



(REVIEW ARTICLE)



## Sleep and menstrual irregularities: A systematic review

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### Abstract

Sleep is crucial to human bodily function, pathological sleep patterns including extremes of sleep duration, poor sleep quality, and shift work are closely linked to menstrual irregularity. Our goal in this review is to evaluate the literature on the relationship between sleep patterns and irregular menstrual cycles in females and possibly to lay out the future research that needs to be done to better understand this issue in the Jordanian population. A literature search was performed using the PubMed, Scopus, and Google Scholar databases. Several studies stated that inadequate sleep had a negative effect on the menstrual cycle of premenopausal women. This review shines a light on the influence of sleep disturbance on the incidence of menstrual problems and emphasizes the importance of regular sleep on the health of premenopausal women.

**Keywords:** Menstrual Cycle; Menstrual Irregularity; Relationship; Sleep; Sleep Irregularities

### 1. Introduction

The menstrual cycle is a normal physiological process in which the lining of the uterus sheds in girls, this cycle is regulated by the hypothalamus-pituitary ovarian axis, which is affected by psychological, social, nutritional, genetic, and biological factors, as well as general health (1, 2). The menstrual cycle ranges from 21 to 35 days averaging 28 days, the duration of the menstrual cycle lasts from 3 to 7 days, and the volume of blood lost ranges from 5 to 80 ml. It consists of four phases, beginning with the menstruation phase, the follicular phase, the ovulation phase, and the luteal phase. The first menstrual cycle occurs at the age of 12-13, and it stops approximately at the age of 51 years (3-5).

the menstrual cycle length is counted from the first day of the menstrual phase of the cycle to the first day of the next cycle. Any variation other than the normal length of the menstrual cycle (less than 21 days or more than 35 days), or not having a period for a 3-month cycle (90 days) is described as irregular menstruation. Several factors affect the regularity of the menstrual cycle such as nutritional, environmental factors, poor sleep quality, stress, and physical activity, as well as some diseases like type 2 diabetes mellitus, heart disease, breast cancer, and osteoporosis (2, 5, 6) Furthermore, girls could experience other menstrual problems during their cycle such as dysmenorrhea (menstrual pain), heavy menstrual bleeding (menorrhagia), oligomenorrhea, polymenorrhea and premenstrual tension syndrome (PMS) (7, 8). Studies have reported the prevalence of menstrual pain in teenage girls is between 16 – 93% and irregular menstruation is reported at 34% (8).

It has been reported that good quality sleep is needed for the best performance of daily activities, on the other hand, inadequate or disturbed sleep causes daytime malfunctioning in addition to other psychological and physical disorders (9, 10). Reports suggest that nearly a third of the world population is affected by insufficient or disturbed sleep, moreover, these reports showed that women have a higher prevalence of sleep disturbance than men (11-13).

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Moreover, disturbed sleep may increase the incidence of menstrual problems because sleep and the menstrual cycle are regulated by the activities of the hypothalamus-pituitary axis(1). As we know, melatonin is produced in the pineal gland which helps regulate the circadian sleep pattern. Furthermore, recent studies showed that melatonin is also produced in the peripheral reproductive system, and it can modulate ovarian and uterine function (1, 14, 15). Therefore, when sleep pattern is altered, this will alter the endogenous production of melatonin and may affect reproductive health (1, 15, 16).

A lot of research studied the relationship between the irregular menstrual cycle and sleep, according to a study conducted in Ethiopia, a significant effect was found between 7 hours of sleep or less and an irregular menstrual cycle (10). This was agreed by a study conducted in the United States, which reported that a short sleep period was associated with an increase of 44% in the possibility of an irregular menstrual cycle (17). However, a study of Chinese university students indicated that a short sleep period (6 hours or less) was not associated with an irregular menstrual cycle (18). Our primary goal in this review is to evaluate the literature on the relationship between sleep patterns and irregular menstrual cycles in females and to focus on the importance of conducting more research to obtain more accurate results.

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## 2. Methods

A literature search was performed using the PubMed, Scopus, and Google Scholar databases to identify studies that reported associations between sleep disturbance and menstrual irregularity. The search was limited to articles focused on menstrual cycle irregularity and sleep patterns published from 1976 to 2023 and did not specify a specific geographic location. We excluded meta-analysis and review articles from the search results. Search terms included "menstrual cycle" AND "sleep." The MeSH terms were "menstrual cycle" [All Fields] AND "irregularity" [All Fields] AND "sleep" [All Fields]. The most relevant articles were selected and narratively reviewed. We searched databases for studies suggesting a relationship between sleep and irregular menses, we screened studies sequentially by title and abstract for eligibility and excluded 5 review studies and 15 studies not specifically related to our topic. We included 19 studies as part of our review almost all of them were cross-sectional studies. These studies were conducted in different countries, eight of which were in the United States and Korea, three in China, four in India and Ethiopia, and one each in Brazil, Japan, Norway and Egypt. Most studies have not only examined the relationship between sleep patterns and irregular periods, but also examined the effect of BMI, anxiety, alcohol intake, depressive mood and other factors on menstruation. Some of them also focused on the effect of sleep on symptoms associated with menstruation. Five of the included studies focused on nurses and night shift workers, as they are the most common segment of the population with irregular sleep patterns. In addition, four studies included adolescents in the study sample and one examined the impact of the COVID-19 pandemic.

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## 3. Results

In this review, we included 19 articles that studied the relation between sleep irregularity and menstrual cycle problems, including irregularity and other abnormal symptoms such as dysmenorrhea and PMS. Of these, sixteen articles showed a positive correlation. Firstly, a study of 5800 Chinese girls aged 12-18 years reported that irregular periods were significantly associated with poor sleep quality and duration (19). Furthermore, in another study in Korea involving 801 females aged 12-18 years, the authors reported a strong association between the duration of sleep and menstrual cycle irregularity, it was found that the better sleep duration and quality the less irregularity in the menstrual cycle among the participants. The authors recommended that improving sleep duration and quality is needed to improve the reproductive health of females (20).

Consistent with these findings, a study of 579 girls aged 20-60 years who lived in Philadelphia reported that short sleep duration impacted the volume of the menstrual cycle and caused heavier bleeding and greater cycle irregularity as compared with normal sleep. These results demonstrated a relationship between abnormal sleep patterns such as short sleep duration and poor sleep quality with heavier bleeding and menstrual cycle irregularity. The authors suggested and highlighted the need for further studies to understand the impact of poor sleep on menstrual irregularities which may help to improve treatment options (17).

Furthermore, Xing et al. reported that the irregularity of the menstrual cycle was significantly higher in those with sleep disturbance than in other participants in a large sample of 1006 female Chinese university students. In addition to this, the prevalence of menstrual cycle abnormalities such as irregular menstrual cycle, menorrhagia and longer menstrual bleeding, period pain and premenstrual syndrome were significantly higher in women with sleep disturbance than those without sleep disturbance. On the other hand, short sleep duration was only associated with premenstrual syndrome. The authors concluded that sleep disturbance can lead to menstrual abnormalities and the authors

recommended that more focus should be put on improving sleep quality in order to improve abnormalities in the menstrual cycle (18).

A population-based study that included 4445 women aged 19-49 years in Korea suggested that short sleep duration was associated with a higher chance of menstrual cycle irregularity. In addition to this, participants with sleep duration of  $\leq 5$  hours a day with psychological health issues such as stress or suicidal ideation had a higher chance of menstrual cycle irregularity. This study concluded that there is an association between mental health problems and short sleep duration with menstrual cycle irregularity in the study group. Therefore, the authors recommended that practices to manage psychological problems and sleep disorders are needed in order to improve reproductive health and menstrual disturbances in women (21).

A pilot study of 100 female students at Adesh University in India also indicated the prevalence of sleep disturbances among women with irregular menstrual cycles. The authors reported that 47% of them sleep 4-7 hours during menstruation, while 64% feel that it is difficult to sleep at night. In addition, 66% of female students reported not having sound sleep during menstruation and 61% were having interrupted sleep. This study concluded that most female students who participated in this study had disturbed or interrupted sleep and insomnia during menstrual cycle irregularities, also supporting that sleep disturbances is common in females with menstrual irregularities (22).

Likewise, a cross-sectional study among students of Debre Berhan University in Ethiopia reported that 32.6% of participants who had irregular menstrual cycles were significantly associated with anemia, alcohol intake, and  $<5$  sleep hours (23). Although this study reported a lower incidence of menstrual irregularity as compared to previous studies, it did report an association between sleep quality and menstrual irregularities consistent with reports included in this review.

In addition to this, according to another Ethiopian study done at the same university, participants who slept  $\leq 5$  hours per day were twice more likely to have menstrual cycle irregularities than those who slept 6-8 hours per day. Furthermore, the results showed that more than one-third of the participants have experienced menstrual irregularity. The study also showed that age under 20 years, early menarche, weight abnormalities and psychological factors are significantly associated with menstrual irregularity in addition to poor sleep. The authors suggested that females should optimize their weight and adopt a healthy lifestyle, including getting adequate sleep, to control menstrual irregularity (10).

There were a couple of studies that researched nurses who work night shifts, these studies researched the effect of shift work on sleep and the menstrual cycle. Four of these studies reported a positive correlation; In this 12-month study of a sample of 287 newly employed nurses between 2015 and 2016, the authors found that insomnia increased the chance of developing menstrual cycle irregularity compared with participants not having insomnia. Also, insomnia increased the prevalence of menstrual cycle irregularity compared with participants not having insomnia by 3 folds. The authors concluded that insomnia could induce menstrual cycle irregularity while doing working shifts and it may possibly affect the circadian rhythm (24).

Another study found that 53% of the women reported menstrual changes when doing shift work. These findings suggested that abnormalities in sleep may lead to menstrual irregularities which may be used as a marker of shift work intolerance (25). Furthermore, a cross-sectional study involving 9,335 pre-menopausal women aged 22-45 suggested that frequent night shifts were associated with irregular cycles in nulliparous women. Furthermore, psychological and physical abnormalities such as depressive and anxiety symptoms, physical fatigue and sleep problems were higher in women with irregular cycles compared to those with normal cycles. The authors suggested that abnormal menstrual cycles are associated with reproductive, lifestyle and occupational factors that may affect sleep quality. These findings may help us to understand the risk factors for menstrual dysfunction, and thus, may help improve women's health (4).

Some studies we included in the review showed no association between sleep disturbances and irregular menstrual cycles, such as the study conducted in Norway on 766 female nurses under 50 years. They obtained the data from the survey of sleep, work period, and health, which focused on sleep, shift work, and other aspects of health. The results of this study indicated that 15% of women have irregular menstruation and did not show any associations between irregular menstruation and night work. It is possible that this finding is because the questionnaire was distributed by mail only, which resulted in a low response rate (26). This is contrary to the result shown by the study conducted on nurses in the US, which showed links between shift work and an irregular menstrual cycle pattern, with relative risks increasing slightly as the duration of shift work increased. This difference may have emerged in the results because of the large population size in the United States study, which included thousands of women (27). Moreover, in a study that researched the relationship between Morningness/Eveningness sleep preference and menstrual cycle regularity in 11

to 17 years adolescent girls, the authors reported no significant associations between sleep preference and menstrual cycle regularity (28).

The literature contained studies that examined sleep patterns, sleep quality, insomnia symptoms and sleep disturbances in relation to menses-related health problems other than menstrual cycle irregularity such as menstrual pain, menorrhagia and premenstrual syndrome. The first of them was a study conducted in China on 2260 healthy young women aged 17 to 30 years, the responses were collected online nationwide. The study revealed that poor sleep quality was significantly associated with dysmenorrhea among healthy Chinese females (29). Another study investigated sleep duration, quality and insomnia symptoms concerning menstrual problems in 5800 Chinese girls aged 12 to 14 years. The results showed that period pain and menstrual flow length  $\geq 7$  days were higher in participants with insomnia symptoms, and period pain was significantly higher in those with poor sleep quality (19).

Also, a study conducted in China investigated the relationship between sleep disturbance and menstrual problems in 1006 university students. The online study included a questionnaire exploring sleep and menstrual features among other features. The finding from this study indicated that sleep disorders were higher in those with longer menstrual flow, period pain and premenstrual syndrome. In addition to this, poor sleep quality was significantly associated with menorrhagia, while short sleep duration ( $\leq 6$ h) was only associated with PMS (18). An Egyptian study investigated the relationship between sleep problems and menstrual symptoms, the participants were 4122 women aged 12-25 years residing in Beni-Suef city in Egypt who were interviewed for their menstrual and sleep abnormalities during the previous 6 months. The authors reported that women with insomnia reported higher rates of dysmenorrhea and premenstrual symptoms (30). In addition, a study of 579 females conducted in Philadelphia that was part of a large study that researched the relationship between sleep duration and bleeding, this study reported a significant association between short sleep duration and poor sleep quality with heavier menstrual bleeding (17). Finally, a cross-sectional study evaluated the effect of imposed pandemic stress and sleep pattern on the reproductive health of 59 women, the study showed that sleep abnormalities and stress are linked to the variation in menstrual cycle experience and PMS (31).

**Table 1** Summary of the studies that were included in this review, including the year, title, author, population and design of the study

Respondents	Paper	Author	Year	Population Design
General Population	Associations of mental health and sleep duration with menstrual cycle irregularity: a population-based study	Kim, T., et al.	2018	cross-sectional study
	Sleep Status and Menstrual Problems among Chinese Young Females.	He, H., et al.	2021	cross-sectional study
	Early Menarche and Menstrual Problems Are Associated with Sleep Disturbance in a Large Sample of Chinese Adolescent Girls.	Liu, X., et al.	2017	Cross-sectional study
	Association of sleep duration and insomnia with menstrual symptoms among young women in Upper Egypt	Arafa, A., et al.	2020	Cross-sectional study
	Effect of Perceived Pandemic Stress and Sleep Variation on Menstrual Cycle Occurrence, its Severity and Premenstrual Syndrome: A Cross Sectional Study	Dhawan, A.Hernole, J.	2020	Cross-sectional study
	Does the reproductive cycle influence sleep patterns in women with sleep complaints?	Hacbul, H., et al.	2009	cross-sectional study
	Morningness/Eveningness and Menstrual Symptoms in Adolescent Females	Negriff, S., Dorn, L. D.	2014	cross-sectional study
	Association between sleep duration and menstrual cycle irregularity in Korean female adolescents	Nam, G. E., et al.	2017	cross-sectional study

	Menstrual regularity and bleeding is associated with sleep duration, sleep quality and fatigue in a community sample	Kennedy, K., et al.	2022	Cross-sectional study
University Students	Social jetlag and menstrual symptoms among female university students	Komada, Y., et al.	2019	cross-sectional study
	Magnitude and associated factors of menstrual irregularity among undergraduate students of DebreBerhan University, Ethiopia.	Zeru, A., et al.	2021	cross-sectional study
	Prevalence of Sleep Disturbances in Menstrual Cycle Irregularities: A Pilot Study.	Kaur, R., et.al.	2020	A pilot study
	Sleep disturbance is associated with an increased risk of menstrual problems in female Chinese university students.	Xing, X., et al.	2020	cross-sectional study
	Menstrual irregularity and its associated factors among college students in Ethiopia	Mittiku, Y., et al.	2021	Cross-sectional study
Shift workers (nurses)	Factors associated with regularity and length of menstrual cycle: Korea Nurses' Health Study	Song, S., et al.	2022	cross-sectional study
	Menstrual characteristics and night work among nurses	Moen, B. E., et al.	2015	Cross – sectional study
	Rotating Shift Work and Menstrual Cycle Characteristics	Lawson, C., et al.	2011	Cross – sectional study
	The menstrual cycle associated with insomnia in newly employed nurses performing shift work: a 12-month follow-up study	Kang, W. Y., et al.	2019	Follow up study
	Effects of shiftwork on sleep and menstrual function in nurses	Labyak, S., et al.	2001	Cross-sectional study

#### 4. Conclusion

Sleep is necessary to human health; when disturbed, it is interrelated to menstrual cycle abnormalities. Several large population studies state that inadequate sleep has a negative effect on the menstrual cycle of premenopausal women. These results enlighten the influence of sleep disturbance, decreased sleep duration, insomnia symptoms or shift work on the incidence of menstrual problems and clears up the importance of regular sleep, in general population health and in premenopausal women in particular. We noticed the absence of studies that research these issues in Jordan and Middle East countries in general. We recommend studies be done in the Jordanian population to see if there is any population difference from the rest of the world. Furthermore, future well-designed prospective studies with objective assessment of sleep and clinical diagnosis are needed to confirm the present findings and provide more evidence of the role of sleep disturbance on the menstrual cycle.

#### Compliance with ethical standards

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##### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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