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Analysis of Factors Affecting the Menstrual Cycle Among Adolescent Girls: A Scoping Review

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Abstract

Menstruation is an important indicator of women's reproductive health and is frequently disrupted during adolescence due to physiological adaptation and multiple external factors. This study aims to identify and synthesize the determinants influencing menstrual cycle regularity among adolescent girls based on recent research evidence. A Scoping Review was conducted according to PRISMA guidelines, using articles published between 2021–2025 from PubMed, Science Direct, and Wiley databases. Eight eligible studies were analyzed narratively under three main categories: psychological, physiological, and lifestyle factors. Findings indicate that stress is the most dominant factor associated with menstrual cycle disturbances through hypothalamic–pituitary–ovarian (HPO) axis dysfunction. Physiological factors such as high body mass index (BMI), obesity, and hormonal imbalance were significantly correlated with irregular cycles and increased risk of polycystic ovary syndrome (PCOS). Unhealthy lifestyle behaviors, including sleep duration of <6 hours, high-fat intake, and excessive physical activity, further contributed to irregularities. Poor sleep quality and unbalanced diet disrupted the circadian rhythm and hormonal regulation of the reproductive system. Overall, menstrual irregularities result from an interaction of biological, psychological, and behavioral factors, most of which are modifiable. Comprehensive reproductive health education and healthy lifestyle interventions are crucial to prevent and manage menstrual disorders. Further longitudinal studies are recommended to strengthen causal evidence among variables.

Keywords: adolescent girls, body mass index, lifestyle, menstrual cycle, sleep quality, stress

INTRODUCTION

Menstruation serves as a key indicator of female reproductive health and an integral part of physiological maturation during adolescence[1][2]. During this period, the endocrine system undergoes complex adjustments due to the maturation of the hypothalamic–pituitary–ovarian (HPO) axis, resulting in frequent menstrual irregularities as manifestations of both physiological and pathological adaptation[3]. Irregular cycles, dysmenorrhea, and premenstrual symptoms are the most common complaints among adolescent girls worldwide and represent a major reason for seeking adolescent health services [4].

Globally, menstrual disorders have become a significant reproductive health issue. Recent reviews report a high prevalence of menstrual disturbances among adolescents and highlight insufficient menstrual education in schools[5][6]. In Indonesia, several local studies within the past five years have shown a high prevalence of dysmenorrhea and irregular cycles among adolescents and university students[7].

Menstrual irregularities are influenced by internal and external factors. Internal factors include post-menarche hormonal instability and endocrine conditions such as PCOS, for which recent guidelines emphasize cautious diagnosis among

adolescents[8]. External factors comprise psychological stress, excessive physical activity, poor sleep patterns, dietary habits, and nutritional status/BMI; cohort and systematic reviews have confirmed associations between academic stress, obesity, and anovulatory cycles[9][10].

Prolonged menstrual irregularities can cause multiple adverse outcomes. In the short term, they are linked to decreased academic concentration, fatigue, absenteeism, and psychological distress (e.g., anxiety and depression)[4]. Long-term consequences include infertility and metabolic disorders (e.g., type 2 diabetes, cardiovascular diseases), particularly in cases involving PCOS [8].

Comprehensive prevention and management of menstrual disorders should incorporate promotive, preventive, and curative strategies, including school-based reproductive health education, adolescent-friendly services, and healthy lifestyle interventions (balanced nutrition, moderate physical activity, stress management), as recommended by international guidelines and global health reports[11][12].

Given these concerns, this review aims to identify and analyze the factors affecting menstrual cycle regularity among adolescent girls. The study is expected to contribute to reproductive health improvement efforts and serve as a basis for more effective intervention and policy planning.

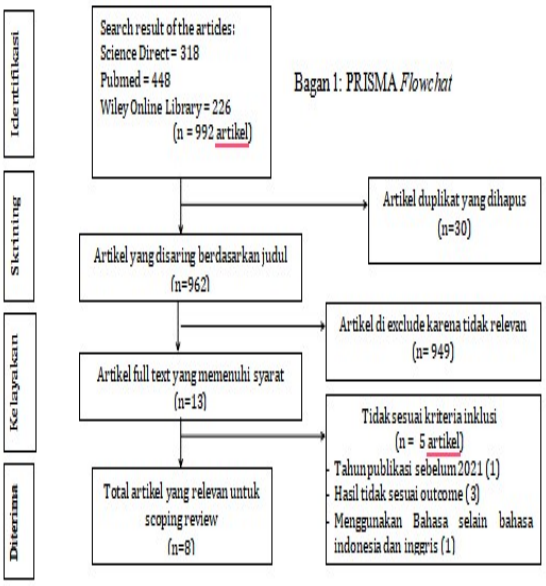
RESEARCH METHODOLOGY

Study Design

This research employs a Scoping Review approach to identify and synthesize empirical evidence on factors influencing the menstrual cycle among adolescent girls. The review compares previous studies to generate new insights regarding contributing factors.

Inclusion and Exclusion Criteria

Eligible articles included primary studies (quantitative, qualitative, or mixed methods) and reviews (narrative, systematic, or meta-analytic) published between 2021–2025, involving adolescents aged 10–19 years, in English or Indonesian. Articles must analyze relevant factors such as hormones, diet, stress, physical activity, or sleep.



Bagan 1: PRISMA *Flowchat*

Search Strategy

The review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Literature searches were conducted in PubMed, Scopus, Science Direct, and Wiley databases using MeSH-based keywords combined with Boolean operators: ("Menstrual Cycle" OR "menstrual cycle irregular*" OR "menstrual disorders" OR "dysmenorrhea") AND ("Adolescent" OR "adolescent female*" OR "teenage girl*" OR "young women") AND ("factors" OR "determinants" OR "risk factors" OR "associated factors") AND ("hormonal changes" OR "body mass index" OR "nutrition" OR "stress" OR "lifestyle" OR "physical activity") AND ("Indonesia" OR "developing countries"). Duplicate articles were manually removed. Titles and abstracts were screened for relevance, and potentially eligible full texts were assessed according to inclusion criteria.

Selection Process and Data Extraction

Two reviewers independently screened and extracted data, resolving discrepancies through discussion or a third reviewer. Data extracted included author, year, population, sample size, study design, variables, menstrual measures, and main findings. Narrative synthesis was performed by categorizing factors (hormonal, nutritional/BMI, stress, physical activity,

sleep, diet), followed by comparative analysis across studies.

Tabel 1. Data Charting

No	Author(s)	Title	Method	Result
1	Fitri, Sofianita, and Octaria, 2024[13]	Factors Affecting the Menstrual Cycle among Female Students in Depok, Indonesia	quantitative (a cross-sectional research). Population: 336 female nutrition students at UPNV Veteran Jakarta, ages 18 to 21. Sample: 193 respondents selected using stratified random sampling	Menstrual cycle abnormalities were linked to high levels of stress, poor sleep, and high fat intake. The dominant factor was stress level.
2	Mykolayivna I. et al, 2023[9]	Stress-induced menstrual disorders in adolescents during the Ukrainian war: cross-sectional study	cross-sectional research. There are 120 teenage girls between the ages of 9 and 18.	The most often reported menstrual disorders were secondary amenorrhea (26.6%, n=21), excessive menstruation during puberty (27.8%, n=22), and dysmenorrhea (45.6%, n=36). 52.5% (n=63) experienced a pathological menarche. Furthermore, of the 81.7% (n=63) who reported dietary changes in the past several months, 61.9% (n=39) satisfied the criteria for hormonal or metabolic abnormalities.
3	Situmorang H, Sutanto RL, Tjoa K, Rivaldo R, Adrian M (2024)[7]	Prevalence and risk factors of primary dysmenorrhoea among medical students: a cross-sectional survey in Indonesia	Web-based cross-sectional study. Participants: 630 female medical students in Indonesia meeting inclusion criteria. Data were collected using a validated online questionnaire. Analysis: binary logistic regression, both univariate and multivariate ($p<0.05$).	Among 630 participants, 91.27% experienced primary dysmenorrhea, with 52.35% reporting moderate-to-severe pain. The main factor associated with dysmenorrhea was family history, while pain severity was influenced by family history, menstrual cycle length, BMI, and ethnicity. Students with higher BMI and non-native ancestry tended to experience milder pain.
4	Siobhan E. Woods, Patricia Nistor, Kelly K. Anderson, Saverio Stranges (2025)[14]	Sleep patterns of Canadian women across the life course: A systematic review	comprehensive analysis of CINAHL, Embase, and PubMed (August 2024). Selection followed PRISMA guidelines; registered in PROSPERO (CRD420245820 07). Included 55 observational studies (cross-sectional, cohort, case-control) with 25,952,718 Canadian women	A total of 25,952,718 people participated in 55 studies. In children and adolescents, particularly in girls, shorter sleep duration was associated with poorer biopsychosocial health. Sleep was affected by the menstrual cycle, and adult women were more likely than I to have sleep problems.
5	Adam C. Cunningham, Lubna Pal, Aidan P. Wickham, Carley Prentice, Frederick G. B. Goddard, Anna	Chronicling menstrual cycle patterns across the reproductive lifespan with real-world data	Retrospective cohort study using real-world digital data. Population: 19,266,573 people between the ages of 18 and 55 use the Flo app worldwide. Inclusion: ≥3 menstrual cycles logged (>10 days), non-pregnant, and not using	The study, which involved over 19 million Flo app users aged 18 to 55, found that as women age and approach menopause, their menstrual cycles lengthen, become more irregular, and shorten. Irregular cycles are most common in women aged 51–55. Symptoms also change with age: younger women experience cramps and acne more frequently, while older women more often have headaches, back pain, stress, and

No	Author(s)	Title	Method	Result
	Klepchukova, & Liudmila Zhaunova (2024)[15]		hormonal contraception. Analysis: One-way ANOVA and t-tests across age groups; main variables: cycle length, menstrual duration, cycle variability, and related symptoms	insomnia. These results confirm that the menstrual cycle and symptoms change dynamically throughout the reproductive years, especially as menopause approaches.
6	Shrinjana Dhar, Kousik Kr. Mondal, & Pritha Bhattacharjee (2023)[16]	Influence of lifestyle factors with the outcome of menstrual disorders among adolescents and young women in West Bengal, India	Cross-sectional random survey. Population: 799 adolescents and young women aged 10–29 years from schools and colleges in Kolkata, India. Study period: January 2020 – January 2022. Instruments: Structured questionnaire including anthropometric data, lifestyle (physical activity, sleep, diet), and menstrual history. Analysis: Descriptive statistics, t-test, and Odds Ratio (OR) using MedCalc	Menstrual problems affect 28.78% of young women and adolescents. with the most common type of disorder being irregular cycles (44.83%), followed by dysmenorrhea (15.14%), PCOS (14.14%), menorrhagia (6.29%), hypomenorrhea (5.16%), and polymenorrhea (3.70%). Significant risk factors include high BMI, sleep duration less than 6 hours per day, excessive physical activity, and unhealthy eating patterns such as excessive consumption of white rice and soy products. Additionally, anemia, gastrointestinal disorders, fatigue, and headaches are also frequently associated with an increased risk of menstrual disorders.
7	Mutiara Ababil Zahra, Aisyiah, Intan Asri Nurani (2023)[17]	Analysis of Factors Associated with the Menstrual Cycle at SMK IT Raflesia Depok	Cross-sectional analytical descriptive study design. Population: all 98 female students of SMK IT Raflesia using total sampling. Instruments: DASS-42, IPAQ, and BMI measurements. Analysis: Chi-square test.	Stress level (p=0.048) and physical exercise (p=0.016) were significantly correlated with regular menstrual cycles. Age at menarche (p=0.069) and nutritional status (p=0.309) did not significantly correlate). Stress and physical activity significantly affected menstrual cycle regularity, while nutrition and menarche age did not.
8	Jenia Paula Sequeira, Bima Suryantara, & Fatimah Sari (2024)[18]	Factors Affecting the Menstrual Cycle among Adolescent Girls at SMA Negeri 2 Ngaglik	Cross-sectional quantitative descriptive study design. Sampling was purposive based on population characteristics	Menstrual cycle irregularities were significantly correlated with body weight (p=0.001), physical activity (p=0.000), and anxiety (p=0.001). Conclusion: all three factors significantly influenced menstrual irregularity among adolescent girls.

RESULTS AND DISCUSSION

Tabel 2. Identified Themes

Main Themes	Sub-Themes
Psychological	Stress, anxiety
Physiological	BMI, age, family history
Lifestyle	Sleep quality, diet, physical activity

Psychological Factors (Stress and Anxiety)

One of the main factors influencing the regularity of the menstrual cycle is psychological. A study by [13] found that high stress is significantly correlated with menstrual cycle disorders in female students in Depok. This stress level is more dominant than other variables, such as fat consumption or sleep quality. This aligns with research

conducted by [9] which investigated adolescent girls in Ukraine during wartime who experienced significant stress, leading to dysmenorrhea, secondary amenorrhea, and hormonal disorders. The hypothalamus-pituitary-ovarian axis is disrupted by unstable psychological conditions. This disrupts the secretion of gonadotropin hormones (FSH and LH) and causes irregular ovulation. Beside stress, a study by[18] found that anxiety also has a significant correlation with the regularity of the menstrual cycle. This finding is supported by [19] which states that emotional stress is correlated with hormonal disturbances that impact delayed menstruation.

Physiological Factors (BMI, Age, Hormonal Changes)

Physiological factors such as BMI, age, and hormonal changes have a significant impact on the regularity of the menstrual cycle. Research by[7] indicates that a high BMI is associated with primary dysmenorrhea and the severity of menstrual pain. Excess weight has a significant relationship with irregular cycles[18]. Research[20] strengthens this finding by showing that BMI increases the risk of irregular cycles. Additionally, obesity increases the risk of polycystic ovary syndrome (PCOS), which is characterized by menstrual irregularities due to insulin resistance and increased free estrogen[21] This result is consistent with[15] which explains that cycle variations change with age; young women tend to have longer cycles, while as they approach menopause, cycles become more irregular and are accompanied by sleep disturbances and stress..

Lifestyle Factors (Sleep, Diet, Physical Activity)

Lifestyle habits significantly impact menstrual patterns. Study by [14] showed that poor sleep is associated with menstrual phase changes and occurs more frequently in women than men. Short sleep duration (<6 hours) increases menstrual irregularity risk[16][13]. Female adolescents in Korea with sleep duration ≤5 hours have a 1.7 times higher risk of irregular menstrual cycles compared to those who sleep ≥8 hours.

Poor sleep quality disrupts the circadian rhythm and melatonin secretion, which play a crucial role in the regulation of reproductive hormones. Similar research by [22] showed a significant relationship between poor sleep quality and delayed menstruation. Beside sleep, diet and nutritional intake also play a role in cycle regularity. [16] found that high consumption of white rice, soy products, and an unhealthy diet increased the risk of menstrual disorders. [13] also reported that high fat intake was associated with irregular cycles. Research by [23] shows a significant correlation between macronutrient intake (fat and carbohydrates) and body fat percentage and menstrual irregularities in female students.

Excessive physical activity increases the risk of menstrual irregularities [17][18]. [16] also confirms that extreme physical activity increases the risk of hormonal dysfunction, leading to amenorrhea or long cycles.

CONCLUSIONS

Menstrual cycle regularity among adolescent girls is influenced by stress, sleep quality, BMI, dietary pattern, physical activity, and reproductive age. Stress is the most dominant factor, followed by poor sleep and high BMI. Unhealthy dietary habits and excessive exercise exacerbate hormonal imbalance.

Most of these factors are modifiable through healthy lifestyle adoption and stress management. Adolescents and women of reproductive age should maintain a balanced diet, ideal body weight, regular exercise, stress control, and good sleep quality to support hormonal stability.

Healthcare professionals, especially midwives, are encouraged to strengthen reproductive health education and counseling addressing psychological and lifestyle factors. Educational institutions should implement periodic reproductive health monitoring, including nutritional assessment, stress evaluation, and menstrual health promotion. Future research should adopt longitudinal or intervention designs to strengthen causal understanding of lifestyle, psychological, and hormonal factors across different age groups of women.

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