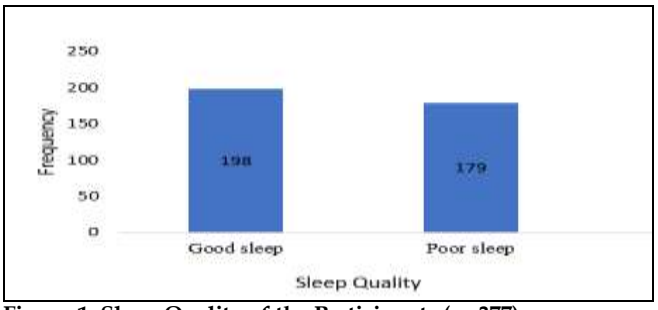


Figure-1: Sleep Quality of the Participants (n=377)

Table-I: American College of Obstetrics and Gynecology Criteria to Diagnose Premenstrual Syndrome (PMS)

Diagnostic Criterion	Description
Symptom Timing	Symptoms should appear during the second half of the menstrual cycle (luteal phase) and subside a few days after menstruation begins.
Emotional Symptoms	Includes feelings such as irritability, anxiety, mood swings, or depression.
Physical Symptoms	Common physical symptoms include fatigue, bloating, breast soreness, or headaches.
Consistency of Symptoms	Symptoms must be experienced over at least two consecutive cycles to confirm regularity.

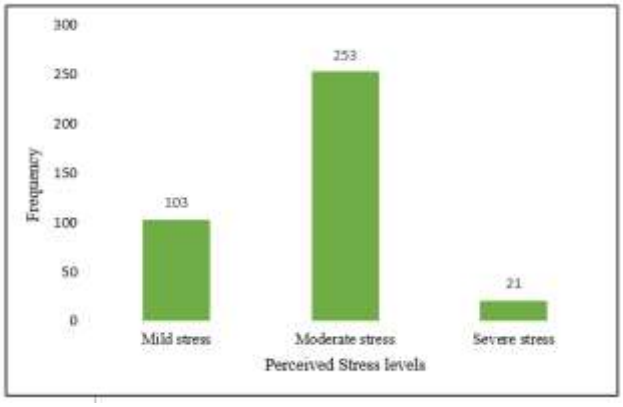


Figure-2: Perceived Stress of the Participants (n=377)

Furthermore, agility of participants showed weak negative and non-significant correlation with sleep quality. There was a weak yet statistically significant correlation (r=0.15, *p*=0.01), with perceived stress suggesting a slight increase in stress with higher speed. Flexibility of participants had weak and non-significant negative correlation with sleep quality. There was a weak and statistically significant correlation (r=0.15, *p*=<0.01) with perceived stress, suggesting higher flexibility was associated with increased stress.

Table-II: Correlation of Physical Fitness with Sleep Quality & Perceived Stress in Females with Premenstrual Syndrome (n=377)

Physical fitness components	Variables	r-value	*p*-value
VO_2max	Sleep quality	-0.03	0.63
	Perceived stress	0.13	<0.01
Upper limb muscle strength	Sleep quality	-0.09	0.88
	Perceived stress	0.06	0.23
Lower limb muscle strength	Sleep quality	-0.16	0.04
	Perceived stress	-0.03	0.57
Agility	Sleep quality	-0.04	0.49
	Perceived stress	0.15	0.01
Flexibility	Sleep quality	-0.10	0.05
	Perceived stress	0.15	<0.01

DISCUSSION

Research on women's health has seen remarkable advancements in recent years.[19] Premenstrual syndrome (PMS) remains a prevalent issue among women of reproductive age, often leading to significant distress and disruptions in daily life.[1] In premenstrual syndrome, hormonal fluctuations affect sleep and increase stress levels.[20] The current study aimed to investigate the correlation of physical fitness with sleep quality and perceived stress in females with premenstrual syndrome. Understanding these relationships is critical, as improving physical fitness may offer a promising approach to managing PMS symptoms and enhancing overall quality of life.

Present study results showed that the correlation of physical fitness with sleep quality was weak and non-significant suggesting that higher physical fitness levels were associated with slightly poorer sleep quality. A cross-sectional study conducted by Mochon-Benguigui *et al*. in 2021 reported no correlation was found between these factors.[21] These findings are consistent with the current study. However, a study conducted by Safaringga *et al*. in 2018 showed that there's a significant correlation between physical fitness and sleep quality. These findings are inconsistent with the current study findings.[22] The difference in the results might be due to different instrument or test used to measure physical fitness score and physical activity levels.

The present study also found a non-significant correlation between physical fitness and perceived stress levels, suggesting that, within this population, fitness levels may not have a direct influence on stress perception. Jeoung *et al*. conducted a study in 2021 to find out the correlation between physical fitness and perceived stress in young adults. The study assessed VO_2max, strength, agility, and flexibility. The study found statistically non-significant correlation of physical fitness with perceived stress levels. These findings are supported by the current study's findings.[23] With contrast to current study results a study conducted by Kaur *et al.* reported significant correlation between perceived stress and endurance, as well as between perceived stress and strength. Additionally, a weak, non-significant correlation was observed between perceived stress and flexibility.[24] These results are inconsistent with current study findings except flexibility. The reason for these variations in results might be due to participants characteristics (Premenstrual syndrome females were included in the current study whereas previous study was done on young healthy individuals of both gender), sample size (Current study sample=377 PMS females, previous study=120 young adults) and differences in the objective measurement tools (Previous study used dynamic sit up test, plank test and trunk lift test). Additionally, cultural or environmental influences on stress perception and physical fitness could played a role in the observed differences.

In another study reported a statistically significant correlation between physical fitness and stress. These results did not align with the results of the current study.[25] The disparities in the results of these two studies might be due to environmental factors influencing stress levels differently.

LIMITATIONS OF STUDY

The study had few limitations. Initially, a hand-held dynamometer was planned to assess the upper limb muscle strength but due to its unavailability, manual muscle testing (MMT) was used. This current study was a cross-sectional study where the data was collected at one time, so the participant's cardiorespiratory fitness at the time of menstruation was not assessed.

CONCLUSION

The study found that physical fitness had weak and statistically non-significant correlations with sleep quality and perceived stress in females with Premenstrual Syndrome.

Conflict of Interest: None.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

NA & MF: Conception, study design, drafting the manuscript, approval of the final version to be published.

SS & MN: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

II & RS: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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