

ORIGINAL RESEARCH

PHYSICAL MEDICINE

Prevalence of pelvic crossed syndrome and its impact on physical activity of female undergraduates with primary dysmenorrhea

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ABSTRACT

Background: Pelvic Crossed Syndrome (PCS) is a musculoskeletal imbalance that may influence menstrual disorders like primary dysmenorrhea, potentially affecting physical activity in young females. This study aims to analyse the relationship between them and their impact on levels of physical activity.

Objective: To quantify the prevalence of Pelvic Crossed Syndrome (PCS) and to evaluate its association with, and impact on, physical activity among female undergraduate students with primary dysmenorrhea.

Methodology: A cross-sectional observational study was carried out at the University of Lahore. 160 participants were selected through convenience sampling. Participants were assessed through a pre-test questionnaire. The presence of PCS was determined according to Pelvic Dysfunction Questionnaire (PDQ) criteria that were content-validated by expert physiotherapists. SPSS version 27 was used. An independent samples t-test was used to compare age, BMI, and physical activity between those with and without PCS, while a one-way ANOVA assessed associations between dysmenorrhea severity and these variables. Binary logistic regression was applied to evaluate the association of PCS with physical activity levels.

Results: PCS was found in 38.75% of participants with primary dysmenorrhea. Among them, 19% had mild, 23% moderate, and 62% severe dysmenorrhea. Regarding activity levels, 14.4% were highly active, 35% moderately active, 30.6% had low activity, and 20% were inactive. PCS was significantly associated with both lower physical activity ($P = 0.026$) and higher BMI ($P = 0.038$). Additionally, dysmenorrhea severity was significantly related to BMI ($P = 0.01$) and activity levels ($P = 0.03$).

Conclusion: The findings demonstrate a significant association between Pelvic Crossed Syndrome and both the severity of dysmenorrhea and reduced physical activity levels. These coexisting conditions may exacerbate each other, reinforcing the need for multidisciplinary approaches, including postural correction and lifestyle interventions in managing menstrual pain.

Abbreviations: IPAQ-SF: International Physical Activity Questionnaire - Short Form, PCS: Pelvic Crossed Syndrome, PD: Primary dysmenorrhea, PDQ: Pelvic Dysfunction Questionnaire, WaLIDD: Working ability, Location, Intensity, Days of pain, and Dysmenorrhea

Keywords: Pelvic Crossed Syndrome, Primary Dysmenorrhea, Physical Activity

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1. INTRODUCTION

Primary dysmenorrhea (PD) is characterized by cramping, painful lower abdominal sensations that precede or accompany menstruation in the absence of pelvic pathology. It is one of the most frequent gynecological conditions among adolescents and young women of reproductive age, with a global prevalence ranging between 45% and 95%.¹⁻³ Beyond abdominal pain, women often experience secondary symptoms such as backache, lethargy, bloating, nausea, and reduced concentration, which can substantially impair both physical functioning and academic performance.⁴ The underlying mechanism is primarily prostaglandin-mediated uterine contractions, peaking within the first 24-72 hours of menstruation. While hormonal factors are well documented, increasing attention has been directed toward musculoskeletal and neuromechanical contributors to PD.^{5,6} Sedentary lifestyles, particularly common among students, further predispose women to posture-related dysfunctions that may exacerbate menstrual pain.⁷

One musculoskeletal factor of growing relevance is Pelvic Crossed Syndrome (PCS). PCS is a neuromuscular imbalance marked by tight hip flexors and lumbar extensors, accompanied by weakness of the gluteal and abdominal muscles. This imbalance contributes to anterior pelvic tilt, exaggerated lumbar lordosis, and dysfunction at the sacroiliac and lumbosacral joint.^{8,9} Such biomechanical alterations can reproduce or intensify menstrual-related lower back and pelvic pain.¹⁰ A high prevalence of PCS-related features, such as iliopsoas tightness, has been documented in young women, particularly among those with low physical activity levels.¹¹

Emerging evidence suggests a possible interaction between PCS and PD. Mahishale and Bhattarai (2023) reported that nearly one-third of women with both conditions demonstrated markedly lower levels of physical activity.¹² Similarly, Vilšinskaitė et al. (2019) highlighted that physical inactivity can act both as a cause and a consequence of menstrual pain, reinforcing a cycle of pain, reduced activity, and musculoskeletal

dysfunction.¹³ These interrelated conditions may produce significant limitations in daily functioning, particularly within academic settings where prolonged sitting is common.^{14,15} Students with both PD and PCS may adopt compensatory postures that further tighten hip flexors and weaken gluteal muscles, perpetuating the disorder.^{8,9}

Despite the high prevalence of PD and PCS individually, few studies have explored their concurrence, particularly in young adult university populations. Most prior work has focused either on general or clinical cohorts, overlooking the unique vulnerabilities of students, whose sedentary habits and psychosocial stress may increase susceptibility to both conditions.^{12,13} This represents a critical research gap, as understanding the overlap between PCS and PD in this population is essential to inform early detection and targeted interventions. Addressing this gap may enable physiotherapists and clinicians to implement posture correction and core-strengthening strategies that can alleviate menstrual pain and improve quality of life.

1.1. Objective

This study aimed to quantify the prevalence of Pelvic Crossed Syndrome (PCS) and evaluate its association with, and impact on, physical activity among female undergraduate students with primary dysmenorrhea, at the University of Lahore.

2. METHODOLOGY

This research was carried out as a cross-sectional observational study over a period of six months after receiving ethical clearance and synopsis approval. The study was based on undergraduate female students at the University of Lahore, Defense Campus, to assess the prevalence of Pelvic Crossed Syndrome (PCS) and its influence on physical activity in patients with primary dysmenorrhea.

160 participants were selected using a convenience sampling technique. Given the study's institutional setting and logistical considerations, this non-probability method enabled efficient access to the target population.

However, as with all convenience samples, this may affect the extent to which the findings can be generalized beyond the study context. Exclusion and inclusion criteria were employed to determine eligibility. Eligibility was based on participants being female undergraduate students who were 17 to 25 years old, had complained of menstrual pain and associated symptoms for at least six consecutive months, and were regular physical activity users. This covered any regular kind of activity such as walking, sports, or exercise, rather than strictly planned training programs.^{16,17} Exclusion criteria were individuals who had a diagnosis of secondary dysmenorrhea, surgery of the abdomen or pelvis, chronic conditions such as cardiovascular disease, diabetes, or autoimmune disorders, congenital musculoskeletal deformities such as hip dysplasia or uneven leg lengths, severe musculoskeletal trauma such as fractures, or any diagnosed psychiatric disorder that may influence pain perception or level of physical activity.^{1,18,19}

The presence of PCS was determined according to PDQ criteria that were content-validated by professional physiotherapists. Participants whose answers fit the criteria for muscular imbalance patterns (tight hip flexors and lumbar extensors, weak gluteal and abdominal muscles) were categorized as having PCS. Data were collected using a four-section standardized questionnaire: demographic information, WaLIDD Scale, Pelvic Dysfunction Questionnaire (PDQ), and International Physical Activity Questionnaire - Short Form (IPAQ-SF). Written informed consent from the participants was obtained before data collection.

WaLIDD Scale (Working ability, Location, Intensity, Days of pain, and Dysmenorrhea) was used to ascertain the severity of primary dysmenorrhea. It has been reported with high internal consistency (Cronbach's alpha = 0.92) and construct validity in previous research. The PDQ was a self-report questionnaire specially designed for this research to measure the symptoms of pelvic dysfunction according to PCS. It was made content valid by expert physiotherapist review, and reliability testing yielded acceptable internal consistency (Cronbach's alpha = 0.84). Physical activity was measured by IPAQ-SF, a universal and validated questionnaire. It measures physical activity in MET-minutes/week and has demonstrated good test-retest reliability ($r = 0.76-0.88$) and acceptable criterion validity.

2.1 Statistical Analysis

All analysis was undertaken utilising SPSS version 26. All questionnaires were fully completed by participants, and no missing data were observed; therefore, no imputation methods were required. Descriptive statistics such as percentages, frequencies, means, and standard

deviations were employed to describe the demographic features and clinical features of the participants. To examine differences in BMI, age, and physical activity levels between participants with and without Pelvic Crossed Syndrome (PCS), an independent samples t-test was applied. Additionally, a one-way ANOVA was conducted to assess the association between dysmenorrhea severity (based on WaLIDD score) and the continuous variables age, physical activity, and BMI. When the ANOVA results were significant, post-hoc comparisons were performed using Tukey's HSD test to identify specific group differences. Furthermore, binary logistic regression analysis was performed to evaluate whether the presence of PCS could predict lower physical activity levels. The results were expressed as odds ratios (OR) with 95% confidence intervals (CI). A $P < 0.05$ was considered statistically significant.

1. RESULTS

160 female undergraduate students aged 17-25 years were involved in the study. The mean age, mean height and weight and mean BMI are given in Table I. 62.5% had a normal BMI, and 15.6% were underweight, another 18.75% overweight, and 3.1% obese (Figure I).

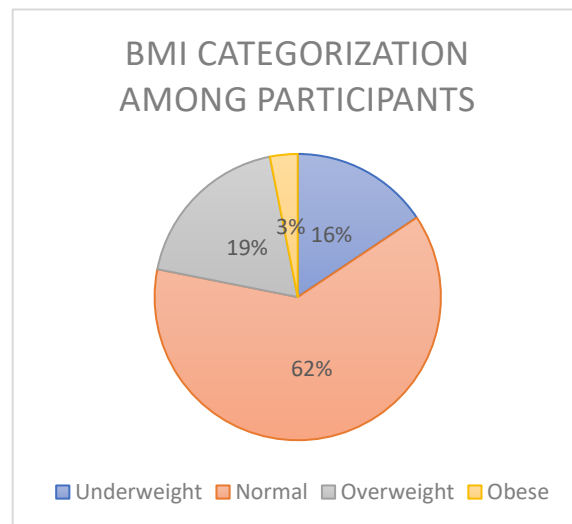


Figure I: BMI Categorization among participants

The majority (80%) of participants had a regular menstrual cycle, and 20% had irregular cycles. Based on IPAQ activity levels, 35% of the total sample had moderate activity, 30.6% low activity, 14.4% high activity, and 20% no activity at all (Table 2).

WaLIDD scale indicated that 41.25% of the participants suffered from severe dysmenorrhea, 39.38% had moderate, and 19.38% mild pain. On the Pelvic Dysfunction Questionnaire (PDQ), 60% of the participants had mild to moderate dysfunction, and 40%

Table 1: Demographic Profile

| Variable | Mean ± SD | Median (IQR) |
|--------------------------|---------------|----------------|
| Age (years) | 21.62 ± 1.74 | 22.00 (2.75) |
| Height (cm) | 162.23 ± 6.88 | 162.00 (43.20) |
| Weight (kg) | 58.56 ± 10.34 | 58.00 (55.00) |
| BMI (kg/m ²) | 22.62 ± 3.97 | 22.40 (21.00) |

Table 2: Menstrual and physical activity profile of participants

| Category | N (%) |
|---------------------------------------|------------|
| Menstrual Cycle Regularity | |
| • Regular | 128 (80.0) |
| • Irregular | 32 (20.0) |
| Physical Activity Level (IPAQ) | |
| • Low | 49 (30.6) |
| • Moderate | 56 (35) |
| • High | 23 (14.4) |
| • Inactive | 32 (20) |

Table 3: Severity of Dysmenorrhea (WaLIDD) and Pelvic Dysfunction (PDQ)

| Classification | Score Range | n (%) |
|---------------------|-------------|------------|
| WaLIDD Score | | |
| Mild | | 31 (19.38) |
| Moderate | 1–4 | 63 (39.38) |
| Severe | 5–7 | 66 (41.25) |
| PDQ Score | | |
| Mild to Moderate | 20–40 | 36 (60) |
| Severe | 41–60 | 24 (40) |

Note: Pelvic Crossed Syndrome was present in 38.75% of participants (n = 62).

had severe dysfunction. In total, 38.75% of the participants (n = 62) were diagnosed with Pelvic Crossed Legs Syndrome. However, when stratified by dysmenorrhea severity, the distribution showed a clear

Table 4: Comparison of PCS status with demographic characteristics

| Variable | PCS Present (n = 62) | PCS Absent (n = 98) | P-value |
|--------------------------|----------------------|---------------------|---------|
| Age (years) | 21.77 ± 1.65 | 21.29 ± 1.67 | 0.074 |
| BMI | 23.40 ± 4.59 | 22.08 ± 3.44 | 0.038 |
| Physical Activity (IPAQ) | 958.92 ± 1175.55 | 1417.00 ± 1303.81 | 0.026 |

overlap, indicating that PCS prevalence increased with higher severity levels. Specifically, only 19.3% of participants with mild dysmenorrhea reported PCS, compared to 23.8% in the moderate group, while the prevalence sharply increased to 62.1% among those with severe dysmenorrhea. This pattern suggests a potential interaction between the severity of dysmenorrhea and the presence of PCS, supporting our research aim to explore this relationship.

Participants with PCS had a higher mean BMI (23.40 ± 4.59 kg/m²) compared to those without PCS (22.08 ± 3.44 kg/m²; P = 0.038) and reported lower physical activity levels (958.92 ± 1175.55 vs. 1417.00 ± 1303.81 MET-min/week; P = 0.026). No significant age difference was observed between PCS (21.77 ± 1.65 years) and non-PCS participants (21.29 ± 1.67 years; P = 0.074) (Table 4).

A one-way ANOVA was conducted to compare age, BMI, and physical activity across dysmenorrhea severity groups (mild, moderate, severe). The analysis revealed significant differences in BMI (P = 0.01) and physical activity (P = 0.03), but not in age (P = 0.21). Participants with severe dysmenorrhea had the highest mean BMI (23.68 ± 4.36 kg/m²) compared with those in the moderate (21.83 ± 3.61 kg/m²) and mild (21.67 ± 2.96 kg/m²) groups. Post-hoc comparisons showed that BMI was significantly higher in the severe group compared with the moderate group (P = 0.04) and borderline higher compared with the mild group (P = 0.05).

For physical activity, women with moderate dysmenorrhea reported the lowest mean activity level (780.93 ± 1131.36 MET-min/week), compared with those with mild (1536.97 ± 1507.99) and severe dysmenorrhea (1132.92 ± 1404.55). Post-hoc analysis using Tukey's HSD test revealed significant differences in BMI and physical activity levels across dysmenorrhea severity groups. Specifically, BMI was significantly higher in participants with severe dysmenorrhea compared to those with moderate (P = 0.04) and mild (P = 0.05) symptoms. Similarly, physical activity levels were significantly lower in the moderate group compared to the mild group (P = 0.03), while differences between other severity groups were not statistically significant. No significant differences were observed in

age across severity categories. These results demonstrate a clear association between increased BMI, reduced physical activity, and greater dysmenorrhea severity (P > 0.05) (Table 5). Post-hoc test results are presented in Table 6.

Table 5: Association of Dysmenorrhea Severity (WaLIDD) with demographic and lifestyle variables

| Variable | Mild | Moderate | Severe | P-value |
|--------------------------|--------------------|------------------|-------------------|---------|
| Age (years) | 21.29 ± 1.64 | 21.81 ± 1.68 | 21.23 ± 1.72 | 0.21 |
| BMI | 21.67 ± 2.96 | 21.83 ± 3.61 | 23.68 ± 4.36 | 0.01 |
| Physical Activity (IPAQ) | 1536.968 ± 1507.99 | 780.93 ± 1131.36 | 1132.92 ± 1404.55 | 0.03 |

Data are presented as mean ± SD; P < 0.05 is considered as significant

Table 6: Post-hoc test

| Variable | Comparisons | Mean ± SD | P-value |
|--------------------------|--------------------|-------------------|---------|
| Age | Mild vs moderate | 0.461 ± 0.364 | 0.623 |
| | Moderate vs severe | 0.486 ± 0.296 | 0.30 |
| | Mild vs severe | 0.024 ± 0.361 | 1.00 |
| | Mild vs moderate | 0.320 ± 0.849 | 1.00 |
| BMI | Moderate vs severe | 1.680 ± 0.690 | 0.04 |
| | Mild vs severe | 2.000 ± 0.840 | 0.05 |
| Physical activity | Mild vs moderate | 729.518 ± 288.838 | 0.03 |
| | Moderate vs severe | 351.005 ± 234.692 | 0.41 |
| | Mild vs severe | 378.513 ± 285.843 | 0.56 |

Table 7: Binary logistic regression analysis of PCS as a predictor of physical activity

| Variable | Regression Coefficient | Standard Error | Wald X ² | p-value | EXP(B) | 95% CI |
|----------|------------------------|----------------|---------------------|---------|--------|------------|
| PCS | -0.720 | 0.334 | 4.658 | 0.031 | 0.487 | 0.253-0.93 |

of reduced physical activity levels (P = 0.031). Participants with PCS were 51.3% less likely to engage in higher physical activity compared to those without PCS (OR = 0.487, 95% CI = 0.253-0.936) (Table 7).

3. DISCUSSION

The purpose of this study was to assess the prevalence of Pelvic Crossed Syndrome (PCS) and its relationship with physical activity levels among young women experiencing primary dysmenorrhea. The results reveal a PCS prevalence of 38.75%, compared with the 28.5% identified by Mahishale and Bhattarai (2023). This higher prevalence can be explained by the characteristics of our study population, as university students are often more prone to sedentary behaviors, prolonged sitting, and reduced structured physical activity, all of which can contribute to the development of musculoskeletal imbalances associated with PCS.¹²

In addition, participants with PCS demonstrated significantly lower physical activity levels (P = 0.026)

and higher BMI (P = 0.038). These findings suggest that PCS may not only co-occur with dysmenorrhea but also be influenced by inactivity and excess weight, both of which can intensify musculoskeletal imbalance and worsen symptom severity.

The logistic regression results reinforce this association, indicating that PCS independently predicted lower physical activity levels (P = 0.031). Specifically, the odds of reporting higher activity were substantially reduced among participants with PCS, suggesting that PCS may act as a contributing factor to reduced physical activity in women with dysmenorrhea rather than a coincidental finding. This aligns with existing literature on sedentary lifestyles and musculoskeletal dysfunction, underlining the need for early preventive and corrective strategies.

Furthermore, BMI (P = 0.01) and physical activity (P = 0.03) were both significantly associated with the severity of dysmenorrhea, with higher BMI and lower physical activity observed among women reporting more severe symptoms. This emphasizes the role of lifestyle-related

factors in shaping the clinical expression of dysmenorrhea.

Severe dysmenorrhea was most common in the highest BMI and lowest IPAQ scores, as was seen in a cyclical relationship between inactivity and pain by Vilšinskaitė et al. (2019).¹³ Interestingly, the moderate pain group showed the lowest physical activity levels, possibly reflecting reduced movement due to discomfort without the initiation of effective coping strategies or care. This nuanced pattern warrants further exploration.

In agreement with Das et al. (2017) and Sushmitha et al. (2020), our results support the hypothesis that core weakness and posture dysfunction amplify menstrual-related symptoms.^{9,20} This study expands upon previous research by providing quantitative data using standardized tools (WaLIDD and IPAQ-SF), while also incorporating the PDQ. Although the PDQ is an established instrument, the cutoff criteria were adapted for this study based on expert physiotherapist input. This adaptation represents a methodological limitation, as the modified cutoff lacks full external validation and may influence the robustness and generalizability of the findings.

In combination, the findings imply that PCS and dysmenorrhea can be more than independent disorders but could be interrelated via modifiable physical factors, including weight and activity. These conclusions support early physiotherapy screening, posture correction, and core strengthening as non-pharmacological treatments in dysmenorrhea patients.

Above all, the current study contributes by utilizing empirically validated questionnaire methodology that permits quantitative data to be elicited with minimal variability of subjective response. Lastly, population-specific focus on female university students, a group that is underrepresented in PCS research, confers originality and direct relevance to educational health interventions. By combining musculoskeletal and gynecological specialisms, the findings establish the multi-system effects of primary dysmenorrhea when combined with dysfunctions of the pelvis.

4. CONCLUSION

This research indicated that 38.75% of university women with primary dysmenorrhea had Pelvic Crossed Syndrome (PCS). PCS was significantly associated with lower levels of physical activity and higher BMI. The findings highlight that musculoskeletal dysfunction, such as PCS, may be linked to greater severity of menstrual pain, potentially contributing to increased physical limitations. These associations underscore the importance of early detection, postural assessment, and targeted physiotherapy treatment in women with

dysmenorrhea. Incorporating musculoskeletal screening alongside menstrual care could help reduce activity limitations and improve quality of life in this population.

5. LIMITATIONS

There are some limitations in the current study. A cross-sectional design prevents us from determining causality between PCS and reduced physical activity. Furthermore, the use of self-reported data gives recall or response bias. Moreover, the use of convenience sampling may introduce selection bias and limit the generalizability of findings beyond this single university population. This limitation is inherent to non-probability sampling methods and should be addressed in future research through more representative sampling strategies, such as stratified or random sampling across multiple sites. Another limitation of this study is the use of a self-designed Pelvic Dysfunction Questionnaire (PDQ) to assess PCS. Although the tool demonstrated acceptable internal consistency and was content-validated by expert physiotherapists, it has not undergone widespread external validation. This may restrict the comparability of findings with studies employing standardized diagnostic measures.

6. Recommendations

Future research must use longitudinal study designs to investigate causal relationships between PCS and physical activity. To validate PCS, it is necessary to include objective assessments of physical function, such as posture or muscle strength evaluations. Subsequent research must also account for psychological and behavioral factors. Finally, intervention trials focused on posture correction or physiotherapy may provide practical treatments for PCS in women with primary dysmenorrhea.

7. Data Availability

The data supporting this study are available from the authors upon reasonable request.

8. Funding

No external funding was received.

9. Conflict of Interest

The authors declare no conflict of interest.

10. Authors contribution

KM: Conceived and designed the study, recruited participants, conducted data collection, performed literature review,

interpreted data, prepared the initial draft, and coordinated revisions and manuscript editing until final approval.

SS: Provided academic supervision and mentorship, contributed to study design and methodology, critically reviewed drafts, ensured scientific accuracy, and approved the final version.

TZ: Critically reviewed the manuscript for important intellectual content, suggested revisions to strengthen arguments, and assisted in final editing.

SF: Assisted in participant management, data collection, organization of records, and initial data entry.

RA: Conducted statistical analysis, verified accuracy of results, and supported interpretation of findings.

ST: Provided subject-matter expertise, contributed to refinement of the discussion and conclusion, and approved the final draft.

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