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Literatur Review: The Relationship Between Macronutrient Intake and Sleep Duration and the Occurrence of Menstrual Disorders in Women of Reproductive Age

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Abstract

This literature review examines the relationship between macronutrient intake and sleep duration with the incidence of menstrual disorders in women of reproductive age. Based on a systematic analysis of ten selected scientific studies, the findings indicate that carbohydrate intake is significantly associated with menstrual disorders, particularly when high glycemic index foods and excessive added sugars are consumed, leading to hormonal imbalances through insulin dysregulation. Protein intake also shows a significant relationship, where both deficiency and excessive consumption of animal protein may disrupt ovulation, while plant-based protein demonstrates a protective effect. Fat intake, especially high saturated fat consumption, is linked to increased severity of dysmenorrhea and premenstrual syndrome (PMS), whereas omega-3 fatty acids contribute to symptom relief. In addition, insufficient sleep duration (less than 7 hours per day) significantly increases the risk of menstrual irregularities and pain intensity. Biologically, these relationships are explained through multiple mechanisms, including disruption of the hypothalamic-pituitary-ovarian (HPO) axis, insulin resistance, increased prostaglandin production, and the reciprocal interaction between poor diet and inadequate sleep. Despite strong evidence, significant research gaps remain, particularly the lack of experimental or clinical studies examining the combined effects of dietary and sleep interventions on menstrual health. Therefore, a comprehensive approach integrating nutritional and lifestyle modifications is essential in managing menstrual disorders.

Introduction

Menstrual disorders are among the most prevalent reproductive health problems affecting women of reproductive age worldwide. According to the World Health Organization (WHO), women of reproductive age are those between 15 and 49 years old, a period characterized by active reproductive function and complex hormonal regulation (Thiyagarajan et al., 2024). During this stage of life, women frequently experience various menstrual disturbances that may affect their physical, psychological, and social well-being. Menstrual disorders encompass a broad range of conditions, including dysmenorrhea, premenstrual syndrome (PMS), amenorrhea, oligomenorrhea, menorrhagia, and irregular menstrual cycles. These conditions are highly prevalent globally and represent a significant public health concern due to their impact on quality of life and reproductive health outcomes (Barrios-De-Tomasi et al., 2023; Ara et al., 2022; Gani et al., 2023; Tazinya et al., 2023).

Among the various menstrual disorders, dysmenorrhea is reported as the most common complaint among women of reproductive age, followed by PMS and menstrual cycle irregularities such as amenorrhea and oligomenorrhea (Musulin et al., 2025; BIO Web of

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Conferences, 2024; Saudi Medical Journal, 2020). Dysmenorrhea is characterized by painful uterine contractions during menstruation and may significantly interfere with daily activities, academic performance, occupational productivity, and social interactions. Similarly, PMS is associated with a combination of physical, emotional, and behavioral symptoms occurring during the luteal phase of the menstrual cycle and can negatively affect psychological well-being and interpersonal relationships (Baker & Lee, 2022).

The high prevalence of these conditions underscores the importance of identifying modifiable factors that contribute to menstrual health. Menstrual disorders are not only associated with discomfort and reduced quality of life but may also serve as early indicators of underlying reproductive or endocrine abnormalities. A regular menstrual cycle reflects the proper functioning of the hypothalamic–pituitary–ovarian (HPO) axis, which regulates ovulation and reproductive hormone production (Thiyagarajan et al., 2024). Conversely, disruptions in menstrual patterns may signal hormonal imbalances or reproductive disorders such as polycystic ovary syndrome (PCOS), endometriosis, thyroid dysfunction, and other gynecological conditions (Singh et al., 2021; Armour et al., 2020). Failure to identify and address these disturbances at an early stage may increase the risk of long-term reproductive complications, infertility, and chronic health problems.

Lifestyle factors have emerged as important determinants of menstrual health. Among these factors, nutritional intake plays a fundamental role in maintaining hormonal balance and reproductive function (Skoracka et al., 2021). Macronutrients, including carbohydrates, proteins, and fats, are essential components of the diet that support various physiological processes involved in the menstrual cycle. Carbohydrates serve as the primary source of energy required for ovarian activity and hormone synthesis, proteins provide amino acids necessary to produce reproductive hormones and neurotransmitters, while fats contribute to the synthesis of steroid hormones such as estrogen and progesterone (Holesh et al., 2023). Consequently, inadequate or excessive consumption of these nutrients may adversely affect menstrual function.

Several studies have reported significant associations between macronutrient intake and menstrual disorders. Taheri et al. (2020) found that women experiencing menstrual disorders had significantly higher intakes of energy, carbohydrates, proteins, and fats compared with women without menstrual disturbances. Similarly, Baş and Yıldırım (2024) observed that women with menstrual problems consumed lower amounts of protein and several essential micronutrients while demonstrating higher consumption of sugar-rich foods. Excessive intake of refined carbohydrates and foods with a high glycemic index has been linked to insulin resistance and hormonal dysregulation, both of which can impair ovulation and menstrual regularity (Jenkins et al., 2022; Çengel & Arslan, 2024). Furthermore, diets high in saturated fats have been associated with increased inflammatory responses and elevated prostaglandin production, potentially contributing to dysmenorrhea and PMS symptoms (Sacks et al., 2021).

Protein intake has also been shown to influence reproductive health. Adequate protein consumption supports hormone synthesis and tissue repair, whereas protein deficiency may impair estrogen production and alter neurotransmitter synthesis, affecting both menstrual function and emotional well-being (Güzeldere et al., 2024). In addition, evidence suggests that the source of dietary protein may be relevant. Excessive consumption of animal-based protein has been associated with an increased risk of ovulatory dysfunction, while plant-based proteins appear to have protective effects on reproductive health due to their anti-inflammatory properties and phytoestrogen content (Skoracka et al., 2021). These findings highlight the importance of dietary quality in maintaining menstrual health.

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Sleep is another lifestyle factor that has gained increasing attention in reproductive health research. Sleep duration and sleep quality are essential for maintaining circadian rhythm integrity and endocrine regulation (Baker & Lee, 2022). Emerging evidence suggests that inadequate sleep may contribute to menstrual disturbances through alterations in hormonal secretion and stress-related physiological pathways. A systematic review conducted by Jeon and Baek (2023) concluded that sleep disturbances are consistently associated with menstrual problems, including dysmenorrhea, PMS, and irregular menstrual cycles. Likewise, a population-based study conducted in Korea demonstrated that shorter sleep duration significantly increased the risk of severe menstrual irregularities among women of reproductive age (Kim et al., 2020).

The biological mechanisms underlying this relationship are multifactorial. Sleep deprivation disrupts circadian rhythms that regulate the secretion of gonadotropin-releasing hormone (GnRH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH), all of which are critical for normal ovarian function (Shechter & Boivin, 2020). Furthermore, insufficient sleep increases cortisol production and systemic inflammation, factors that may exacerbate menstrual pain and worsen PMS symptoms (Lateef & Akintubosun, 2020; Cureus, 2023). Chronic sleep restriction may therefore compromise reproductive health through both endocrine and inflammatory pathways.

Importantly, nutrition and sleep are closely interconnected and may exert synergistic effects on menstrual health. Research has demonstrated a bidirectional relationship between dietary habits and sleep patterns, whereby poor dietary choices can impair sleep quality, while inadequate sleep can promote unhealthy eating behaviors (Palma et al., 2021). High-glycemic-index foods may influence melatonin production and sleep architecture, whereas sleep deprivation can increase cravings for energy-dense foods high in sugar and fat through alterations in appetite-regulating hormones such as ghrelin and leptin (Knutson et al., 2020; Jenkins et al., 2022). Additionally, deficiencies in essential fatty acids and other nutrients may contribute to both inflammatory processes and hormonal dysregulation that negatively affect menstrual health (Hess et al., 2021; Sacks et al., 2021). These interactions suggest that dietary intake and sleep duration should not be examined independently when investigating factors associated with menstrual disorders.

Despite growing evidence linking nutritional factors and sleep to reproductive health, research examining the combined influence of macronutrient intake and sleep duration on menstrual disorders remains limited (Barrios-De-Tomasi et al., 2023; Skoracka et al., 2021). Most available studies have focused on either dietary factors or sleep characteristics separately, with relatively few investigations exploring their interaction and cumulative effects on menstrual outcomes (Taheri et al., 2020; Jeon & Baek, 2023). Given the complexity of hormonal regulation and the multifactorial nature of menstrual disorders, a comprehensive understanding of these interrelated lifestyle factors is essential for developing effective prevention and management strategies.

Therefore, examining the relationship between macronutrient intake, sleep duration, and menstrual disorders among women of reproductive age is of considerable importance. A comprehensive synthesis of existing scientific evidence can contribute to a better understanding of how these modifiable lifestyle factors influence menstrual health and may provide valuable insights for the development of integrated reproductive health interventions aimed at improving the well-being and quality of life of women worldwide (Snyder, 2019; Aromataris & Pearson, 2021).

DOI: https://doi.org/10.71435/734647

Method

Research Design

This study employed a systematic literature review (SLR) design to comprehensively synthesize and critically evaluate existing scientific evidence regarding the relationship between macronutrient intake, sleep duration, and the occurrence of menstrual disorders among women of reproductive age. A systematic literature review is a structured and transparent research methodology that aims to identify, assess, and integrate findings from relevant studies using predefined procedures, thereby minimizing bias and enhancing reproducibility (Snyder, 2019). Unlike traditional narrative reviews, a systematic review follows explicit protocols for literature searching, study selection, data extraction, and quality appraisal, allowing researchers to generate more reliable and evidence-based conclusions.

The systematic review approach was considered appropriate for the present study because the relationship between nutrition, sleep, and menstrual health is multifactorial and has been investigated across diverse populations, settings, and study designs. By synthesizing findings from multiple studies, this review sought to identify recurring patterns, underlying biological mechanisms, areas of agreement and disagreement, and existing knowledge gaps within the current body of literature.

The review process was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological transparency, consistency, and scientific rigor throughout all stages of the review (Page et al., 2021).

Research Context and Data Sources

This review focused on scientific evidence examining the relationship between dietary macronutrient intake, sleep duration, and menstrual disorders among women of reproductive age. The review included studies investigating various menstrual disorders, such as dysmenorrhea, premenstrual syndrome (PMS), amenorrhea, oligomenorrhea, irregular menstrual cycles, and abnormal uterine bleeding.

To ensure comprehensive coverage of the available evidence, literature searches were conducted across five major international electronic databases: PubMed, ScienceDirect, Scopus, ProQuest, and Google Scholar. These databases were selected because they provide extensive access to peer-reviewed literature in medicine, nutrition, reproductive health, epidemiology, and public health research (Gusenbauer & Haddaway, 2020). Searching multiple databases reduced the likelihood of publication bias and increased the probability of identifying relevant studies from diverse scientific disciplines.

In addition to database searching, manual searches were conducted by reviewing the reference lists of eligible articles and relevant review papers. This supplementary search strategy was intended to identify potentially relevant studies that may not have been retrieved through electronic database searches due to indexing differences or keyword variations.

The literature search was conducted between January and March 2025. To ensure that the review reflected the most current evidence, the primary focus was placed on studies published between January 2020 and March 2025. Nevertheless, seminal methodological and theoretical references published prior to 2020 were retained when considered essential for explaining concepts related to menstrual physiology, reproductive health, systematic review methodology, and nutritional science.

DOI: https://doi.org/10.71435/734647

Literature Search Strategy

A comprehensive search strategy was developed using a combination of Medical Subject Headings (MeSH) terms and free-text keywords related to the study variables. The search terms were selected based on the research objectives and previous literature addressing menstrual health, nutrition, and sleep.

The primary search terms included *menstrual disorders*, *menstrual irregularities*, *dysmenorrhea*, *premenstrual syndrome*, *menstrual cycle*, *macronutrient intake*, *carbohydrate intake*, *protein intake*, *fat intake*, *dietary patterns*, *sleep duration*, *sleep quality*, and *reproductive health*. Boolean operators such as AND and OR were applied to combine search terms and optimize search sensitivity and specificity.

An example of the search string used was:

(menstrual disorders OR dysmenorrhea OR premenstrual syndrome OR menstrual irregularity) AND (macronutrient intake OR carbohydrates OR protein OR fat OR nutrition) AND (sleep duration OR sleep quality OR sleep) AND (women of reproductive age).

Search strategies were adapted according to the indexing systems and search functionalities of each database. The search process was documented systematically to ensure transparency and reproducibility.

Eligibility Criteria

Eligibility criteria were established prior to the literature search to ensure consistency and minimize selection bias. Studies were included if they were original quantitative studies, observational studies, clinical studies, or systematic reviews published in peer-reviewed journals; investigated the relationship between macronutrient intake, sleep duration, and menstrual disorders; involved women of reproductive age (15–49 years); were published in English or Indonesian; provided full-text access; and were published between 2020 and 2025 (Methley et al., 2020).

Studies were excluded if they were editorials, commentaries, conference abstracts, opinion papers, case reports, letters to editors, animal studies, laboratory-based studies, or articles lacking sufficient methodological information. Furthermore, studies involving participants with severe medical conditions known to independently affect menstrual function, such as malignant diseases, autoimmune disorders, or severe endocrine abnormalities, were excluded to reduce potential confounding effects and improve the validity of the review findings (Higgins et al., 2023).

Study Selection and Screening Process

The study selection process followed the PRISMA 2020 framework and was conducted in several stages. Initially, all identified references were exported into a reference management system. Duplicate records retrieved from multiple databases were identified and removed prior to screening.

Subsequently, title and abstract screening was performed to assess the relevance of studies to the research objectives. Articles that clearly failed to meet the inclusion criteria were excluded at this stage.

The remaining studies underwent full-text assessment to determine eligibility based on the predefined inclusion and exclusion criteria. During the full-text review, studies were evaluated for population characteristics, exposure variables, outcome measures, methodological quality, and relevance to the review objectives.

DOI: https://doi.org/10.71435/734647

Reasons for exclusion were documented to maintain transparency. The final selection included only studies that met all eligibility requirements and provided sufficient data for synthesis.

Data Extraction

Data extraction was conducted systematically using a standardized data extraction form developed specifically for this review. The purpose of the extraction process was to ensure consistency in collecting relevant information from each included study.

The extracted information included author names, publication year, country of origin, study objectives, study design, sample size, participant characteristics, measurement instruments, exposure variables related to macronutrient intake and sleep duration, menstrual health outcomes, statistical analyses performed, and principal findings.

Additional information regarding proposed biological mechanisms and study limitations was also recorded whenever available. The extracted data were organized into evidence tables to facilitate comparison across studies and identify recurring themes and patterns within the literature.

Data Synthesis and Analysis

The findings from the included studies were analyzed using a narrative synthesis approach. Narrative synthesis was considered the most appropriate analytical method because substantial heterogeneity existed across studies regarding research design, population characteristics, measurement instruments, outcome definitions, and statistical methods.

The synthesis process involved grouping studies according to key themes, including carbohydrate intake, protein intake, fat intake, sleep duration, sleep quality, and biological interactions between nutrition and sleep.

Findings from individual studies were compared and interpreted to identify consistencies, discrepancies, and emerging trends. Particular attention was given to explaining the physiological pathways linking dietary intake and sleep patterns to menstrual health outcomes.

The synthesis also sought to identify research gaps, methodological limitations, and areas requiring further investigation. This thematic approach enabled the development of a comprehensive understanding of the multidimensional factors contributing to menstrual disorders among women of reproductive age.

Quality Assessment and Risk of Bias Evaluation

To enhance the validity and reliability of the review findings, the methodological quality of all included studies was critically appraised using established quality assessment tools.

Observational studies were evaluated using the Newcastle–Ottawa Scale (NOS), which assesses study quality based on participant selection, comparability of study groups, and outcome assessment. Systematic reviews were evaluated using the Assessment of Multiple Systematic Reviews (AMSTAR) checklist.

Studies demonstrating inadequate methodological reporting, substantial risk of bias, poor participant selection procedures, or insufficient outcome assessment were excluded from the final synthesis. The quality appraisal process provided an indication of the overall strength of the available evidence and informed the interpretation of findings.

DOI: https://doi.org/10.71435/734647

Strategies to Ensure Trustworthiness of Findings

Several measures were implemented to enhance the credibility and trustworthiness of the review. First, literature was collected from multiple databases to maximize coverage and reduce publication bias. Second, explicit inclusion and exclusion criteria were applied consistently throughout the review process. Third, methodological quality appraisal was conducted using internationally recognized assessment tools.

Fourth, methodological triangulation was achieved through the comparison of findings across different study designs, populations, and geographical settings. Furthermore, all stages of the review process were documented systematically to facilitate transparency and reproducibility.

These strategies collectively strengthened the validity, reliability, and comprehensiveness of the synthesized evidence regarding the relationship between macronutrient intake, sleep duration, and menstrual disorders among women of reproductive age.

Result and Discussion

This section presents the findings obtained from the systematic literature review regarding the relationship between macronutrient intake, sleep duration, and menstrual disorders among women of reproductive age. The results are organized systematically to provide a comprehensive understanding of the evidence identified across the included studies.

The presentation begins with the literature search and selection process, followed by the characteristics and methodological quality of the included studies. Subsequently, the findings are synthesized according to the major variables investigated, namely carbohydrate intake, protein intake, fat intake, sleep duration, and the biological interaction between nutrition and sleep. Finally, important research gaps identified from the reviewed literature are presented.

Literature Search and Study Selection

A systematic search was conducted across five electronic databases: PubMed, Scopus, ScienceDirect, ProQuest, and Google Scholar. The search strategy identified a total of 260 potentially relevant articles. After removing 65 duplicate records, 195 articles remained for title and abstract screening.

During this stage, 120 articles were excluded because they did not meet the inclusion criteria, including irrelevance to the research topic, inappropriate publication period, non-peer-reviewed status, or language incompatibility. The remaining 75 articles underwent full-text eligibility assessment.

Of these, 47 articles were excluded due to unclear methodology, unavailable full text, inappropriate populations, incomplete outcome data, or substantial risk of bias. Ultimately, 10 studies met all eligibility criteria and were included in the final synthesis.

The selection procedure followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guideline to ensure methodological transparency and reproducibility.

DOI: https://doi.org/10.71435/734647

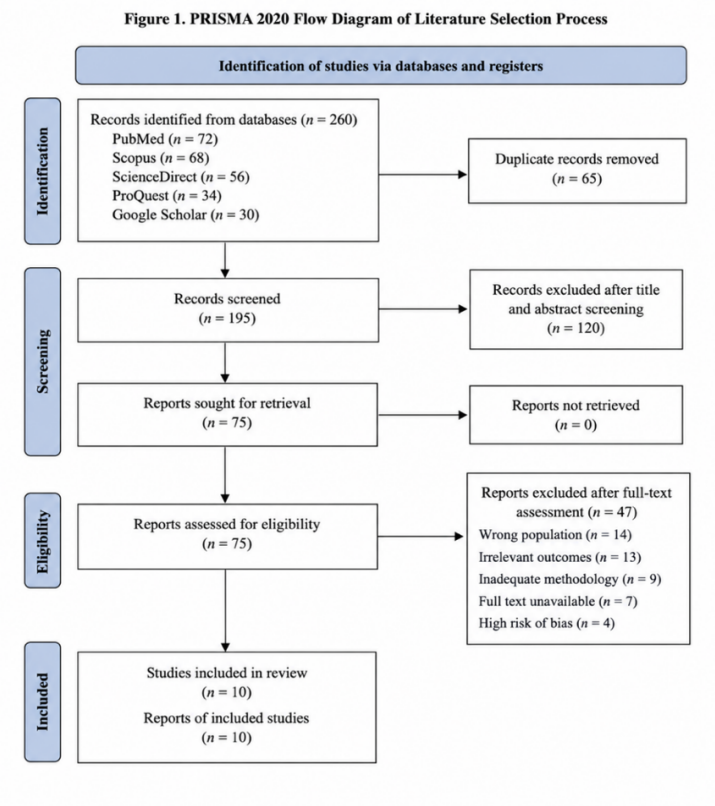

Figure 1. PRISMA 2020 Flow Diagram of Literature Selection Process

- Records identified through database searching (n = 260)
- Duplicate records removed (n = 65)
- Records screened (n = 195)
- Records excluded after title and abstract screening (n = 120)
- Full-text articles assessed for eligibility (n = 75)
- Full-text articles excluded (n = 47)
- Studies included in final review (n = 10)

Source: Adapted from the PRISMA 2020 guideline (Page et al., 2021).

The final studies represented diverse geographical settings, including Indonesia, Turkey, Poland, Korea, China, Jordan, and the United States. This geographical diversity indicates that the relationship between nutritional intake, sleep, and menstrual health is a globally relevant issue rather than a region-specific phenomenon.

Characteristics of the Included Studies

The characteristics of the included studies are summarized in Table 1. The majority of studies used cross-sectional designs (n = 6), followed by systematic reviews (n = 2), clinical research (n = 1), and observational studies (n = 1). Overall, the primary studies involved more than 12,000 women of reproductive age.

DOI: https://doi.org/10.71435/734647

Table 1. Characteristics and Main Findings of the Included Studies

No	Author (Year)	Country	Design / Sample	Main Variables	Principal Findings
1	Ciołek et al. (2024)	Poland	Cross-sectional / n=217	Sugar intake, menstrual distress	High sugar intake significantly increased menstrual distress
2	Kartika & Estiani (2020)	Indonesia	Cross-sectional / n=68	Fat intake, carbohydrates, PMS	Fat and carbohydrates predicted PMS severity
3	Güzeldere et al. (2024)	Turkey	Cross-sectional / n=428	Protein intake, menstrual disorders	Protein deficiency associated with menstrual disorders
4	Kim (2021)	USA	Clinical research / n=195	Animal vs plant protein	Animal protein increased ovulatory disorder risk
5	Tantri (2025)	Indonesia	Cross-sectional / n=89	Saturated fat, dysmenorrhea	Saturated fat increased dysmenorrhea severity
6	Nahdah et al. (2022)	Indonesia	Cross-sectional / n=147	Fat intake, sleep quality	Poor diet and sleep prolonged menstrual bleeding
7	Xiong et al. (2025)	China	Cross-sectional / n=9,139	Sleep duration, irregularity	Sleep deprivation increased menstrual irregularity risk
8	Polat & Mucuk (2021)	Turkey	Cross-sectional / n=456	Sleep quality, dysmenorrhea	Poor sleep quality associated with severe dysmenorrhea
9	Jeon & Baek (2023)	Korea	Systematic review / 21 studies	Sleep disturbances	Sleep problems associated with menstrual disorders
10	Al-Magableh (2023)	Jordan	Systematic review / 18 studies	Sleep duration, hormones	Sleep deprivation linked to irregular menstrual cycles

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Source: Synthesized from the reviewed literature (2020–2025)

Overall, eight out of the ten reviewed studies reported statistically significant relationships between macronutrient imbalance and menstrual disorders, while all sleep-related studies demonstrated significant associations between inadequate sleep and menstrual health outcomes.

Methodological Quality Assessment

To ensure the reliability and validity of the synthesized evidence, all included studies underwent methodological quality appraisal using standardized assessment tools. Observational and cross-sectional studies were evaluated using the Newcastle–Ottawa Scale (NOS), whereas systematic reviews were assessed using the AMSTAR checklist.

Table 2. Methodological Quality Assessment of Included Studies

Author	Study Design	Appraisal Tool	Score	Quality
Ciołek et al. (2024)	Cross-sectional	NOS	8/9	High
Kartika & Estiani (2020)	Cross-sectional	NOS	7/9	Moderate-High
Güzeldere et al. (2024)	Cross-sectional	NOS	8/9	High
Kim (2021)	Clinical Research	NOS	8/9	High
Tantri (2025)	Cross-sectional	NOS	7/9	Moderate-High
Nahdah et al. (2022)	Cross-sectional	NOS	8/9	High
Xiong et al. (2025)	Cross-sectional	NOS	9/9	High
Polat & Mucuk (2021)	Cross-sectional	NOS	8/9	High
Jeon & Baek (2023)	Systematic Review	AMSTAR	9/11	High
Al-Magableh (2023)	Systematic Review	AMSTAR	9/11	High

Source: Authors' quality appraisal based on NOS and AMSTAR criteria

The assessment demonstrated that most studies possessed moderate-to-high methodological quality. None of the included studies were categorized as low quality, thereby strengthening the credibility of the synthesized findings.

Relationship Between Carbohydrate Intake and Menstrual Disorders

The findings of this literature review consistently indicate that carbohydrate intake plays an important role in influencing menstrual health among women of reproductive age. Excessive consumption of refined carbohydrates and foods with a high glycemic index appears to be associated with an increased risk of various menstrual disorders, including dysmenorrhea, premenstrual syndrome (PMS), and irregular menstrual cycles. Refined carbohydrates are rapidly digested and absorbed, resulting in sudden increases in blood glucose levels and subsequent elevations in insulin secretion. Over time, repeated exposure to these metabolic fluctuations may contribute to endocrine disturbances that adversely affect reproductive function.

Several studies included in this review demonstrated statistically significant relationships between excessive sugar intake and menstrual symptoms. Ciołek et al. (2024) reported that women with higher consumption of added sugars experienced significantly greater menstrual distress than women who adhered to healthier dietary patterns ($p < 0.0001$). Similarly, Estiani and Djokosujono (2020) found that carbohydrate intake significantly predicted the severity of PMS symptoms ($p = 0.040$). These findings suggest that dietary carbohydrate quality and quantity may be important determinants of menstrual health and symptom severity.

DOI: https://doi.org/10.71435/734647

From a physiological perspective, high-glycemic carbohydrate consumption promotes rapid increases in blood glucose concentration, stimulating excessive insulin secretion by pancreatic β-cells. Persistent hyperinsulinemia may eventually lead to insulin resistance, a condition characterized by reduced cellular responsiveness to insulin. Insulin resistance has been strongly associated with reproductive hormonal disturbances because insulin interacts with ovarian function and steroid hormone production. Elevated insulin levels can increase androgen production, impair follicular maturation, and interfere with normal ovulation, thereby contributing to menstrual irregularities and ovulatory dysfunction.

Furthermore, disturbances in glucose metabolism may influence the hypothalamic–pituitary–ovarian (HPO) axis, the primary neuroendocrine system responsible for regulating the menstrual cycle. Alterations in insulin sensitivity and hormonal homeostasis may disrupt gonadotropin secretion, leading to irregular menstrual patterns and worsening dysmenorrhea symptoms. These mechanisms are particularly relevant in conditions such as polycystic ovary syndrome (PCOS), where insulin resistance frequently coexists with menstrual disturbances.

In addition to endocrine effects, excessive consumption of refined carbohydrates may affect psychological and emotional well-being during menstruation. Fluctuations in blood glucose levels can influence neurotransmitter activity, particularly serotonin, which plays a critical role in mood regulation. Several studies reviewed in this analysis reported that women with high intakes of refined carbohydrates frequently experienced irritability, mood swings, fatigue, and increased emotional sensitivity during the menstrual period. These symptoms may contribute to a greater perception of menstrual discomfort and a reduction in overall quality of life.

Moreover, high-sugar dietary patterns have been associated with increased systemic inflammation and oxidative stress. Chronic low-grade inflammation may sensitize pain receptors and enhance prostaglandin-mediated uterine contractions, thereby intensifying menstrual pain. Consequently, the relationship between carbohydrate intake and menstrual disorders appears to involve multiple interconnected pathways, including metabolic dysregulation, hormonal imbalance, neurotransmitter alterations, and inflammatory processes.

Taken together, the evidence suggests that dietary interventions aimed at reducing excessive intake of refined carbohydrates and added sugars while promoting complex carbohydrates with lower glycemic indices may contribute to improved menstrual health. Such dietary modifications could potentially reduce insulin resistance, stabilize hormonal regulation, alleviate PMS symptoms, and decrease the severity of menstrual pain among women of reproductive age.

Relationship Between Protein Intake and Menstrual Disorders

The findings of this literature review indicate that protein intake is an important nutritional factor influencing menstrual health among women of reproductive age. Protein serves numerous physiological functions, including tissue repair, enzyme production, hormone synthesis, and regulation of immune function. Adequate protein consumption is essential for maintaining reproductive hormone balance because amino acids derived from dietary proteins are required for the synthesis of hormones and neurotransmitters involved in regulating the menstrual cycle.

Several studies included in this review demonstrated significant associations between protein intake and menstrual disorders. Güzeldere et al. (2024) found that women with inadequate protein intake had significantly lower estrogen concentrations and a higher prevalence of menstrual disturbances compared with women who consumed sufficient protein ($p < 0.005$).

DOI: https://doi.org/10.71435/734647

These findings suggest that insufficient protein intake may compromise reproductive function through hormonal dysregulation.

One possible explanation for this relationship is that protein deficiency limits the availability of amino acids required for the synthesis of reproductive hormones. Estrogen and progesterone production depend on adequate nutritional status, and prolonged nutritional inadequacy may disrupt the normal functioning of the hypothalamic–pituitary–ovarian (HPO) axis. When reproductive hormone synthesis becomes impaired, ovulation may become irregular, leading to menstrual cycle disturbances such as oligomenorrhea, amenorrhea, or irregular menstruation.

Protein intake also influences the production of neurotransmitters involved in emotional regulation and sleep. Tryptophan, an essential amino acid obtained from dietary proteins, serves as a precursor for serotonin and melatonin. Serotonin plays a major role in mood stabilization, while melatonin regulates circadian rhythms and sleep quality. Low protein intake may therefore contribute to PMS symptoms such as irritability, anxiety, depression, and sleep disturbances. These symptoms may indirectly worsen menstrual experiences and reduce quality of life among affected women.

Interestingly, the reviewed studies suggest that not only the quantity but also the source of dietary protein may influence menstrual health. Kim (2021) reported that excessive consumption of animal-derived protein was associated with an increased risk of ovulatory disorders, particularly when animal protein contributed more than 25% of total daily energy intake. In contrast, plant-based protein sources appeared to exert protective effects against ovulatory dysfunction.

Several biological mechanisms may explain these findings. Animal proteins are frequently accompanied by high levels of saturated fats, cholesterol, and pro-inflammatory compounds that may contribute to metabolic dysfunction and hormonal imbalance. Excessive intake of these nutrients can promote systemic inflammation and insulin resistance, both of which have been implicated in menstrual irregularities.

Conversely, plant-based protein sources such as legumes, soybeans, lentils, and nuts contain fiber, antioxidants, and phytoestrogens that may support hormonal stability and improve reproductive health outcomes. Phytoestrogens found in plant foods may exert mild estrogenic effects that help maintain hormonal balance, particularly among women experiencing estrogen fluctuations.

In addition, plant-based diets are generally associated with lower inflammatory markers and improved insulin sensitivity, factors that may contribute to more regular menstrual cycles and reduced PMS symptoms. The evidence suggests that maintaining adequate protein intake while prioritizing high-quality protein sources may contribute positively to menstrual health.

Future research should further investigate the differential effects of animal and plant proteins on reproductive hormones and menstrual outcomes.

Relationship Between Fat Intake and Menstrual Disorders

Among the macronutrients examined in this review, fat intake demonstrated one of the strongest associations with menstrual symptoms, particularly dysmenorrhea and premenstrual syndrome. Dietary fats are essential for numerous physiological processes, including energy storage, cell membrane formation, and steroid hormone synthesis. However, the type and quantity of dietary fat consumed appear to play a critical role in determining menstrual health outcomes.

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Several studies reviewed in this analysis consistently demonstrated that excessive consumption of saturated fats was associated with increased menstrual pain and symptom severity. Das et al. (2023) reported that women with high saturated fat intake were significantly more likely to experience severe dysmenorrhea compared with those who consumed lower amounts of saturated fat ($p<0.005$). Similarly, Estiani & Djokosujono (2020) found that fat intake significantly predicted PMS severity ($p=0.047$).

The biological mechanism underlying this relationship is primarily linked to prostaglandin production. Saturated fatty acids contribute to the formation of arachidonic acid, which serves as a precursor for prostaglandins. During menstruation, prostaglandins stimulate uterine muscle contractions necessary for endometrial shedding.

However, excessive prostaglandin production can lead to intense uterine contractions, reduced uterine blood flow, ischemia, and increased pain perception. Women who consume diets rich in fried foods, processed foods, fast foods, and fatty meats may therefore experience more severe menstrual pain due to elevated prostaglandin synthesis. In addition, saturated fats can promote chronic low-grade inflammation, which may further intensify menstrual symptoms and discomfort.

In contrast, omega-3 fatty acids appear to exert protective effects against menstrual disorders. Several studies have shown that women with higher intake of omega-3-rich foods such as fish, nuts, seeds, and avocados generally experience less severe dysmenorrhea. Omega-3 fatty acids compete with arachidonic acid in inflammatory pathways and promote the production of anti-inflammatory mediators that reduce prostaglandin activity.

Beyond pain reduction, omega-3 fatty acids may also improve mood symptoms associated with PMS by influencing neurotransmitter function and reducing neuroinflammation. These benefits highlight the importance of considering fat quality rather than focusing solely on total fat intake.

Another important finding was reported by Nahdah et al. (2022), who demonstrated that the combination of excessive fat intake, inadequate fiber consumption, and poor sleep quality significantly prolonged menstrual bleeding duration. This observation suggests that menstrual disorders should not be viewed as isolated consequences of single dietary components but rather as outcomes influenced by complex interactions among multiple lifestyle factors.

Taken together, the evidence suggests that reducing saturated fat intake while increasing consumption of unsaturated fats, particularly omega-3 fatty acids, may represent an effective nutritional strategy for improving menstrual health and reducing menstrual pain.

Relationship Between Sleep Duration and Menstrual Disorders

Sleep duration emerged as one of the most influential lifestyle factors associated with menstrual health outcomes. Sleep is a fundamental physiological process that supports endocrine regulation, metabolic function, immune activity, and psychological well-being. Growing evidence indicates that inadequate sleep may significantly disrupt reproductive health and contribute to various menstrual disorders.

Several studies included in this review consistently demonstrated significant associations between sleep deprivation and menstrual disturbances. Xiong et al. (2025), involving 9,139 women, reported that sleeping less than seven hours per night increased the risk of menstrual irregularity by 44% (OR = 1.44; $p<0.0001$). Furthermore, each one-hour reduction in sleep duration increased the risk of menstrual disturbances by approximately 14%.

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Similarly, Polat & Mucuk (2021) found that 82.4% of women with severe dysmenorrhea experienced poor sleep quality based on the Pittsburgh Sleep Quality Index (PSQI). Jeon and Baek (2023), in their systematic review of 21 studies, concluded that sleep disturbances were consistently associated with PMS, dysmenorrhea, irregular menstrual cycles, and menstrual-related mood symptoms.

The biological explanation for these associations primarily involves circadian rhythm disruption. The circadian system regulates hormonal secretion through interactions between the suprachiasmatic nucleus (SCN) and the hypothalamic–pituitary–ovarian axis. Sleep deprivation disrupts this regulatory network, leading to alterations in gonadotropin-releasing hormone (GnRH) secretion and subsequent disturbances in follicle-stimulating hormone (FSH) and luteinizing hormone (LH) production.

These hormonal disruptions may impair follicular development, ovulation, and menstrual cycle regularity. Chronic sleep deprivation may therefore contribute to irregular menstruation, anovulation, and reduced reproductive function.

Furthermore, inadequate sleep increases cortisol secretion as part of the body's physiological stress response. Elevated cortisol levels can suppress reproductive hormone production and increase inflammatory activity. Increased levels of inflammatory mediators such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) may heighten pain sensitivity and worsen menstrual symptoms.

Sleep deprivation may also negatively affect emotional regulation and pain perception, thereby exacerbating PMS symptoms and dysmenorrhea. Consequently, ensuring adequate sleep duration and quality should be considered an important component of menstrual health promotion and reproductive healthcare interventions.

Biological Interaction Between Macronutrient Intake and Sleep

One of the most important findings emerging from this literature review is the existence of a bidirectional relationship between dietary patterns and sleep behavior. Nutrition and sleep do not operate independently; rather, they interact through multiple physiological and behavioral pathways that collectively influence menstrual health.

Poor dietary habits may impair sleep quality through several mechanisms. High consumption of refined carbohydrates and added sugars can cause fluctuations in blood glucose levels that interfere with normal sleep architecture. Similarly, deficiencies in essential nutrients may alter neurotransmitter production and disrupt circadian rhythm regulation.

Inadequate sleep has been shown to influence appetite regulation through hormonal changes involving ghrelin and leptin. Sleep deprivation increases ghrelin levels, which stimulate hunger, while reducing leptin levels, which signal satiety. As a result, individuals experiencing insufficient sleep often develop stronger cravings for energy-dense foods high in sugar and fat.

The reviewed literature identified four major biological pathways linking nutrition, sleep, and menstrual disorders.

The first pathway involves disruption of the hypothalamic–pituitary–ovarian axis, resulting in hormonal imbalance and menstrual irregularities. The second pathway involves insulin resistance caused by excessive sugar intake and chronic sleep deprivation. The third pathway involves increased prostaglandin production due to saturated fat consumption and inflammatory activation. The fourth pathway consists of reciprocal behavioral interactions in which poor dietary habits worsen sleep quality and inadequate sleep promotes unhealthy eating behaviors.

DOI: https://doi.org/10.71435/734647

These pathways create a self-reinforcing cycle that may progressively worsen menstrual health outcomes. Women who experience both poor dietary quality and insufficient sleep may therefore face a substantially higher risk of menstrual disturbances than those exposed to either factor alone.

Research Gaps Identified in the Literature

Despite the growing body of evidence linking macronutrient intake and sleep duration to menstrual health, several important research gaps remain. One of the most significant limitations identified in the reviewed literature is the predominance of cross-sectional study designs. Although cross-sectional studies are useful for identifying associations, they do not establish causality. Consequently, it remains unclear whether poor dietary habits and sleep disturbances directly contribute to menstrual disorders or whether menstrual disorders themselves lead to changes in dietary behavior and sleep patterns.

Another major limitation is the lack of integrated studies simultaneously evaluating dietary intake, objective sleep measurements, and reproductive hormone profiles. Most studies focused on only one or two variables, making it difficult to fully understand the complex interactions among nutrition, sleep, endocrine function, and menstrual health. Furthermore, no randomized controlled trials were identified that specifically investigated the combined effects of dietary and sleep interventions on menstrual disorders. Such studies would provide stronger evidence regarding the effectiveness of lifestyle modifications in improving menstrual outcomes.

An additional gap concerns menstrual phase-specific analyses. None of the reviewed studies differentiated the effects of nutrition and sleep across the follicular and luteal phases of the menstrual cycle, despite substantial physiological differences between these phases. Hormonal fluctuations throughout the cycle may alter nutritional requirements, sleep patterns, and symptom severity, suggesting that future research should adopt a phase-specific approach.

Considerable variation exists in the measurement methods used across studies. Differences in dietary assessment tools, sleep questionnaires, menstrual outcome definitions, and statistical analyses may contribute to inconsistencies in findings and limit comparability between studies.

Future investigations should employ standardized measurement protocols and longitudinal designs to generate stronger and more clinically applicable evidence.

The Relationship Between Carbohydrate Intake and the Incidence of Menstrual Disorders

Based on the literature reviewed, carbohydrate intake appears to play a substantial role in influencing menstrual health among women of reproductive age. The evidence consistently suggests that excessive consumption of refined carbohydrates, added sugars, and foods with a high glycemic index is associated with a higher prevalence of menstrual disorders, including dysmenorrhea, premenstrual syndrome (PMS), menstrual irregularities, and ovulatory disturbances. Ciołek et al. (2024) demonstrated a highly significant association between high added sugar consumption and increased menstrual distress ($p<0.0001$), while Estiani & Djokosujono (2020) found that carbohydrate intake significantly predicted PMS severity ($p=0.040$). These findings indicate that dietary carbohydrate quality may be as important as carbohydrate quantity in maintaining reproductive health.

The biological mechanisms underlying this relationship are closely related to glucose metabolism and endocrine regulation. Consumption of large amounts of refined carbohydrates results in rapid increases in blood glucose concentration, triggering excessive insulin secretion from pancreatic β-cells. Repeated exposure to high insulin levels eventually contributes to

DOI: https://doi.org/10.71435/734647

insulin resistance, a condition in which body tissues become less responsive to insulin. Insulin resistance is known to interfere with ovarian function because insulin directly affects steroidogenesis and follicular maturation. Elevated insulin levels stimulate ovarian androgen production, suppress normal follicular development, and impair ovulation. Consequently, women with persistent insulin resistance may experience irregular menstrual cycles, anovulation, and symptoms like those observed in polycystic ovary syndrome (PCOS).

Furthermore, insulin resistance contributes to chronic low-grade inflammation and oxidative stress, both of which have been implicated in menstrual dysfunction. Inflammatory mediators may alter ovarian hormone production and increase prostaglandin synthesis, thereby exacerbating menstrual pain. This mechanism may partially explain why women with diets high in sugar and processed foods often report more severe dysmenorrhea and PMS symptoms than those consuming balanced diets rich in whole grains, fruits, and vegetables.

In addition to its metabolic effects, excessive carbohydrate intake may influence emotional and psychological symptoms associated with menstruation. High-glycemic foods cause fluctuations in blood glucose levels that can affect neurotransmitter production, particularly serotonin. Rapid declines in blood glucose following excessive sugar intake may trigger compensatory increases in stress hormones such as cortisol and epinephrine. These hormonal responses can contribute to irritability, mood swings, anxiety, fatigue, and heightened emotional sensitivity during the premenstrual and menstrual periods. Such psychological disturbances may intensify the overall burden of menstrual symptoms and negatively affect quality of life.

Another important consideration is the role of dietary patterns rather than individual nutrients alone. Women who consume excessive amounts of refined carbohydrates often exhibit broader unhealthy dietary behaviors characterized by low fiber intake, inadequate micronutrient consumption, and excessive consumption of processed foods. These dietary patterns may collectively contribute to hormonal imbalance and reproductive dysfunction. Therefore, interventions aimed at reducing menstrual disorders should emphasize not only reducing sugar consumption but also promoting healthier dietary patterns that include complex carbohydrates, dietary fiber, and nutrient-dense foods.

Taken together, the findings suggest that carbohydrate intake influences menstrual health through multiple pathways involving insulin regulation, hormonal balance, inflammation, neurotransmitter function, and overall dietary quality. These mechanisms highlight the importance of dietary counseling and nutritional education as part of comprehensive strategies to prevent and manage menstrual disorders among women of reproductive age.

The Relationship Between Protein Intake and the Incidence of Menstrual Disorders

An important finding emerging from this literature review is that the relationship between protein intake and menstrual health is more complex than simply consuming enough protein. Evidence suggests that both the amount and the source of dietary protein influence reproductive function and menstrual outcomes. Güzeldere et al. (2024) reported that women with inadequate protein intake exhibited significantly lower estrogen levels and a higher prevalence of menstrual disturbances ($p<0.005$). However, Kim (2021) further demonstrated that excessive intake of animal-derived protein may also contribute to ovulatory dysfunction, indicating that both deficiency and excess may adversely affect menstrual health.

Adequate protein intake is essential for reproductive health because proteins provide amino acids required for the synthesis of hormones, enzymes, and neurotransmitters. Estrogen, progesterone, and other reproductive hormones depend indirectly on adequate nutritional status

DOI: https://doi.org/10.71435/734647

and protein availability (Calcaterra et al., 2024; Das et al., 2023). When dietary protein intake is insufficient, the body may prioritize essential physiological processes necessary for survival, leading to reduced allocation of resources toward reproductive functions. Consequently, menstrual irregularities may occur as an adaptive response to nutritional inadequacy.

Protein deficiency may also disrupt the functioning of the hypothalamic–pituitary–ovarian axis (Chen et al., 2022; Valera et al., 2025). Reduced availability of amino acids can impair hormone synthesis and alter signaling pathways involved in ovulation and menstrual cycle regulation. This mechanism may explain why women experiencing chronic undernutrition or restrictive dietary practices frequently report amenorrhea, oligomenorrhea, or irregular menstruation.

Beyond reproductive hormones, protein intake influences the production of neurotransmitters that regulate mood and sleep. Tryptophan, an essential amino acid obtained from dietary proteins, serves as the precursor for serotonin and melatonin. Serotonin is responsible for emotional regulation, while melatonin plays a crucial role in maintaining circadian rhythms and sleep quality. Insufficient protein intake may therefore lead to decreased serotonin and melatonin production, increasing vulnerability to PMS-related mood disturbances, irritability, anxiety, depressive symptoms, and sleep disorders (Martire et al., 2026; Robinson et al., 2025).

Interestingly, the reviewed literature suggests that protein source may be equally important as protein quantity. Excessive consumption of animal-derived protein, particularly red meat and processed meat products, may contribute to reproductive dysfunction due to its association with saturated fat intake. Diets rich in saturated fats have been linked to increased systemic inflammation, insulin resistance, and hormonal disturbances, all of which may adversely affect ovulation and menstrual regularity. Therefore, the observed association between excessive animal protein intake and ovulatory disorders may partly reflect the accompanying dietary fat composition.

Conversely, plant-based protein sources appear to exert protective effects on reproductive health. Foods such as soybeans, tofu, tempeh, legumes, lentils, and nuts contain phytoestrogens, fiber, antioxidants, and anti-inflammatory compounds that may support hormonal balance. Phytoestrogens can interact with estrogen receptors and may help stabilize fluctuations in estrogen levels, particularly among women experiencing hormonal disturbances.

Additionally, plant-based diets are generally associated with improved insulin sensitivity and lower levels of inflammatory markers, both of which may contribute to better menstrual outcomes. The findings of this review support growing evidence that dietary protein should be evaluated not only quantitatively but also qualitatively.

A balanced intake of high-quality protein from diverse sources may support hormonal stability, improve mood regulation, enhance sleep quality, and promote regular menstrual function. Consequently, nutritional interventions targeting menstrual health should emphasize adequate protein consumption while encouraging greater inclusion of plant-based protein sources within the diet.

The Relationship Between Fat Intake and the Incidence of Menstrual Disorders

Based on the studies included in this review, dietary fat intake appears to have one of the most direct and consistent relationships with menstrual disorders, particularly dysmenorrhea and premenstrual syndrome (PMS). While fats are essential nutrients required for energy storage, cellular membrane integrity, and steroid hormone synthesis, the physiological effects of dietary fat depend largely on both the quantity and quality of fat consumed. The literature consistently

DOI: https://doi.org/10.71435/734647

suggests that excessive intake of saturated fats is associated with increased menstrual pain severity, prolonged menstrual symptoms, and greater menstrual discomfort.

Thiyagarajan et al. (2024) reported that women with high saturated fat consumption had a significantly greater risk of experiencing severe dysmenorrhea compared with those consuming lower amounts of saturated fats ($p<0.005$). Similar findings were reported by Estiani & Djokosujono (2020), who found that fat intake significantly predicted PMS severity ($p=0.047$). The consistency of these findings across multiple studies strengthens the evidence that dietary fat is an important modifiable factor influencing menstrual health.

The biological mechanism underlying this association primarily involves inflammatory pathways. Saturated fatty acids are metabolized into arachidonic acid, a polyunsaturated fatty acid that serves as the primary precursor for prostaglandin synthesis. During menstruation, prostaglandins facilitate uterine contractions necessary for the shedding of the endometrial lining. However, excessive prostaglandin production can result in exaggerated uterine contractions, reduced uterine blood flow, tissue ischemia, and increased activation of pain receptors. Consequently, women with high saturated fat intake may experience more intense menstrual pain due to elevated prostaglandin concentrations.

In addition to prostaglandin production, saturated fats contribute to systemic inflammation by increasing circulating inflammatory markers. Chronic inflammation may alter endocrine function, impair insulin sensitivity, and exacerbate menstrual symptoms. Inflammatory cytokines can also influence pain perception, making individuals more sensitive to uterine contractions during menstruation. These mechanisms provide a plausible explanation for why women consuming diets rich in fried foods, processed foods, fast foods, and fatty animal products frequently report more severe menstrual discomfort.

Several studies suggest that unsaturated fats, particularly omega-3 fatty acids, may have protective effects against menstrual disorders. Omega-3 fatty acids are commonly found in fatty fish, flaxseeds, chia seeds, walnuts, and certain plant oils. These fatty acids compete with arachidonic acid during inflammatory processes and promote the production of anti-inflammatory eicosanoids. As a result, omega-3 fatty acids may reduce prostaglandin-mediated uterine contractions and alleviate menstrual pain.

Beyond their anti-inflammatory effects, omega-3 fatty acids may influence neurotransmitter function and emotional regulation. Research has demonstrated that omega-3 fatty acids contribute to serotonin and dopamine signaling, which may help reduce mood-related PMS symptoms such as irritability, anxiety, and depressive symptoms. Therefore, dietary fat composition may influence both the physical and psychological manifestations of menstrual disorders.

Another important contribution to the literature was provided by Nahdah et al. (2022), who demonstrated that high fat intake combined with low fiber consumption and poor sleep quality significantly prolonged menstrual bleeding duration. This finding highlights the multifactorial nature of menstrual disorders and suggests that dietary fats interact with other lifestyle factors to influence reproductive health outcomes. Rather than acting independently, dietary fat may amplify the negative effects of inadequate nutrition and poor sleep, resulting in more severe menstrual disturbances.

Taken together, the available evidence suggests that reducing saturated fat intake while increasing the consumption of healthy unsaturated fats may represent a practical and effective strategy for improving menstrual health. Public health interventions aimed at reducing

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dysmenorrhea and PMS should therefore consider emphasizing dietary fat quality in addition to overall caloric intake.

Relationship Between Sleep Duration and the Incidence of Menstrual Disorders

Among all lifestyle factors examined in this review, sleep duration emerged as one of the most influential determinants of menstrual health. Despite being frequently overlooked in reproductive health discussions, sleep plays a critical role in endocrine regulation, immune function, metabolic homeostasis, and psychological well-being. The reviewed literature consistently demonstrated that inadequate sleep duration is associated with increased risks of menstrual irregularities, dysmenorrhea, PMS, and other menstrual-related symptoms.

One of the strongest pieces of evidence was provided by Xiong et al. (2025), who analyzed data from 9,139 women and found that sleeping less than seven hours per night increased the likelihood of menstrual irregularities by 44% (OR = 1.44, $p<0.001$). Furthermore, each one-hour reduction in nightly sleep duration increased the risk of menstrual disturbances by approximately 14%. These findings suggest a dose-response relationship in which progressively shorter sleep duration contributes to progressively greater reproductive health risks.

The biological basis for this association lies primarily in circadian rhythm regulation. The body's internal biological clock is governed by the suprachiasmatic nucleus (SCN), located within the hypothalamus. The SCN coordinates daily physiological rhythms, including hormone secretion, sleep-wake cycles, metabolism, and reproductive processes. Adequate sleep helps maintain synchronization between these biological systems, whereas chronic sleep deprivation disrupts circadian regulation.

One consequence of circadian disruption is altered secretion of gonadotropin-releasing hormone (GnRH), which serves as the primary regulator of reproductive hormone production. Disturbances in GnRH secretion may impair the release of follicle-stimulating hormone (FSH) and luteinizing hormone (LH), both of which are essential for follicular development, ovulation, and menstrual cycle regulation. Consequently, women experiencing chronic sleep deprivation may develop irregular menstrual cycles, delayed ovulation, or anovulatory cycles.

Another important mechanism involves the physiological stress response. Insufficient sleep increases activation of the hypothalamic–pituitary–adrenal (HPA) axis, resulting in elevated cortisol secretion. High cortisol concentrations suppress reproductive hormone production and may inhibit normal ovarian function. From an evolutionary perspective, the body may interpret chronic sleep deprivation as a stressful environmental condition and temporarily reduce reproductive activity to preserve energy and maintain survival.

Furthermore, sleep deprivation contributes to increased systemic inflammation. Elevated concentrations of inflammatory markers such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and C-reactive protein have been observed among individuals with chronic sleep insufficiency. These inflammatory mediators may increase pain sensitivity and amplify uterine inflammatory responses during menstruation, thereby worsening dysmenorrhea symptoms.

The findings of Polat and Mucuk (2021) provide additional support for this mechanism. Their study found that 82.4% of women experiencing severe dysmenorrhea also reported poor sleep quality. This relationship may be bidirectional because menstrual pain can disrupt sleep while poor sleep simultaneously increases pain sensitivity.

DOI: https://doi.org/10.71435/734647

Such interactions create a self-perpetuating cycle that may worsen menstrual outcomes over time. The systematic review conducted by Jeon and Baek (2023) further strengthens the evidence base. Among 21 studies examined, the majority reported significant associations between sleep disturbances and menstrual problems. The consistency of findings across diverse populations suggests that sleep may represent a universal and modifiable determinant of menstrual health.

These findings have important clinical implications because sleep is a modifiable behavior that can potentially be improved through lifestyle interventions. Encouraging adequate sleep duration, promoting sleep hygiene practices, and addressing sleep disorders may therefore represent valuable strategies for reducing menstrual symptoms and improving reproductive health outcomes.

Biological Mechanisms Linking Macronutrients and Sleep in Affecting Menstruation

One of the most important observations emerging from this review is that nutrition and sleep should not be viewed as isolated determinants of menstrual health. Instead, these factors interact through multiple biological and behavioral pathways that collectively influence reproductive function. The evidence suggests that poor dietary habits can impair sleep quality, while inadequate sleep simultaneously promotes unhealthy eating behaviors. Together, these factors create a cycle of metabolic and hormonal disturbances that may substantially increase the risk of menstrual disorders.

The first major mechanism involves disruption of the hypothalamic–pituitary–ovarian (HPO) axis. The HPO axis serves as the primary regulatory system governing the menstrual cycle. Adequate nutritional intake provides the energy required for reproductive processes, while adequate sleep ensures proper neuroendocrine regulation. When dietary intake is inadequate or when sleep duration becomes chronically restricted, hypothalamic signaling may be altered. This disruption can suppress GnRH secretion and subsequently reduce FSH and LH production, leading to ovulatory dysfunction and menstrual irregularities.

The second mechanism involves insulin resistance. Both excessive consumption of refined carbohydrates and chronic sleep deprivation contribute to reduced insulin sensitivity. Insulin resistance has profound effects on ovarian hormone production because insulin interacts directly with ovarian tissue. Elevated insulin levels stimulate androgen production, impair follicular maturation, and disrupt ovulation. Therefore, poor dietary quality and inadequate sleep may work synergistically to increase the risk of menstrual disorders through shared metabolic pathways.

The third mechanism involves inflammatory activation. Excessive intake of saturated fats increases the availability of prostaglandin precursors, while sleep deprivation elevates inflammatory cytokines such as IL-6 and TNF-α. Together, these factors create a pro-inflammatory environment that intensifies uterine contractions, increases pain sensitivity, and exacerbates dysmenorrhea symptoms. This pathway appears particularly important for explaining the severity of menstrual pain among women exposed to multiple adverse lifestyle factors.

The fourth mechanism involves reciprocal behavioral interactions. Sleep deprivation alters appetite-regulating hormones, increasing ghrelin and decreasing leptin levels. These hormonal changes stimulate cravings for foods rich in sugar and fat. Conversely, excessive consumption of high-sugar foods contributes to unstable blood glucose fluctuations that impair sleep quality. This bidirectional relationship creates a reinforcing cycle in which poor diet worsens sleep and poor sleep promotes unhealthy dietary choices.

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These interconnected mechanisms suggest that menstrual disorders are influenced by complex interactions among metabolic, endocrine, inflammatory, and behavioral factors. Consequently, interventions addressing only a single lifestyle factor may produce limited benefits. Integrated approaches targeting both nutrition and sleep are likely to be more effective in improving menstrual health outcomes.

Identification of Research Gaps

Although the literature reviewed provides substantial evidence linking macronutrient intake and sleep duration with menstrual disorders, several important research gaps remain. Addressing these gaps is essential for developing more effective prevention and intervention strategies.

The most significant limitation is the predominance of cross-sectional study designs. Most studies included in this review measured dietary intake, sleep characteristics, and menstrual outcomes at a single point in time. While such studies are valuable for identifying associations, they do not establish temporal relationships or causality. Consequently, it remains unclear whether poor dietary habits and inadequate sleep directly contribute to menstrual disorders or whether menstrual disorders themselves influence dietary and sleep behaviors.

Another notable gap is the absence of randomized controlled trials evaluating combined nutritional and sleep interventions. Although mechanistic evidence strongly suggests that both factors influence menstrual health, there is currently limited experimental evidence demonstrating whether simultaneous improvements in diet and sleep produce meaningful reductions in menstrual symptoms. Such intervention studies would provide stronger evidence for clinical recommendations.

A further limitation is the lack of integrated assessments combining dietary intake, objective sleep measurements, and reproductive hormone analyses. Most studies rely on self-reported dietary questionnaires and subjective sleep assessments, which may introduce recall bias and measurement error. Future studies should incorporate objective measures such as actigraphy for sleep assessment, detailed dietary records, and laboratory analyses of reproductive hormones.

The reviewed studies rarely examined whether nutritional influences vary across different phases of the menstrual cycle. Hormonal profiles differ substantially between the follicular and luteal phases, suggesting that nutritional requirements and physiological responses may also differ. Understanding these phase-specific relationships could facilitate the development of more personalized nutritional recommendations.

Many studies were conducted within specific populations and cultural settings, limiting the generalizability of findings. Future research should include more diverse populations and consider socioeconomic, cultural, and environmental factors that may influence dietary patterns, sleep behaviors, and menstrual health outcomes.

Conclusion

Based on the review of ten scientific articles, it can be concluded that macronutrient intake and sleep duration are significantly associated with menstrual disorders among women of reproductive age. Excessive consumption of high-glycemic carbohydrates, inadequate or excessive protein intake, high saturated fat consumption, and insufficient sleep are associated with increased risks of PMS, dysmenorrhea, and menstrual irregularities. These relationships are mediated through several biological mechanisms, including disruption of the hypothalamic–pituitary–ovarian (HPO) axis, insulin resistance, inflammatory responses, and

DOI: https://doi.org/10.71435/734647

hormonal imbalance. Furthermore, dietary habits and sleep patterns interact with one another, creating cumulative effects on menstrual health. Although the available evidence supports these associations, further longitudinal and intervention studies are needed to establish causality and evaluate the effectiveness of integrated nutrition and sleep interventions in preventing and managing menstrual disorders.

References

Ara, I., Maqbool, M., & Gani, I. (2022). Reproductive Health of Women: implications and attributes. *International Journal of Current Research in Physiology and Pharmacology*, *6*(3), 8-18.

Ara, N., VK, A., Mustapha Kura, S., Ali Ahmada, H., Khatoon, N., & Abubakar Ally, T. (2024, February). Menstrual cycle effects on mental health outcomes: an ethnographic study. In *BIO Web of Conferences* (Vol. 86, p. 01011). EDP Sciences. https://doi.org/10.1051/bioconf/20248601011

Armour, M., Sinclair, J., Chalmers, K. J., & Smith, C. A. (2019). Self-management strategies amongst Australian women with endometriosis: A national online survey. *BMC Complementary and Alternative Medicine, 19*(1), 17. https://doi.org/10.1186/s12906-019-2431-x

Aromataris, E., & Pearson, A. (2021). The systematic review: An overview. *AJN American Journal of Nursing, 114*(3), 53–58. https://doi.org/10.1097/01.naj.0000444496.24228.2c

Baker, F. C., & Lee, K. A. (2022). Menstrual cycle effects on sleep. *Sleep Medicine Clinics, 17*(2), 283–294. https://doi.org/10.1016/j.jsmc.2022.02.004

Barrios-De-Tomasi, J., Barrientos-Durán, A., Peña-Casanova, V., & Parra-Hernández, S. (2023). Lifestyle and menstrual cycle disorders: A systematic review. *International Journal of Environmental Research and Public Health, 20*(5), 4365. https://doi.org/10.1186/s12905-024-03235-4

Baş, B., & Yıldırım, B. Y. (2024). The relationship between dietary habits and menstruation problems in women: A cross-sectional study. *BMC Women's Health, 24*, 393. https://doi.org/10.1007/s13224-021-01606-7

Calcaterra, V., Verduci, E., Stagi, S., & Zuccotti, G. (2024). How the intricate relationship between nutrition and hormonal equilibrium significantly influences endocrine and reproductive health in adolescent girls. *Frontiers in nutrition*, *11*, 1337328. https://doi.org/10.3389/fnut.2024.1337328

Çengel, N., & Arslan, M. (2024). Relationship between menstruation period, nutrients intake and appetite with premenstrual syndrome. *Journal of Human Sciences, 21*(2), 160–173. https://doi.org/10.14687/jhs.v21i2.6459

Chen, X., Xiao, Z., Cai, Y., Huang, L., & Chen, C. (2022). Hypothalamic mechanisms of obesity-associated disturbance of hypothalamic–pituitary–ovarian axis. *Trends in endocrinology & metabolism*, *33*(3), 206-217. https://doi.org/10.1016/j.tem.2021.12.004

Das, P. K., Mukherjee, J., & Banerjee, D. (2023). Female reproductive physiology. In *Textbook of veterinary physiology* (pp. 513-568). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-19-9410-4_22

DOI: https://doi.org/10.71435/734647

Estiani, K., & Djokosujono, K. (2020). Hubungan asupan gizi dengan kejadian premenstrual syndrome. *Jurnal Ilmu Kesehatan Masyarakat*, *9*(02), 93-98. https://doi.org/10.33221/jikm.v9i02.523

Gani, I., Ara, I., & Dar, M. A. (2023). Reproductive Health of Women: a comprehensive review. *International Journal of Current Research in Physiology and Pharmacology*, *7*(4s).

Gusenbauer, M., & Haddaway, N. R. (2020). Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Research Synthesis Methods, 11*(2), 181–217. https://doi.org/10.1002/jrsm.1378

Hess, J. M., Stephensen, C. B., Kratz, M., & Bolling, B. W. (2021). Exploring the links between diet and inflammation: Dairy foods as case studies. *Advances in Nutrition, 12*(Suppl. 1), 1S–13S. https://doi.org/10.1093/advances/nmaa073

Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2023). *Cochrane handbook for systematic reviews of interventions* (Version 6.4). Cochrane. https://doi.org/10.1002/14651858.ed000142

Holesh, J. E., Aslam, S., & Martin, A. (2023). Physiology, carbohydrates. In *StatPearls*. StatPearls Publishing.

Jenkins, D. J. A., Kendall, C. W. C., Augustin, L. S. A., Franceschi, S., Hamidi, M., & Marchie, A. (2022). Glycemic index: Overview of implications in health and disease. *American Journal of Clinical Nutrition, 76*(1), 266S–273S.

Jeon, B., & Baek, J. (2023). Menstrual disturbances and its association with sleep disturbances: A systematic review. *BMC Women's Health, 23*(1), 470. https://doi.org/10.1186/s12905-023-02629-0

Jeon, B., & Baek, J. (2023). Menstrual disturbances and its association with sleep disturbances: a systematic review. *BMC women's health*, *23*(1), 470. https://doi.org/10.1186/s12905-023-02629-0

Kim, T., Nam, G. E., Han, B., Cho, S. J., Kim, J., & Eum, D. H. (2020). Associations of mental health and sleep duration with menstrual cycle irregularity: A population-based study. *Archives of Women's Mental Health, 21*(6), 619–626. https://doi.org/10.1007/s00737-018-0872-8

Knutson, K. L., Spiegel, K., Penev, P., & Van Cauter, E. (2020). The metabolic consequences of sleep deprivation. *Sleep Medicine Reviews, 11*(3), 163–178. https://doi.org/10.1016/j.smrv.2007.01.002

Lateef, O. M., & Akintubosun, M. O. (2020). Sleep and reproductive health. *Journal of Circadian Rhythms, 18*, Article 1. https://doi.org/10.5334/jcr.190

Lefebvre, C., Glanville, J., Briscoe, S., Littlewood, A., Marshall, C., & Metzendorf, M. I. (2023). Searching for and selecting studies. In J. P. T. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. J. Page, & V. A. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions* (Version 6.4). Cochrane.

Martire, F. G., Costantini, E., Ianes, I., d'Abate, C., De Bonis, M., Piccione, E., & Andreoli, A. (2026). Premenstrual Syndrome and Nutritional Factors: A Narrative Review of

DOI: https://doi.org/10.71435/734647

Current Evidence and Clinical Implications. *Journal of Clinical Medicine*, *15*(3), 1124. https://doi.org/10.3390/jcm15031124

Methley, A. M., Campbell, S., Chew-Graham, C., McNally, R., & Cheraghi-Sohi, S. (2014). PICO, PICOS and SPIDER: A comparison study of specificity and sensitivity in three search tools for qualitative systematic reviews. *BMC Health Services Research, 14*, 579. https://doi.org/10.1186/s12913-014-0579-0

Musulin, C., Yeshitila, N., & Harper, J. (2025). Periods and well-being: A focus group study to discuss how menstruation affects the well-being of women aged 18–40. *Women's Health, 21*, 17455057251362992. https://doi.org/10.1177/17455057251362992

Nahdah, A. A., Nugrahayu, E. Y., & Hutahaean, Y. O. (2022). Hubungan Tingkat Stres Dengan Pola Asuh Orang Tua Yang Memiliki Anak Penyandang Autisme Di Pusat Layanan Autis Kota Samarinda. *Verdure: Health Science Journal*, *4*(1), 206-215.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

Palma, B. D., Tufik, S., & Mello, M. T. (2021). Sleep quality and body composition: Metabolic connections. *Einstein (São Paulo), 19*, eRB5470.

Rafique, N., & Al-Sheikh, M. H. (2018). Prevalence of menstrual problems and their association with psychological stress in young female students studying health sciences. *Saudi medical journal*, *39*(1), 67. https://doi.org/10.15537/smj.2018.1.21438

Robinson, J., Ferreira, A., Iacovou, M., & Kellow, N. J. (2025). Effect of nutritional interventions on the psychological symptoms of premenstrual syndrome in women of reproductive age: a systematic review of randomized controlled trials. *Nutrition reviews*, *83*(2), 280-306. https://doi.org/10.1093/nutrit/nuae043

Rugvedh, P., Gundreddy, P., & Wandile, B. (2023). The menstrual cycle's influence on sleep duration and cardiovascular health: a comprehensive review. *Cureus*, *15*(10).*15*(10), e47296. https://doi.org/10.7759/cureus.47296

Sacks, F. M., Lichtenstein, A. H., Wu, J. H. Y., Appel, L. J., Creager, M. A., Kris-Etherton, P. M., Miller, M., Rimm, E. B., Rudel, L. L., Robinson, J. G., Stone, N. J., & Van Horn, L. V. (2017). Dietary fats and cardiovascular disease: A presidential advisory from the American Heart Association. *Circulation, 136*(3), e1–e23. https://doi.org/10.1161/CIR.0000000000000510

Shechter, A., & Boivin, D. B. (2020). Sleep, hormones, and circadian rhythms throughout the menstrual cycle in healthy women and women with premenstrual dysphoric disorder. *International Journal of Endocrinology, 2020*, 9072075. https://doi.org/10.1155/2020/9072075

Singh, S., Best, C., Dunn, S., Leyland, N., & Wolfman, W. L. (2013). Abnormal uterine bleeding in pre-menopausal women. *Journal of Obstetrics and Gynaecology Canada, 35*(5), S1–S28. https://doi.org/10.1016/S1701-2163(15)30912-1

DOI: https://doi.org/10.71435/734647

Skoracka, K., Ratajczak, A. E., Rychter, A. M., Dobrowolska, A., & Krela-Kaźmierczak, I. (2021). Female fertility and the nutritional approach: The most essential aspects. *Advances in Nutrition, 12*(6), 2372–2386. https://doi.org/10.1093/advances/nmab068

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Taheri, R., Ardekani, F. M., Shahraki, H. R., Heidarzadeh-Esfahani, N., & Hajiahmadi, S. (2020). Nutritional status and anthropometric indices in relation to menstrual disorders: A cross-sectional study. *The Scientific World Journal, 2020*, 5980685. https://doi.org/10.1155/2020/5980685

Tazinya, R. M. A., El-Mowafi, I. M., Hajjar, J. M., & Yaya, S. (2023). Sexual and reproductive health and rights in humanitarian settings: a matter of life and death. *Reproductive Health*, *20*(1), 42. https://doi.org/10.1186/s12978-023-01594-z

Thiyagarajan, D. K., Basit, H., & Jeanmonod, R. (2024). Physiology, menstrual cycle. In *StatPearls*. StatPearls Publishing.

Valera, H., Chen, A., & Grive, K. J. (2025). The hypothalamic-pituitary-ovarian axis, ovarian disorders, and brain aging. *Endocrinology*, *166*(10), bqaf137. https://doi.org/10.1210/endocr/bqaf137

Xiong, Y., Li, S., Wang, C., Sun, D., Li, Z., Gu, H., ... & Chinese Stroke Association Guidelines Writing Group on Reperfusion Therapy for Acute Ischemic Stroke. (2025). Chinese stroke association guidelines on reperfusion therapy for acute ischaemic stroke 2024. *Stroke and Vascular Neurology*, *10*(5), 527-541. https://doi.org/10.1136/svn-2024-003977

DOI: https://doi.org/10.71435/734647