

Systematic Review

Biopsychosocial Factors Associated with Dysmenorrhea among Young Women: A Systematic Review

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ABSTRACT

Introduction: Primary dysmenorrhea is one of the most common menstrual disorders among young women, characterized by high prevalence and a significant impact on quality of life and academic performance. This condition is associated not only with biological factors but also with psychological and behavioral aspects across multiple biopsychosocial domains.

Objective: To identify and synthesize risk factors associated with the severity of dysmenorrhea pain in young women across biological psychological, and social/behavioral domains.

Method: This systematic review included observational studies published between 2015 and 2025 and indexed in Scopus Q1-Q4. The review was conducted in accordance with PRISMA 2020. Article eligibility was determined using the PECO framework, and methodological quality was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies.

Result: Eight high-quality studies (JBI score 7–8) met the inclusion criteria. Biological factors, including early menarche, family history, menstrual characteristics, and body mass index, were associated with dysmenorrhea severity. Psychological factors, particularly stress, and behavioral factors, such as low physical activity, caffeine consumption, and smoking, were also associated with variations in pain severity. However, the associations between physical activity and dysmenorrhea showed inconsistent findings across studies. Differences in pain assessment instruments, scales, and severity definitions also contributed to heterogeneity.

Conclusion: These findings support a biopsychosocial perspective for understanding the multidimensional nature of dysmenorrhea pain; however, the cross-sectional evidence does not establish causality or interaction effects among these factors. Holistic approaches addressing potentially modifiable factors may inform future clinical and physical therapy interventions.

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INTRODUCTION

Primary dysmenorrhea is one of the most common gynecological conditions affecting young women and is associated with substantial physical, psychological, academic, and social

consequences (1), (3). Its occurrence and severity have been associated with multiple factors, including biological characteristics such as age at menarche, family history, menstrual patterns, and body mass index, as well as psychological and behavioral or lifestyle factors, including stress, physical activity, smoking, and caffeine consumption (4), (10). However, existing evidence has often examined these factors separately or focused on individual risk factors, limiting an integrated understanding of the biological, psychological, and social or behavioral factors associated with primary dysmenorrhea among young women. Therefore, this systematic review specifically focused on primary dysmenorrhea and excluded evidence related to secondary dysmenorrhea caused by identifiable underlying pathological conditions. Accordingly, this systematic review aimed to identify and synthesize biopsychosocial factors associated with primary dysmenorrhea among young women.

From an epidemiological perspective, primary dysmenorrhea is a reproductive health issue with a high prevalence worldwide, particularly among young women (5). The prevalence of dysmenorrhea is reported to be high globally; based on various recent meta-analyses, the global prevalence of dysmenorrhea reaches approximately 71.3%, confirming that this condition is a common reproductive health issue among young women through young adulthood (6). In Indonesia, the prevalence of dysmenorrhea among young women is also relatively high, with studies reporting prevalence ranging from approximately 54.89% to 64.5%, and some local studies reporting a prevalence exceeding 80%, with pain levels varying from mild to severe (7). This condition not only causes physical discomfort but also impacts daily activities, such as reduced concentration during study, increased school absenteeism, and a decline in quality of life (8). These findings indicate that primary dysmenorrhea has far-reaching effects and cannot be viewed merely as a physiological complaint.

Biologically, dysmenorrhea is closely linked to physiological mechanisms involving the hormonal system and the inflammatory response. Excessive prostaglandin production during the menstrual phase is known to increase uterine contractions, thereby triggering pain. Additionally, earlier age at menarche, the length and regularity of the menstrual cycle, and genetic factors also play a role in determining an individual's susceptibility to dysmenorrhea (9). The interaction of these various factors indicates that biological aspects make a fundamental contribution to the pathophysiology of menstrual pain.

In addition to biological factors, psychological conditions also play an equally important role in influencing pain perception and intensity (10). Stress, anxiety, and emotional imbalance can increase sensitivity to pain through neuroendocrine mechanisms involving the central nervous system (11). Individuals with high stress levels tend to have a lower pain threshold, so dysmenorrhea is experienced as more severe. Thus, an approach to dysmenorrhea cannot be separated from the accompanying psychological aspects.

Lifestyle factors and daily behaviors are also known to contribute to the occurrence and severity of dysmenorrhea. Lack of physical activity, unhealthy eating habits, smoking, excessive caffeine consumption, and poor sleep quality have been linked to increased menstrual pain intensity (12). Conversely, adopting a healthy lifestyle, such as regular exercise and a balanced diet, can provide a protective effect against dysmenorrhea (13). This suggests that modifiable factors present a significant opportunity for intervention.

Although the literature on dysmenorrhea continues to grow, previous systematic reviews have primarily focused on specific categories of risk factors or particular determinants of dysmenorrhea, resulting in evidence that remains fragmented across biological, psychological, and behavioral domains (14). For example, a previous meta-analysis synthesized the prevalence and general risk factors of primary dysmenorrhea among students, including menstrual, lifestyle, environmental, and psychological factors, but did not specifically synthesize factors associated with pain severity across these domains within an integrated framework (34). Consequently, there is still a need for a systematic synthesis that examines associations across multiple biopsychosocial domains within a single framework, particularly in relation to dysmenorrhea pain severity. Furthermore, differences in pain measurement instruments, outcome definitions, and sample characteristics across studies may contribute to heterogeneity and limit the comparability and generalizability of findings (15). A more integrative synthesis may therefore provide a clearer

understanding of the range and consistency of factors associated with dysmenorrhea pain severity, while avoiding assumptions about causal or interaction effects that have not been formally tested.

Therefore, this systematic review aimed to identify and synthesize evidence on risk factors associated with the severity of dysmenorrhea pain in young women, with consideration of biological, psychological, and social/behavioral domains. The findings are expected to contribute to the evidence base for a more comprehensive understanding of dysmenorrhea and provide a foundation for developing holistic, evidence-based approaches to clinical practice, particularly in physical therapy.

METHOD

This study employed a systematic review method to examine scientific articles relevant to the topic of dysmenorrhea in young women. A systematic review is a structured and explicit method for identifying, evaluating and interpreting the results of published research (16). This study was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement (17). The review protocol was not prospectively registered in PROSPERO, OSF, or any other publicly accessible repository. Therefore, the possibility of post hoc methodological decisions cannot be completely excluded. A comprehensive electronic literature search was conducted on January 9, 2026 across four databases: PubMed, Cochrane Library, Google Scholar, and DOAJ. The search strings were tailored to each database's syntax using Boolean operators. The search terms used in the initial database search were: ("dysmenorrhea" OR "primary dysmenorrhea") AND (adolescent OR young women) AND ("risk factor" OR "physical activity" OR "pain"). The specific biopsychosocial factors examined in the eligible studies were subsequently identified during title/abstract screening, full-text assessment, and data extraction. This approach allowed the review to assess biological, psychological, and social/behavioral factors within the predefined eligibility criteria without requiring each individual factor to be included as a mandatory search term.

Table-specific search filters were applied to identify English-language scientific articles published between 2015 and 2025. English-language studies were selected to ensure consistent interpretation during screening, data extraction, and critical appraisal, while full-text availability was required to obtain sufficient methodological and outcome information for eligibility assessment and data extraction. The restriction to English-language publications and studies with accessible full texts may have introduced language and availability bias by excluding potentially relevant evidence that was published in other languages or was not accessible in full text. The search retrieved a total of 128 raw records, distributed across databases as follows: PubMed (n = 52), Cochrane Library (n = 4), Google Scholar (n = 63), and DOAJ (n = 9). Google Scholar and DOAJ were explicitly included in the search architecture to mitigate potential publication bias and ensure comprehensive capture of relevant regional studies that may not yet be indexed in larger medical repositories.

Inclusion criteria included articles with observational designs (cross-sectional, cohort, case-control), a population of young women, a focus on risk factors for dysmenorrhea, and those indexed in Scopus (Q1–Q4). To fulfill the inclusion criterion requiring articles to be indexed within Scopus quartiles Q1–Q4, the quartile status and formal indexing of each journal were independently cross-verified through the official database of SCImago Journal & Country Rank (SJR) based on the journal's ISSN. Irrelevant articles, duplicates, and those without full text were excluded from the study.

Article eligibility was determined based on the PECO framework, defined as follows: P (Population) young women experiencing primary dysmenorrhea; E (Exposure) biological, psychological, and social/ behavioral factors; C (Comparison) different levels or absence of exposure when applicable; and O (Outcome) level, intensity, or severity of dysmenorrhea pain. Studies specifically investigating secondary dysmenorrhea or dysmenorrhea attributable to identifiable pathological conditions, such as endometriosis, pelvic inflammatory disease, or other structural pelvic abnormalities, were excluded. Studies including participants with dysmenorrhea without distinguishing between primary and secondary dysmenorrhea were excluded unless data

specific to primary dysmenorrhea could be separately identified and extracted. No specific pain assessment instrument, measurement scale, or severity threshold was required for eligibility, as eligible studies could use different validated or study-specific approaches to assess dysmenorrhea pain. However, the pain assessment method or instrument, measurement scale, threshold or categorization, and effect estimates were extracted and reported for each included study when available.

Although the initial inclusion criteria allowed for various observational designs, all final eligible articles ($n = 8$) utilized an analytical cross-sectional design. Therefore, the methodological quality of the included studies was rigorously evaluated using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies. The appraisal process was conducted independently by two reviewers. Any discrepancies or disagreements during the scoring process were resolved through collaborative discussion until a consensus was reached. Articles with a JBI score of ≥ 7 were categorized as high-quality methodology and included in the final qualitative synthesis. Subsequently, data from the selected articles were qualitatively and descriptively synthesized to analyze the factors associated with dysmenorrhea pain. Subsequently, data from the selected articles were qualitatively and descriptively synthesized to analyze factors associated with dysmenorrhea pain severity. The identified factors were grouped into three domains based on their primary characteristics: biological, psychological, and behavioral/social factors. The direction and consistency of associations were determined by comparing the reported effect estimates and statistical significance across studies; when adjusted and unadjusted estimates were both available, adjusted estimates were prioritized. Because the included studies used heterogeneous pain instruments, scales, and severity definitions, the findings were synthesized according to the reported outcome categories or continuous pain measures rather than applying a uniform threshold across studies.

RESULTS

The literature search was conducted using several scientific databases, namely PubMed, the Cochrane Library, Google Scholar, and DOAJ, using predetermined keywords. From the initial search results, a total of 128 articles were identified, comprising 52 from PubMed, 4 from the Cochrane Library, 63 from Google Scholar, and 9 from DOAJ. Subsequently, 6 duplicate articles were removed, leaving 122 articles for the initial screening stage.

In the first screening stage, articles were filtered based on the publication year and research design types; articles published before 2015 ($n = 10$) and those utilizing a systematic review design ($n = 14$) were excluded, leaving 98 articles for further evaluation.

During the subsequent screening stage based on titles and abstracts, 58 articles that did not meet the criteria for specific observational study designs (cross-sectional, cohort, or case-control) were excluded, leaving 40 relevant articles. The final filtration stage involved assessing journal quality and indexing status. Articles not indexed in Scopus ($n = 22$) and those not ranked within the Q1–Q4 quartiles ($n = 10$) were excluded. After completing all selection stages, 8 articles fully met the strict inclusion criteria and were identified for further qualitative synthesis in this study.

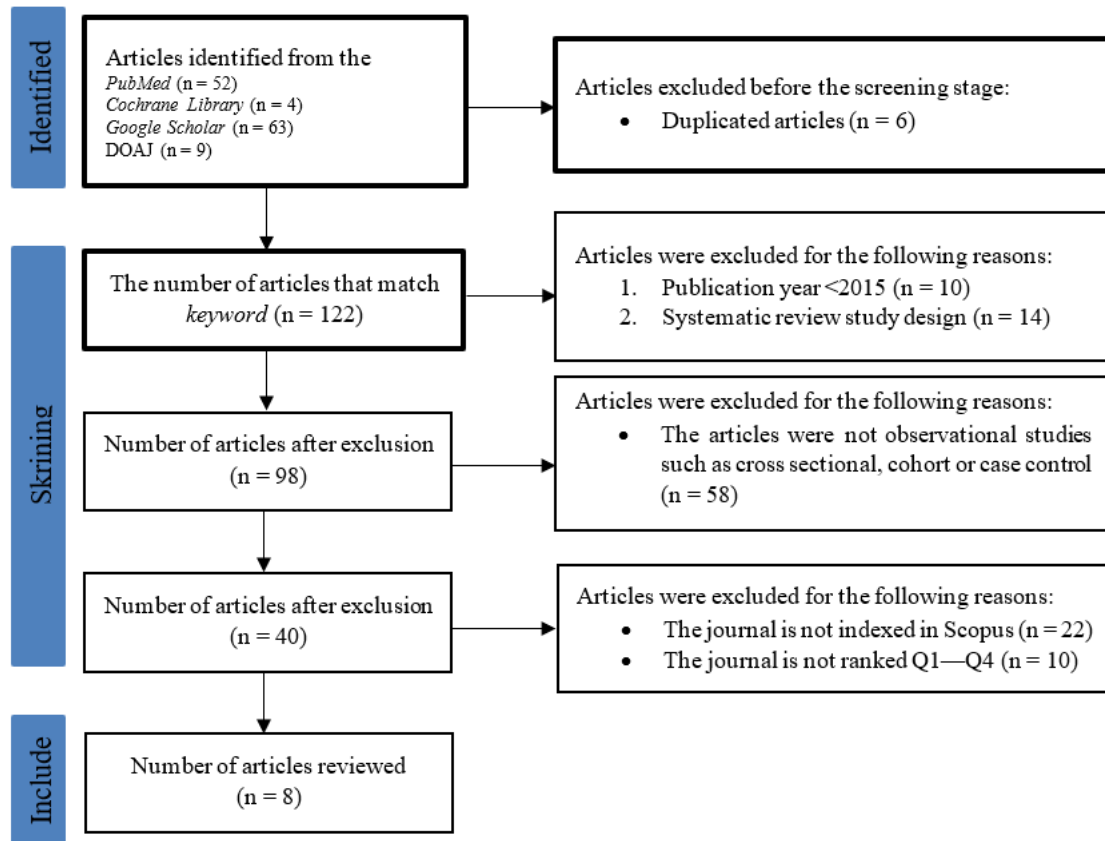


Figure 1. PRISMA Flow Chart

The following is a list of articles obtained from searches on several search engines and filtered based on several criteria.

Table 1. List of Articles

No	Title and Author	Year	Quartile	Summary of Key Findings	Source Link
1	Prevalence of Primary Dysmenorrhea and Factors Associated with Its Intensity among Undergraduate Students: A Cross-Sectional Study (Habibi <i>et al.</i> , 2015)	2015	Q2	The study included 311 undergraduate female students aged 18–27 years at Isfahan University of Medical Sciences, Iran. Younger age, positive family history, heavier menstrual bleeding, and shorter menstrual intervals were associated with greater dysmenorrhea intensity; however, specific OR/AOR/ β with 95% CI were not reported in the available results (NR). Pain intensity was assessed using a 0–10 Numeric Pain Rating Scale (NPRS), with pain categorized as mild (1–3), moderate (4–6), and severe (7–10). The prevalence of PD is high (~89%); associated factors include younger age, family history, heavier bleeding, and shorter menstrual cycles.	https://pubmed.ncbi.nlm.nih.gov/26328887/
2	Prevalence, Risk Factors, and Management Practices of Primary Dysmenorrhea among Young Females (Karout <i>et al.</i> , 2021)	2021	Q2	The study involved 550 young female university students from six universities in Lebanon. Heavy menstrual bleeding was strongly associated with primary dysmenorrhea (AOR 10.28), while family history (AOR 2.52), history of weight-loss attempts (AOR 2.05), and medical specialization (AOR 1.66) were also significant predictors; the corresponding 95% CIs should be extracted from the original regression table. Pain intensity was assessed using a 10-point Visual Analogue Scale (VAS), categorized as mild (1–3), moderate (4–7), and severe (8–10). Prevalence of PD: 80.9%; significant risk factors: severe bleeding (AOR $\approx$ 10.3), family history, attempts to lose weight; many do not seek formal medical care.	https://pubmed.ncbi.nlm.nih.gov/34749716/
3	Risk Factors for Primary Dysmenorrhea and the Effect of Complementary and Alternative Treatment Methods: Sample From Corum, Turkey (Duman <i>et al.</i> , 2022)	2022	Q3	The study included 180 female students aged ≥ 18 years at Hitit University, Çorum, Türkiye. Early menarche, menorrhagia, family history, smoking, caffeine consumption, and emotional problems were identified as potential risk factors; dysmenorrhea pain was assessed using a VAS (mean 5.99 ± 2.06), while OR/AOR/ β with 95% CI were not reported (NR). Dysmenorrhea pain was assessed using a 0–10 Visual Analogue Scale (VAS), with a mean pain score of 5.99 ± 2.06 ; no specific severity threshold was reported. Risk factors: early menarche, menorrhagia, family history, smoking, caffeine consumption, emotional issues; physical activity and complementary and alternative medicine (CAM) are evaluated as factors or modifiers.	https://pubmed.ncbi.nlm.nih.gov/35599944/



4	Prevalence of Dysmenorrhea and Associated Risk Factors among University Students in Zimbabwe (Nyirenda <i>et al.</i> , 2023)	2023	Q2	The study included 382 female undergraduate/postgraduate students aged 18–40 years at Midlands State University, Gweru, Zimbabwe. Positive family history was associated with dysmenorrhea (POR 1.68, 95% CI 1.03–2.75), whereas younger age at menarche (POR 0.19, 95% CI 0.10–0.45), higher parity (POR 0.15, 95% CI 0.03–0.82), and irregular menstrual cycles (POR 0.14, 95% CI 0.10–0.33) were associated with lower prevalence. Dysmenorrhea severity was assessed using self-reported pain severity through a structured questionnaire; however, a specific pain scale or numerical threshold was not reported. Prevalence: 75.9%; risk factors: family history, earlier age at menarche, regular cycles; no significant association with physical activity was found in this study.	https://pubmed.ncbi.nlm.nih.gov/37563987/
5	Role of Stress and Physical activity on Primary Dysmenorrhea: A Cross-Sectional Study (Triwahyuningsih <i>et al.</i> , 2024)	2024	Q3	The study involved 150 young women in Indonesia, with a mean age of approximately 21.3 ± 2.1 years. Stress was strongly positively correlated with dysmenorrhea pain intensity ($r = 0.782$, $p < 0.001$), whereas physical activity showed a strong negative correlation ($r = -0.748$, $p < 0.001$); OR/AOR/β with 95% CI were not reported (NR). Pain intensity was assessed using a 0–10 Numeric Rating Scale (NRS), categorized as no pain (0), mild (1–3), moderate (4–6), and severe (7–10). There is a significant association between stress levels and PD; low levels of physical activity are associated with greater pain intensity (multivariate results).	https://pubmed.ncbi.nlm.nih.gov/38798864/
6	Prevalence and Risk Factors of Primary Dysmenorrhoea among Indonesian Medical Students (Situmorang <i>et al.</i> , 2024)	2024	Q1	The study examined Indonesian medical students as the target population and investigated demographic, menstrual, anthropometric, physical activity, and nutritional factors associated with primary dysmenorrhea. The study was conducted in Indonesia, and the relevant associations were evaluated using multivariable analysis; the specific age range and adjusted effect estimates (OR/AOR/β with 95% CI) should be extracted directly from the original regression table rather than inferred from the abstract. Dysmenorrhea severity was assessed using the Verbal Multidimensional Scoring System (VMSS), ranging from Grade 0 (no pain) to Grade 3 (severe pain), with moderate-to-severe dysmenorrhea defined as the primary severity outcome. The prevalence of PD is very high ($\approx 91\%$); factors include age at menarche, BMI, and menstrual patterns; physical activity and nutrition are discussed as modifiable factors.	https://pubmed.ncbi.nlm.nih.gov/39477265/
7	Dysmenorrhea and Its Impact on Patients' Quality of Life-A Cross-Sectional Study (Amza <i>et al.</i> , 2024)	2024	Q2	The study included 504 women of reproductive age in Romania and examined dysmenorrhea characteristics and their impact on quality of life. Early menarche, family history, caffeine consumption, and low physical activity were evaluated as potential risk factors, while pain	https://pubmed.ncbi.nlm.nih.gov/39407720/



				intensity and other dysmenorrhea characteristics were associated with quality-of-life outcomes; specific OR/AOR/ β with 95% CI should be taken directly from the original analysis table. Pain intensity was assessed using a numerical 1–10 pain rating scale, with participants classified into mild, moderate, and severe pain categories; however, specific numerical thresholds for these categories were not reported. Reports of risk factors, including early menarche, family history, caffeine consumption, and lack of physical activity; dysmenorrhea has a significant impact on quality of life.
8	Prevalence of Dysmenorrhea and Associated Factors and Its Effect on Daily Academic Activities among Female Undergraduate Students of Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia (Belayneh <i>et al.</i> , 2023)	2023	Q2	The study included 348 female undergraduate students from Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia. Age at menarche, menstrual duration, family history, and other menstrual and lifestyle characteristics were examined as factors associated with dysmenorrhea and its severity, with the corresponding adjusted effect estimates and 95% CIs reported in the multivariable analysis. Pain severity was assessed using the Numeric Pain Rating Scale (NPRS) and the Verbal Multidimensional Scoring System (VMSS), with NPRS categories of mild (0–3), moderate (4–6), severe (7–9), and very severe (10), and VMSS grades of mild (Grade 1), moderate (Grade 2), and severe (Grade 3). High prevalence; significant factors include age at menarche, duration of menstruation, and family history; the study highlights the role of physical activity as a factor that warrants further investigation. https://pubmed.ncbi.nlm.nih.gov/38162010/

The following table presents the analysis using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies for the 8 articles analyzed in this study. The scoring scheme uses Yes (✓), No (X), and Unclear (?). The score is calculated based on the number of Yes (✓) responses, with a maximum score of 8.

Table 2. JBI Critical Appraisal

Title and Author	Clear Inclusion Criteria	Subject & Setting Explained	Valid Exposure Measurement	Valid Outcome Measurement	Confounding Factors Identified	Strategies for Addressing Confounding Factors	Reliable Outcomes	Accurate Statistical Analysis	Score	Quality
Prevalence of Primary Dysmenorrhea and Factors Associated with Its Intensity among Undergraduate Students: A Cross-Sectional Study (Habibi <i>et al.</i> , 2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8	High
Prevalence, Risk Factors, and Management Practices of Primary Dysmenorrhea among Young Females (Karout <i>et al.</i> , 2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8	High
Risk Factors for Primary Dysmenorrhea and the Effect of Complementary and Alternative Treatment Methods: Sample From Corum, Turkey (Duman <i>et al.</i> , 2022)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	7/8	High
Prevalence of Dysmenorrhea and Associated Risk Factors among University Students in Zimbabwe (Nyirenda <i>et al.</i> , 2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8	High
Role of Stress and Physical activity on Primary Dysmenorrhea: A Cross-Sectional Study (Triwahyuningsih <i>et al.</i> , 2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8	High
Prevalence and Risk Factors of Primary Dysmenorrhoea among Indonesian Medical Students (Situmorang <i>et al.</i> , 2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8	High
Dysmenorrhea and Its Impact on Patients' Quality of Life-A Cross-Sectional Study (Amza <i>et al.</i> , 2024)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	7/8	High
Prevalence of Dysmenorrhea and Associated Factors and Its Effect on Daily Academic Activities among Female Undergraduate Students of Hawassa University College of Medicine and Health Sciences, Hawassa, Ethiopia (Belayneh <i>et al.</i> , 2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8	High

The JBI appraisal indicated generally good methodological quality across the included studies, with scores ranging from 7 to 8 out of 8. Nevertheless two studies had an “unclear” judgment for strategies addressing confounding, suggesting potential residual confounding, while the cross-sectional design of all studies limits inference regarding temporality and causal relationship. Thus, methodological concerns were not uniform but primarily related to confounding control and the inherent limitations of cross-sectional study designs.

DISCUSSION

Primary dysmenorrhea is common gynecological conditions among young women, characterized by menstrual pain in the absence of identifiable pelvic pathology (18). Although its high prevalence highlights its public health importance, the present review focused on factors associated with the severity of dysmenorrhea pain rather than its prevalence. The synthesized evidence showed that biological factors, including early menarche, family history of dysmenorrhea, and heavy menstrual bleeding, were associated with greater pain severity. These findings represent epidemiological associations and do not establish that these factors directly increase endometrial prostaglandin production. However, evidence from external literature suggests that excessive prostaglandin activity may contribute to dysmenorrhea through increased myometrial contractility, uterine vasoconstriction, reduced uterine blood flow, and ischemia (19); (20). Therefore, these mechanisms should be interpreted as plausible biological explanations for the observed associations rather than pathway directly demonstrated by the included studies.

From a behavioral perspective, lifestyle factors may synergistically exacerbate the biological mechanism underlying dysmenorrhea. Smoking, excessive caffeine consumption, and aggressive weight-loss practices have been associated with increased risk and severity of dysmenorrhea, potentially through vasoconstrictions altered prostaglandin activity, and hormonal or nutritional disturbances. Importantly, many young women with severe menstrual pain do not seek professional care, including physical therapy, reflecting persistent gaps in menstrual health literacy and the normalization of dysmenorrhea as a routine part of menstruation. This may delay appropriate care-seeking and the adoption of effective behavioral modifications (20); (21).

Beyond baseline hormonal and behavioral factors, the trajectory of reproductive development and anthropometric characteristics heavily influences individual susceptibility to menstrual pain. Evidence from cross-continental cohorts indicates that an earlier age at menarche is consistently associated with a higher incidence and severity of dysmenorrhea, which is fundamentally driven by a longer lifetime exposure to estrogen and progesterone (22). Furthermore, biological markers such as body mass index (BMI) and irregular menstrual patterns significantly compound this risk (23). Collectively, these developmental characteristics dictate the baseline sensitivity of the endometrium, directly regulating the volume of prostaglandin synthesis that triggers painful uterine contractions.

Within the biopsychosocial framework, these biological underpinnings do not operate in a vacuum but are actively modulated by psychological states. Chronic stress and emotional imbalance demonstrate a powerful positive correlation with heightened dysmenorrhea severity. Physiologically, psychological distress triggers the activation of the central nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, leading to a sympathetic nervous system surge. This neuroendocrine disruption substantially lowers the individual's pain threshold and heightens the sensitivity of nociceptors. Consequently, an adolescent under high stress will perceive identical biological uterine contractions as significantly more debilitating pain. Conversely, physical activity functions as a vital protective behavioral modifier; a sedentary lifestyle and low physical activity exacerbate pain intensity, whereas regular movement helps disrupt this psychosomatic pain cycle (11).

The association between physical activity and dysmenorrhea severity remains inconsistent across the included studies. While some evidence reported that lower levels of physical activity were associated with greater dysmenorrhea pain intensity (24), others studies found no statistically significant association between regular exercise and dysmenorrhea

occurrence (22). This inconsistency should be interpreted cautiously because the included studies used different approaches to assess dysmenorrhea pain severity, including numerical pain scales, visual analogue scales, and multidimensional severity scoring systems (20), (23); (24). Differences in the assessment and categorization of physical activity were also observed across studies. Therefore, differences in how both physical activity and dysmenorrhea severity were measured may represent one possible explanation for the heterogeneous findings. However, this interpretation should be considered a methodological hypothesis rather than a demonstrated explanation, as detailed and standardized study-level information on physical activity measurement, including exercise intensity, duration and frequency was not consistently extracted across all included studies. Differences in exercise characteristics, participant populations, and sociocultural contexts may also have contributed to the observed heterogeneity.

Beyond physical activity, other behavioral factors may also influence the occurrence and severity of dysmenorrhea. Within the included studies, caffeine consumption and other lifestyle-related factors were evaluated as potential risk factors, although the evidence was heterogeneous across studies. High-sugar dietary exposure, however, was not consistently evaluated across the eight studies included in this review; therefore, its potential role should be interpreted as contextual evidence from the broader literature rather than as a finding synthesized from the present systematic review (24). Mechanistically, excessive caffeine consumption may contribute to increased menstrual pain through its potential vasoconstrictive effects on uterine and pelvic blood vessels, which may exacerbate uterine ischemia (21). In addition, a positive family history was frequently identified as an associated factor among the included studies (21); (24). However, because the included studies used different analytical approaches and the available evidence was not sufficiently comparable in term of adjusted effect estimates and confidence intervals, the present review does not rank family history as the strongest predictor of dysmenorrhea pain severity. Instead, the findings suggest that family history represents a consistently reported, non-modifiable factor associated with dysmenorrhea across the included studies.

Primary dysmenorrhea remains highly prevalent among young women, with reported prevalence ranging from approximately 50% to over 90% across populations and settings (25); (26). This review indicates that dysmenorrhea is a multifactorial condition, with relatively consistent associations for biological factors, such as early menarche, family history, and menstrual characteristics, whereas findings for behavioral and psychological factors were more heterogeneous. This variability may be explained by differences in study populations, outcome measurements, severity thresholds, and confounder adjustment. Because most included studies were cross-sectional and reported adjusted effect estimates inconsistently, causal inferences and comparisons across studies should be made cautiously. Nevertheless, the findings support the need for a multidimensional approach to dysmenorrhea, given its potential impact on academic functioning, emotional well-being, and quality of life (27).

Biologically, developmental and genetic indicators were among the factors repeatedly associated with dysmenorrhea outcomes in several included studies, although the consistency of these associations varied across populations. Early age at menarche, atypical menstrual patterns, heavy bleeding, and a positive family history were recurrently identified as factors associated with greater dysmenorrhea pain or severity emerge as universal predictors of heightened pain intensity across global populations (22), (23), (26); (28). Early menarche and heavy menstrual bleeding may be linked to mechanism involving hormonal and prostaglandin activity, which can contribute to increased myometrial contractions, uterine ischemia, and menstrual pain (29). In addition, the repeated association between a maternal or sister history of dysmenorrhea and pain outcomes may indicate a potential familial or genetic contribution to individual susceptibility to dysmenorrhea, although the underlying mechanisms remain incompletely understood (28).

Behaviorally, lifestyle variables introduce dynamic, highly modifiable elements that interact directly with this biological baseline. Dietary patterns heavily laden with high-sugar foods, excessive caffeine, smoking, and poor sleep quality are shown to significantly exacerbate pain severity (23), (24), (30). Caffeine and nicotine act as acute vascular constrictors, which directly worsen pelvic and endometrial ischemia. In contrast, the role of physical activity remains a subject of ongoing methodological debate. While low physical activity and sedentary routines

are frequently linked to increased pain severity (31), other cohorts show no statistical association between exercise habits and pain mitigation (22). This outcome is highly dependent on contextual variables, as most existing studies rely on subjective, self-reported questionnaires rather than objective metabolic measurements, masking the true therapeutic threshold of exercise intensity and duration.

Within this biopsychosocial synergy, psychological states function as critical neural modulators that heavily amplify physical symptoms. Chronic academic stress and anxiety demonstrate a robust association with severe dysmenorrhea manifestations (11). Prolonged psychological distress triggers a continuous activation of the hypothalamic-pituitary-adrenal (HPA) axis and a sympathetic nervous system surge, releasing elevated levels of cortisol. This neuroendocrine disruption fundamentally alters central pain processing, lowering the individual's pain threshold and magnifying their perception of uterine contractions (32). Consequently, managing primary dysmenorrhea effectively requires moving away from fragmented treatments toward an integrated biopsychosocial approach, where physical therapy can play a vital role.

This review has several methodological limitations that should be considered when interpreting the findings. First, the review protocol was not prospectively registered in PROSPERO, OSF, or another publicly accessible repository. Therefore, the possibility of post hoc methodological decisions cannot be completely excluded. Although the review was conducted in accordance with the PRISMA 2020 statement and employed predefined eligibility criteria, a structured search strategy, systematic data extraction, and methodological quality assessment using the JBI Critical Appraisal Checklist, the absence of prospective protocol registration may reduce transparency regarding whether all methodological decisions were established before the evidence was examined. Future systematic reviews should consider prospective protocol registration to enhance methodological transparency and reduce the potential for selective or post hoc decisions.

Critical Gaps

Although the number of studies on dysmenorrhea continues to increase, important research gaps remain. All studies included in this review used cross-sectional designs, which can identify associations between potential risk factors and dysmenorrhea but cannot establish temporal or causal relationships; therefore, the observed associations should be interpreted cautiously because reverse causation and residual confounding cannot be excluded. In addition, most studies have examined biological, psychological, and social/behavioral factors separately, with limited integration of these domains within a single comprehensive analytical model. Future longitudinal studies are needed to clarify temporal relationships and the independent contributions of multiple factors, while research on non-pharmacological interventions, particularly physical therapy, represents a separate direction for future research to evaluate the effectiveness and standardization of these approaches for dysmenorrhea (25).

In addition, most studies still rely on self-reported data, which is susceptible to subjective bias. Variations in pain measurement tools and operational definitions of dysmenorrhea also pose challenges in consistently synthesizing results. Therefore, longitudinal studies and experimental interventions are needed to strengthen the evidence of causality and the effectiveness of interventions.

Novelty Statement

This study offers an integrative synthesis by combining a methodological appraisal using the JBI Critical Appraisal Checklist with the organization of risk factors for primary dysmenorrhea within a biopsychosocial framework. Rather than demonstrating multidimensional statistical interaction among biological, psychological, and lifestyle factors, this review synthesizes the available evidence across these domains to provide a broader understanding of factors associated with dysmenorrhea. The novelty of this study lies in its synthesis framework and in the identification of evidence gaps, including the limited integration of multiple biopsychosocial domains within individual studies, while also highlighting potential implications for physical therapy and future multidimensional research.

Clinical Implications of Physical Therapy

These findings have important implications for physical therapy practice. The studies included in this review primarily identified factors associated with dysmenorrhea pain and did not evaluate the effectiveness of specific interventions. However, clinical implications may be informed by separate evidence showing that exercise-based intervention, such as aerobic exercise and stretching, may help reduce pain through mechanisms that improve circulation and trigger the release of endorphins (25). Similarly, relaxation techniques and stress management may help address the psychological component of pain (33). Therefore, these approaches should be interpreted as clinical implications informed by separate evidence rather than as intervention effects tested by the studies included in this review. Integration of a biopsychosocial approach into physical therapy practice may provide a relevant framework for addressing the multidimensional nature of dysmenorrhea.

CONCLUSION

This systematic review identified multidimensional factors associated with the severity of dysmenorrhea pain in young women. Biological factors, including early menarche, family history, menstrual cycle characteristics, and body mass index, as well as psychological and behavioral factors, such as stress, low physical activity, caffeine consumption, and smoking, were associated with variations in dysmenorrhea pain severity. These findings support a biopsychosocial perspective for understanding the complex and multidimensional nature of dysmenorrhea pain. However, because all included studies were cross-sectional, the observed associations cannot establish temporality or causality.

The identified modifiable factors may inform the development of future interventions for young women with dysmenorrhea; however, the effectiveness of integrated biopsychosocial interventions cannot be inferred from the included observational studies. Future intervention studies should therefore consider these modifiable factors and prospectively evaluate their effectiveness using longitudinal or experimental designs and standardized outcome measurements.

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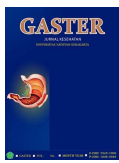
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