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# Effect of Menstrual Pain on Sleep Quality and Anaerobic Performance

**Seda YALÇIN***
Iğdır University Faculty of Sports Sciences, Iğdır, Türkiye

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## Abstract

This study aimed to examine the effect of menstrual pain on sleep quality and anaerobic performance in women and the relationship between menstrual symptoms, sleep quality, and anaerobic performance. The study consisted of 22 (20.64 ± 1.91 years) healthy young women. The participants were divided into two groups according to their verbal expressions as menstruating with pain (n=11) and menstruating without pain (n=11). The study used a calendar-based counting method reported by women and an ovulation prediction kit to determine urinary LH surge. After the menstrual cycle phases were determined, Wingate anaerobic performance test measurements were applied to the participants in three phases (late follicle, ovulation and mid-luteal phase). Besides, the Pittsburgh sleep quality index was used to determine women's sleep quality, and the menstrual symptom scale was used to measure menstrual symptoms. Mann-Whitney U test, one of the non-parametric tests, was used in the data analysis. In statistical analysis, the level of significance was accepted as $p < 0.05$. Spearman correlation analysis was used to determine the relationship between menstrual pain, sleep quality and anaerobic performance. As a result, the average sleep quality of the participants was higher than the painless group. Menstrual symptom scale "pain symptoms", and "coping methods" scores and menstrual symptom scale total scores differed between the groups. The study found that the power drop score, one of the anaerobic performance scores, differed between the groups in the mid-luteal phase. As a result of the correlation test, menstrual pain and sleep quality were associated with anaerobic performance.
**Keywords:** Exercise, Menstrual cycle, Menstrual symptoms, Sleep quality

# Menstrual Ağrının, Uyku Kalitesi ve Anaerobik Performans Üzerine Etkisi

## Öz

Bu çalışmanın amacı kadınlarda menstruel ağrının, uyku kalitesi ve anaerobik performans üzerindeki etkisini ve menstruel semptomler ile uyku kalitesi ve anaerobik performans arasındaki ilişkiyi incelemektir. Çalışma 22 (20.64 ± 1.91 yıl) sağlıklı genç kadından oluşmuştur. Katılımcılar sözlü ifadelerine göre ağrılı (n=11) ve ağrısız (n=11) adet görenler olarak iki gruba ayrılmıştır. Çalışmada, kadınlar tarafından bildirilen takvime dayalı sayma yöntemi ve idrar LH dalgalanmasını belirlemek için bir ovulasyon tahmin kiti kullanılmıştır. Menstruel siklus evreleri belirlendikten sonra Wingate anaerobik performans testi ölçümleri katılımcılara üç fazda (geç folikül, ovulasyon ve mid-luteal faz) uygulanmıştır. Aynı zamanda kadınların uyku kalitesini belirlemek için Pittsburgh uyku kalitesi indeksi, adet semptomlarını ölçmek için menstruel semptom ölçeği kullanılmıştır. Verilerin analizinde parametrik olmayan testlerden biri olan Mann-Whitney U testi uygulanmıştır. İstatistiksel analizde anlamlılık düzeyi $p < 0,05$ olarak kabul edilmiştir. Menstruel ağrı ile uyku kalitesi ve anaerobik performans arasındaki ilişkiyi belirlemek için Spearman korelasyon analizi kullanılmıştır. Araştırma sonuçlarına göre katılımcıların ortalama uyku kalitesinin ağrısız gruba göre daha yüksek olduğu tespit edilmiştir. Menstruel semptom ölçeği “ağrı belirtileri”, “başa çıkma yöntemleri” puanları ve menstruel semptom ölçeği toplam puanının gruplar arasında farklılık gösterdiği saptanmıştır. Çalışmada, anaerobik performans skorlarından biri olan yorgunluk indeksi skorunun orta luteal fazda gruplar arasında farklılık gösterdiği bulunmuştur. Korelasyon testi sonuçlarına göre ise menstrual ağrının ve uyku kalitesinin anaerobik performans ile ilişkili olduğu görülmüştür.
**Anahtar kelimeler:** Adet döngüsü, Adet semptom, Egzersiz, Uyku kalitesi

* **Corresponding Author:** Seda YALÇIN, **Email:** y.seda@hotmail.com

## INTRODUCTION

Only 11% of the total athlete participating in the 1960 Rome Olympic Games were women participants. In Rio at the 2016 Games, this number rose to over 45%. The Paris 2024 Olympic Games will see full gender equality in the number of athletes for the first time. Women's competition also increased from 20% in 1960 to 50% in Rio Olympics (International Olympic Committee, 2020). As a result, the number of studies on athletic performance has also increased. In these studies, women constitute only 35% of the athletes (Costello et al., 2014). Because the existing study group in the studies was male, more information was gathered about training methods aimed at increasing athletic performance in the predominantly male population. Particularly high personalization of training has led to more targeted training methods and more optimized sports performance (Jiménez-Reyes et al., 2017; Zhanneta et al., 2015). Identifying a single training method that works for everyone was impossible. The reason for this is that athletes generally react differently to experiencing stimuli and the training load required to adapt to training also differs between genders (Pedersen et al., 2019). Ideally, each individualized training strategy, technique, and tactic requires an approach that fits each athlete's needs. Female athletes are less involved than males in most studies. The exclusion of women from the studies was justified by several researchers, including hormonal changes from the menstrual cycle (Meignié et al., 2021).

The menstrual cycle is a complex, physiological phenomenon of nature (Kin et al., 2000). Circulating estrogen and progesterone levels in healthy young women normally change during the menstrual cycle (Yen et al., 1970). This undergoes a permanent change from the premenopausal state to the postmenopausal state (Rozenberg et al., 1988). The menstrual cycle (MC) begins on the first day of bleeding when estrogen and progesterone levels drop. This first phase is divided into menstruation (early follicular phase) followed by a late follicular phase. The late follicular phase is the time between the first day of menstruation and the ovulation phase (Treloar, 1967). Follicular stimulating hormone (FSH) and luteinizing hormone (LH) levels increase in the follicular phase when FSH levels are higher than the LH level in the preovulatory phase (Simmen and Simmen, 2006).

After an average of 36 hours, the LH peak of the universe begins to ovulate. Estrogen levels peak just before ovulation and drop right after. The luteal phase is the time between ovulation when progesterone is produced, and the start of menstruation (Vollman, 1977). During the follicular phase, FSH levels drop and LH levels do not fluctuate. The level is low. Ovulation forms the third stage of the universe. Estrogen levels are highest just before ovulation. After a short time, it drops and progesterone levels begin to rise. LH is released at a higher rate while FSH increases less. The time between ovulation and the onset of menstruation, when higher levels of progesterone are produced, is the luteal phase (LP), the final phase of the cycle. At the end of the LP, it reaches the peak and a fall follows. Estrogen rises and falls simultaneously. A slight disruption of the balance between estradiol and progesterone during the menstrual period creates many negative situations. These include fatigue, temporary weight gain, bloating, pain, sleep and mood change (Meignié et al., 2021). Menstrual pain is expressed by severe cramps in the lower abdomen on the first and second days of bleeding. This phenomenon is called dysmenorrhea (Shangold, 1990). Increased production of the hormone prostaglandin is linked to uterine cramps, and Dysmenorrhea is suspected to be the cause (Kishali et al., 2006). In the study of Özbar et al., (2016) on the effect of the menstrual cycle on women's athletic performance, it was determined that 10% of women use pain relievers during athletic competitions. They found that 8.8% of the athletes in the research group had painful menstruation, 55.6% had sometimes painful menstruation, and 35.6% of the painless group. Moreover, in the same research results, 78.1% of the athletes reported that they felt good after menstruation, while the period when the athletes did not feel well belonged to the premenstrual period with 10.1%. They stated that the athletic performance of 19.9% of the athletes did not change during the menstrual period, and 2.5% of them performed better during this period.

In another similar study, 56 female volleyball players were surveyed and set out to examine the relationship between exercise and the menstrual cycle. As a result of the study, it was determined that exercise did not affect menstrual bleeding, but menstruation affects athletic performance physiologically (Çolakoğlu et al., 2005). Constantini et al., (2005) have reviewed the components of athletic performance (cardiovascular, brain function, respiration, response to ergogenic aids, metabolic and ergogenic aids) that may be affected by the menstrual cycle, and the menstrual cycle determined to influence aerobic and anaerobic strength. Therefore, MC can be seen as a potential defining performance. However, hormonal changes are considered when personalizing women's workouts. In a study, 44.6% of university female athletes believed that menstrual cramps affected their training or competition performance and reported that they experienced fatigue symptoms (Takeda et al., 2015).

Reproductive hormones not only regulate reproductive function during the menstrual cycle, but also affect sleep and circadian rhythms. Negative menstrual symptoms are most commonly experienced by women in the last few days of the cycle as progesterone and estrogen levels drop (Nowakowski et al., 2013). Premenstrual syndrome and premenstrual dysphoric disorder women typically report sleep-related complaints such as insomnia, frequent awakenings, restless sleep, unpleasant dreams or nightmares, and poor sleep quality associated with their symptoms; and during the premenstrual week and in the first few days of menstruation, disturbances such as drowsiness, fatigue, decreased alertness and inability to concentrate are observed (Baker and Driver, 2004; Woosley and Lichstein, 2014). Women with severe premenstrual syndrome report significant reductions in sleep quality associated with their symptoms during the late luteal phase compared to the early follicular phase of their cycle (Lee et al., 2008; Moline et al., 2004).

Some studies aiming to examine exercise physiology in women have also tested it in the early follicular phase when hormone levels are usually lowest (Fleck and Kraemer, 2004). This limitation has led to misunderstandings about how hormones affect aspects of female physiology, from the cardiovascular to the autonomic nervous systems, energy pathways (Tarnopolsky, 2008) or thermal stress responses (Barnes and Charkoudian, 2021; Hashimoto et al., 2014). Therefore, this study aimed to investigate the effects of menstrual pain on sleep quality and anaerobic performance, as well as the relationship between menstrual pain and sleep quality with anaerobic performance, regarding the three phases of MC (late follicular, ovulatory, and late luteal phases).

## METHODS

### Research Model

The research was carried out with the experimental model, which is one of the quantitative research methods.

### Participants

Twenty-two healthy young women (mean age 20.64 ± 1.91 years and weight 56.14 ± 8.63 kg) voluntarily participated in the study. The women were divided into two groups as painful (n=11) and painless (n=11) menstruation according to their self-reported verbal expressions. Healthy women without lower extremity injury and pregnancy history, who did not use any medication that could affect sex hormones, and who had a regular menstrual cycle (21-35 cycle length) for at least one year were included in the study.

### Research Publication Ethics

Ethics committee approval was received for this study from Iğdır University (E-37077861-900-85513 Date: 18.11.2022). All participants were informed in advance and signed a voluntary consent statement. The research was conducted following the Declaration of Helsinki.

### Data Collection Tools

### Determining the Menstrual Cycle Phase

The study used women's self-reported calendar counting and an ovulation predictor kit to identify urinary LH surges. For the ovulation phase, participants were instructed to start using a digital ovulation predictor kit with 99% accuracy from day 12 to day 15 of the menstrual cycle, calculated based on their menstrual cycle length. They placed the test strip in the urine according to the seller's instructions. During the menstrual period, the participants collected urine at the same times of the day until a positive test result was obtained. Most studies have shown that ovulation occurs within 14-26 hours after the urinary LH peak (Miller and Soules, 1996). When a positive result was obtained, women were asked to immediately contact the research coordinator to ensure data collection. Women who contacted the research coordinator were 10-14 days old according to their menstrual cycle length. For the late follicular phase between days 20-26. Between days and days, they were programmed for the mid-luteal phase. Participants were encouraged to avoid strenuous physical activity, avoid alcohol and caffeine, and ensure adequate food intake and hydration within 48 hours prior to each test.

### Wingate Anaerobic Strength Test (WAnT) Measurement Protocol Meet Session

At least three days before the first test, the entire research group was invited to the Performance Laboratory of the Faculty of Sport Sciences of Iğdır University to learn about the expectations of the WAnT and the measurement protocol. Meanwhile, the research coordinator explained all the instructions and introduced WAnT. For women, 30 seconds of WAnT and 3 minutes of the active break were applied. Again instructed to start a second WAnT attempt. All women were verbally encouraged by the research coordinator to maintain maximum acceleration at the start of the WAnT and maximum effort throughout the 30-second test. The research group was asked not to be full (≥ 2 hours) and tired at least 2 hours before the measurements, to stay away from alcohol, caffeine, and heavy and intense physical activity, and to maintain their normal diet and fluid intake. All tests were performed at the same time of day for each participant to control for diurnal variability.

**Test Day**

After initial measurements, the seat height and position of the bicycle ergometer (Monark 894E Peak Bike; Monark Exercise AB, Vansbro, Sweden) were prepared for each participant. The warm-up, which lasted for 5 minutes, started by pedalling against the lowest resistance at 70 rpm. After warming up, women were instructed to initiate WAnT as described in the introductory session. During the 30-second test, the brake weight resistance was applied automatically and the test result was transferred to the computer environment and recorded.

**Pittsburgh Sleep Quality Index (PSQI)**

PSQI was a self-reported assessment test developed by Buysse et al., The Turkish validity and reliability study of PSQI was performed by Ağargün et al., (1996). The Cronbach alpha value of the scale was found to be 0.804. Moreover, 19 of the 24 questions included in PSQI were self-report questions. The remaining five questions were answered by a spouse or roommate. The 18 items participating in the scoring were grouped into seven components. These were subjective sleep quality, time to fall asleep, sleep duration, effective sleep habits, sleep disturbance, use of sleeping pills, and daytime dysfunction. In the index, scores for seven components were obtained. Each component is evaluated over 0-3 points. The PSQI score calculated in this way can take a value between 0-21. The cut-off value for PSQI was five. Values of 5 points or more from the scale were evaluated as low sleep quality. It showed that the person has serious trouble in at least two areas of sleep or mild or moderate distress in more than three areas (Ağargün et al., 1996; Aksakoğlu, 2006).

**Menstrual Symptom Scale**

The Menstruation Symptom Scale (MSS) was used to evaluate menstrual pain and symptoms of women participating in our study. Turkish validity and reliability were conducted by Güvenç et al., (2014). The scale was a 5-point Likert-type scale and consisted of three sub-parameters: 'negative effects/somatic effects', 'menstrual pain' and 'coping methods, and 22 items. The participants were asked to give a score between '1' never and '5' always for the symptoms they experience related to menstruation. The MSS score was calculated by taking the total score mean. An increase in the mean score indicated an increase in the severity of menstrual symptoms.

**Data Analysis**

The data collected from the participants were individually checked, coded and transferred to the SPSS 23.0 package program. For statistical analysis, first of all, skewness and kurtosis values were examined, and it was checked whether the data were normally distributed. Mann-Whitney U test, one of the non-parametric tests, was used in the analysis of the data. In statistical analysis, the level of significance was accepted as $p < 0.05$. Spearman's correlation analysis was used to determine the relationship between menstrual pain, sleep quality and anaerobic performance. The correlation level was accepted as 0-30 low, between 0-30 and 0-70 accepted as moderate, and 0-70 and above accepted as high (Büyüköztürk, 2018).

## RESULTS

**Table 1.** Comparison of sleep quality scores of the study group compared to those who had a painful and painless menstrual period

| Sub-Dimensions | Groups | n | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|
| **Subjective Sleep Quality** | Painful | 11 | 11.77 | 129.50 | 57.500 | .826 |
| | Painless | 11 | 11.23 | 123.50 | | |
| **Time To Fall Asleep** | Painful | 11 | 11,86 | 130.50 | 56.500 | .765 |
| | Painless | 11 | 11.14 | 122.50 | | |
| **Sleep Time** | Painful | 11 | 14.09 | 155.00 | 32.000 | .058 |
| | Painless | 11 | 8.91 | 98.00 | | |
| **Effective Sleeping Habit** | Painful | 11 | 11.50 | 126.50 | 60.500 | 1.000 |
| | Painless | 11 | 11.50 | 126.50 | | |
| **Sleeping Disorders** | Painful | 11 | 13.00 | 143.00 | 44.000 | ,186 |
| | Painless | 11 | 10.00 | 110.00 | | |
| **Use Of Sleeping Pills** | Painful | 11 | 12.09 | 133.00 | 54.000 | .475 |
| | Painless | 11 | 10.91 | 120.00 | | |
| **Daily Dysfunction** | Painful | 11 | 12.09 | 133.00 | 54.000 | .641 |
| | Painless | 11 | 10.91 | 120.00 | | |
| **PSQI Total** | Painful | 11 | 13.14 | 144.50 | 42.500 | ,233 |
| | Painless | 11 | 9.86 | 108.50 | | |

Table 1 showed the results of the "Mann-Whitney U Test", which was used to compare the sleep quality level scores of the research group with those who had a painful and painless menstrual period. According to the results, it was determined that the sleep quality level scores of the study did not differ according to the groups (p>0.05).

**Table 2.** Comparison of the menstrual symptom scale scores of the research group compared to those who had a painful and painless menstrual period

| Sub-Dimensions | Groups | n | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|
| **Negative Effects Somatic Complaints** | Painful | 11 | 13.00 | 143.00 | 44.000 | .278 |
| | Painless | 11 | 10.00 | 110.00 | | |
| **Pain Symptoms** | Painful | 11 | 14.86 | 130.50 | 23.500 | .015* |
| | Painless | 11 | 8.14 | 122.50 | | |
| **Coping Methods** | Painful | 11 | 14.77 | 133.50 | 24.500 | .017* |
| | Painless | 11 | 8.23 | 119.50 | | |
| **MSS Total** | Painful | 11 | 14.64 | 98.00 | 26.000 | .023* |
| | Painless | 11 | 8.36 | 155.00 | | |

***p<0.05**

Table 2 showed the results of the "Mann-Whitney U Test", which was used to compare the menstrual symptom scale scores of the research group with those who had a painful and painless menstrual period. According to the results, the research menstrual symptom scale scores included pain symptoms (U=23.500; p=.015; p<0.05), coping methods (U=24.500; p=.017; p<0.05), menstrual symptom scores, and scale score totals (U=26.000; p=.023; p<0.05) were found to differ according to the groups.

**Table 3.** Comparison results of the interphase anaerobic performance values of the research group compared to those who had a painful and painless menstrual period

| Peak Power (W) | Groups | n | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|
| **Late Follicle Phase** | Painful | 11 | 13.64 | 150.00 | 37.000 | .123 |
| | Painless | 11 | 9.36 | 103.00 | | |
| **Ovulation** | Painful | 11 | 12.00 | 132.00 | 55.000 | .718 |
| | Painless | 11 | 11.00 | 121.00 | | |
| **Mid-Luteal Phase** | Painful | 11 | 12.36 | 136.00 | 51.000 | .533 |
| | Painless | 11 | 10.64 | 117.00 | | |
| **Average Power (W) Late Follicle Phase** | Painful | 11 | 12.82 | 141.00 | 46.000 | .341 |
| | Painless | 11 | 10.18 | 112.00 | | |
| **Ovulation** | Painful | 11 | 11.45 | 126.00 | 60.000 | .974 |
| | Painless | 11 | 11.55 | 127.00 | | |
| **Mid-Luteal Phase** | Painful | 11 | 11.36 | 125.00 | 59.000 | .922 |
| | Painless | 11 | 11.64 | 128.00 | | |
| **Minimum Power (W) Late Follicle Phase** | Painful | 11 | 12.18 | 134.00 | 53.000 | .622 |
| | Painless | 11 | 10.82 | 119.00 | | |
| **Ovulation** | Painful | 11 | 11.09 | 122.00 | 56.000 | .768 |
| | Painless | 11 | 11.91 | 131.00 | | |
| **Mid-Luteal Phase** | Painful | 11 | 9.36 | 103.00 | 37.000 | .123 |
| | Painless | 11 | 13.64 | 150.00 | | |
| **Power Drop (%) Late Follicle Phase** | Painful | 11 | 12.27 | 135.00 | 52.000 | .577 |
| | Painless | 11 | 10.73 | 118.00 | | |
| **Ovulation** | Painful | 11 | 12.18 | 134.00 | 53.000 | .622 |
| | Painless | 11 | 10.82 | 119.00 | | |
| **Mid-Luteal Phase** | Painful | 11 | 14.82 | 163.00 | 24.000 | .017* |
| | Painless | 11 | 8.18 | 90.00 | | |

***p<0.05**

Table 3 showed the results of the "Mann-Whitney U Test", which was used to compare the anaerobic performance values of the research group with those who had a painful and painless menstrual period. According to the results, it was determined that the power drop (%) (U=24.000; p=.017; p<0.05) value, one of the anaerobic performance values of the research, differed according to the groups in the middle luteal phase.

**Table 4.** The relationship between menstrual symptoms and sleep quality of the research group with anaerobic performance

| **Menstrual Symptoms Scale** | | | | |
|---|---|---|---|---|
| **Variables** | **Phases** | | **Negative Effects Somatic Complaints** | **Pain Symptoms** |
| **Minimum Power (W)** | Ovulation | r | -,475* | |
| **Power Drop (%)** | Mid-Luteal | r | | .444* |

| **Sleep Quality Scale** | | | | |
|---|---|---|---|---|
| **Variables** | **Phases** | | **Time to Fall Asleep** | **Use of Sleeping Pills** |
| **Minimum Power(W)** | Late Follicle | r | -,464* | |
| | Ovulation | r | | -,495* |
| **Power Drop (%)** | Late Follicle | r | .543** | |
| **Peak Power (W)** | Late Follicle | r | | -,481* |

***p<0.05**

According to the results of the correlation test used to determine the relationship between menstrual pain and sleep quality and anaerobic performance in Table 4, a moderate negative correlation was found with the minimum power, one of the anaerobic variables of "Negative effects somatic complaints", one of the menstrual symptom scale dimensions, and the ovulation phase. Moreover, a positive correlation was found in the sub-dimension of "Pain symptoms", one of the dimensions of the menstrual symptom scale, and a moderate correlation with the power drop in the middle luteal phase. When the relationship between the sleep quality scale and anaerobic performance was examined, a negative and moderate relationship was found in the minimum power variable of the "time to fall asleep" in the late follicular phase, and a positive and moderate relationship in the power drop. On the other hand, there was a moderate negative correlation between the "use of sleeping pills" in the minimum power value in the ovulation phase and the peak power values in the late follicular phase.

## DISCUSSION

Gender differences in sleep levels were evident at an early age. Compared to males, females report lower sleep quality. The risk of insomnia in females was higher than in male. A person's sleep level can be affected by changes in reproductive hormones, sadness, mental depression, ageing, role changes in life, and other reasons (Nowakowski et al., 2013). Most females suffered from menstrual-related health issues during their childbearing years. Therefore, menstrual cramps can affect a large part of females' daily lives (Komado et al., 2021). The menstrual cycle was found to be associated with changes in circadian rhythm and sleep patterns. Menstruating females reported lower overall sleep quality and more sleep disturbances in the premenstrual week than at other times of their menstrual cycle. In addition to sleep disturbances, females with severe premenstrual symptoms often reported more disturbing dreams, fatigue, drowsiness, decreased alertness, and concentration than premenstrual (Nowakowski et al., 2013).

Healthy young females included in this study were divided into two groups those with and without menstrual pain according to their self-reported verbal expressions. In the study, the effect of menstrual pain on females' sleep quality levels was measured, and according to the results of the study, it was determined that the sleep quality level scores did not differ between the groups (p > 0.05). Although there was not any statistical difference between the groups, but also the sleep quality sub-dimension score means of the painful menstruation group were found to be higher than the other group. In a study in the literature, a non-invasive method was used to monitor rest/activity cycles in females, and it was concluded that sleep efficiency decreased during the menstrual period in a female of childbearing age. They found that this decrease mainly occurred in the last week of the menstrual cycle (Zheng et al., 2015). In another study, they stated that progesterone levels increased more rapidly from the follicular period to the mid-luteal stage, and more awakenings occurred after the sleep process began. They found that the late luteal phase was associated with sleep fragmentation (Sharkey et al., 2014). Although sleep problems were common in the general population, they were more common in females due to hormonal changes, especially during the menstrual period. Research on sleep during the menstrual phase was limited to cycle lengths, lack of ovulation time control, and use of oral contraceptives. Because of these methodological problems and the limited number of studies, much was unknown about premenstrual sleep quality (Nowakowski et al., 2013).

The menstrual period of a healthy female was characterized by cyclical changes in estradiol, LH, progesterone, FSH, prolactin and growth hormone levels. Unwanted menstrual cramps were most common in females in the last days of the period when progesterone and oestrogen levels fall (Driver and Baker, 1998). Premenstrual syndrome and premenstrual dysphoria were manifested by emotional, physical, and behavioural symptoms that occur in the premenstrual phase of the menstrual cycle and resolve at the beginning of menstruation or the end of menstruation. Most females of reproductive age experience some premenstrual symptoms, but between 3 and 8% of females reported that these symptoms were devastating and interfere with their daily functioning (Halbreich et al., 2003).

In this study, it was found that the menstrual symptom scale scores were determined by "pain symptoms" (U=23.500; p=.015; p<0.05), "coping methods" (U= 24.500; p=.017; p<0.05), and menstrual symptom scale score totals (U=26.000; p=.023; p<0.05) were found to differ according to the painful group. Our research results support the literature results. A study conducted by Kin et al., that included the participation of 103 athletes and 99 sedentary females (12-25 years old) showed that 70% to 87% of females athletes during the menstrual phase stated that their symptoms increased during this period, while 29.3% of them survived this period without pain. In a study conducted by Imamoglu et al., (2004) they stated that 36.9% of the athletes experienced painful menstrual periods and 17.4% experienced this painless process. They found that 45.6% of them had this cycle sometimes painful and 9.5% of female athletes used medication to reduce pain. They stated that 11.6% of them used drugs during the competition and only 1.7% of them used drugs to reduce pain. Dušek (2001) found that sedentary females felt twice as much pain in the menstrual phase as compared to athletes, in the results of a survey conducted in a group of 72 athletes and 96 sedentary females aged between 15-21 years. While some female athletes experienced declines in menstruation physical abilities, Olympic medal gains still occurred at all stages of the menstrual cycle

(Fleck and Kraemer, 2004; Fox et al., 1989). A study of cross-country skiers found that females' best times were recorded during the post-ovulation and postmenstrual phases. This suggested that the training load should be chosen according to the cycle phase to optimize performance (Lebrun, 1993).

In this study, when the anaerobic performance values of the research group were compared with those who had a painful and painless menstrual period, it was found that the power drop (%) (U=24.000; p=.017; $p<0.05$) value, which was one of the anaerobic performance values, differed from the groups in the middle luteal phase. Although it was not statistically significant in other values, it was seen that the means of some phases were in favour of the painful group.

Ozbar et al., (2016) in a study they conducted, they aimed to study the effect of the menstrual cycle on female athletes engaged in team sports and included a total of 160 female athletes, including 40 football players, 40 volleyball players, 40 handball players, and 40 basketball players, who did elite sports. They applied a questionnaire about menstrual phases. As a result of the study, 19.9% of the female stated that their performance did not change during the menstrual period, while 2.5% stated that their performance was better. They concluded that the menstrual phase does not affect the performance of the athletes participating in the research (Ozbar et al., 2016).

Kin et al., (2000) in their study on the effect of a menstrual period on female athletes on their performance concluded that it did not affect 50.49% of the participants, while 49.51% of them affected sports performance. Reer (1992) stated that 70% of females performed the same or better during the menstrual period, and 30% of them perform worse. Imamoglu et al., (2004) defined that 71% of female athletes felt good in the first 14 days after the start of the menstrual period, and the period just before menstruation was the period when they felt the worst with a rate of 49%. In the same study, it was stated that the performance of 62.2% of the athletes did not change, while 21.2% of them were worse. Özdemir and Küçükoğlu (1993) concluded that the speed and strength of female's painless menstruation were not adversely affected. Cakmakci et al., (2005) found that there was no statistical difference in anaerobic power values, according to the results of a study in which 30 females whose menstrual phase was painless and less painful were included. Hazir et al., (2011) did not find the effect of menstrual on repeated sprint performance in the mid-follicular phase and luteal phase collection speed tests in the sprint test in a study in which 11 female athletes participated. Finally, the relationship between menstrual pain and sleep quality and anaerobic performance was examined in the study. As a result, "negative somatic complaints" in the menstrual symptom scale were moderately negative in the ovulation phase with minimum strength, positive in the pain symptoms sub-dimension, and moderately weak in the mid-luteal phase relationship. In the late follicular phase of the "time to fall asleep", a moderate and negative relationship was found in the minimum power variable and a moderate relationship in the positive direction in the power drop. On the other hand, there was a moderate negative correlation between the use of sleeping pills in the minimum power value in the ovulation phase and the peak power values in the late follicular phase.

## CONCLUSION AND RECOMMENDATIONS

Sleep problems were common throughout a female's life. Important biological conditions caused by hormones and physiological changes such as menstruation, menopause, and pregnancy affect sleep in general. Identifying and treating these problems was important to a female's quality of life. Despite the work being done in sleep and female health, other areas need more work. One of these was the effect of menstrual periods on the sleep cycle. Although it was known that hormones were associated with sleep and changes in the menstrual phase cause changes in sleep quality, there were few studies examined treatment options in a female with premenstrual syndrome and premenstrual dysphoria and significant sleep problems.

While most studies in the literature claimed that phases of the menstrual cycle affect athletic performance, many studies claim the opposite. The characterization of hormone profiles in different menstrual phases, their physiological consequences and their effects on athletic performance was very important for the success of training methods. Therefore, further studies in this area were recommended to understand the effect of a menstrual period on athletic performance, especially in the long term.

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