Applied Psychology Research 2024, 3(2), 1432.
https://doi.org/10.59400/apr.v3i2.1432

Review

The impact of the menstrual cycle on emotions and behavior—A review of current research

Magdalena Kurpanik[1], Maja Grzybowska[1], Karolina Krupa-Kotara[1], Katarzyna Barylska[2], Paweł Juraszek[2], Mateusz Krystian Grajek[2,*]

[1] Department of Epidemiology, Faculty of Public Health in Bytom, Medical University of Silesia in Katowice, 41-902 Bytom, Poland
[2] Department of Public Health, Department of Public Health Policy, Faculty of Health Sciences in Bytom, Medical University of Silesia in Katowice, 41-902 Bytom, Poland
*** Corresponding author:** Mateusz Krystian Grajek, mgrajek@sum.edu.pl.

CITATION

Kurpanik M, Grzybowska M, Krupa-Kotara K, et al. (2024). The impact of the menstrual cycle on emotions and behavior—A review of current research. Applied Psychology Research. 3(2): 1432. https://doi.org/10.59400/apr.v3i2.1432

ARTICLE INFO

Received: 5 June 2024
Accepted: 5 July 2024
Available online: 22 July 2024

Abstract: The menstrual cycle has attracted the interest of many researchers for many years. It is analyzed from many angles, including its impact on mental health. Hormonal changes over the course of the cycle have a very strong impact on the emotions, needs, or pain experienced. Estrogen, secreted shortly before ovulation, influences increased confidence and feelings of attractiveness, which can lead to new relationships. In contrast, progesterone, secreted during the luteal phase, promotes the strengthening of stable relationships, and a large proportion of women may experience premenstrual syndrome (PMS) during this time. This publication discusses studies from recent years that have assessed the variability of women's needs and emerging symptoms during different phases of the cycle. It also summarizes any strategies and practical tips needed to work with women considering their cyclical variability.

Keywords: menstrual cycle; premenstrual syndrome; emotions; social behavior

1. Introduction

The menstrual cycle is a complex biological process that accompanies women for almost most of their adult lives. It affects various aspects of physical and mental health. In recent years, researchers have increasingly turned their attention to the relationship between the phases of the menstrual cycle and emotions and behavior. Understanding these relationships is crucial not only for women's health and well-being but also for society.

As early as the 1980s, it was pointed out that hormonal fluctuations accompanying the menstrual cycle can significantly affect mood, stress levels, the ability to concentrate, and social interactions. Different phases of the cycle are characterized by different concentrations of hormones, which can lead to emotional and behavioral variability (Johnson, 1987).

The purpose of this publication is to review and analyze current research on the impact of the menstrual cycle on women's emotions and behavior. Both experimental and observational studies will be discussed, considering a variety of methodologies and study populations. The publication aims not only to understand the biological mechanisms underlying these phenomena but also to identify practical implications for mental health and therapy.

The remainder of this paper will present key findings, conclusions, and directions for further research that can further our understanding of the relationship between the menstrual cycle and women's mental health.

2. Definition of the menstrual cycle and its phases

The menstrual cycle is an integral part of every woman's adult life. Each month, its purpose is to release an egg cell to fertilize and develop a pregnancy. This is accompanied by a cascade of hormonal changes that affect all body systems, including the brain, emotions, and eating behavior. On average, the menstrual cycle lasts 28 days, while it can fluctuate individually for each woman (Reed et al., 2018). It is common to divide the cycle into two main phases: the follicular phase and the luteal phase. However, in the literature, a more precise division can be found that considers the concentrations of individual hormones and distinguishes:

- Early follicular phase,
- Late follicular phase,
- Ovulation,
- The middle luteal phase (Rogan et al., 2023).

Hormones produced by the pituitary gland are responsible for regulating the menstrual cycle: LH (luteinizing hormone) and FSH (folliculotropic hormone), and hormones produced by the ovaries like estrogen and progesterone (**Figure 1**). The hypothalamus-pituitary-ovarian axis is responsible for mutual stimulation.

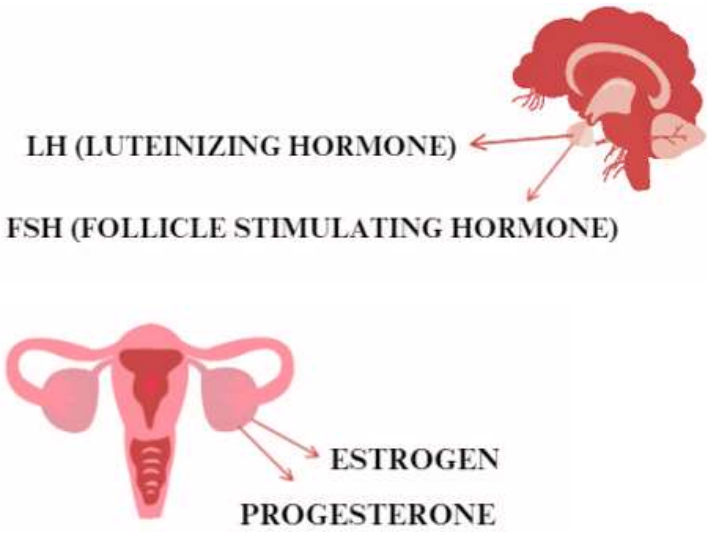

Figure 1. Sites of hormone secretion.

The early follicular phase is characterized by low levels of estrogen and progesterone. It begins on the first day of the onset of monthly bleeding and lasts until the end—that is, on average, until the 5th day of the cycle. The bleeding itself is the result of the exfoliation of the endometrium that was overbuilt in the earlier cycle. Menstruation is stopped by a sudden discharge of estrogen, which simultaneously stimulates the development of the dominant Graff follicle.

The late follicular phase is the moment 14–26 h before ovulation, when the concentration of estrogen reaches the peak of secretion, accompanied by a slight increase in progesterone.

Ovulation, detected by a positive urine ovulation test that detects LH levels, occurs in the middle of the cycle and lasts 24–36 h. It is characterized by a peak in the

secretion of LH and FSH, which leads to the rupture of the Graff follicle and the release of an egg ready for fertilization.

The middle luteal phase, defined as 7 days after confirmation of ovulation, is characterized by a peak in progesterone secretion. This is due to the transformation of the ruptured Graff follicle into a corpus luteum secreting progesterone to support the eventual development of pregnancy (**Figure 2**). On the other hand, when fertilization does not occur, the egg cell dies and the corpus luteum disappears. There is then a rapid decline in progesterone, which results in the onset of monthly bleeding. (Rogan et al., 2023)

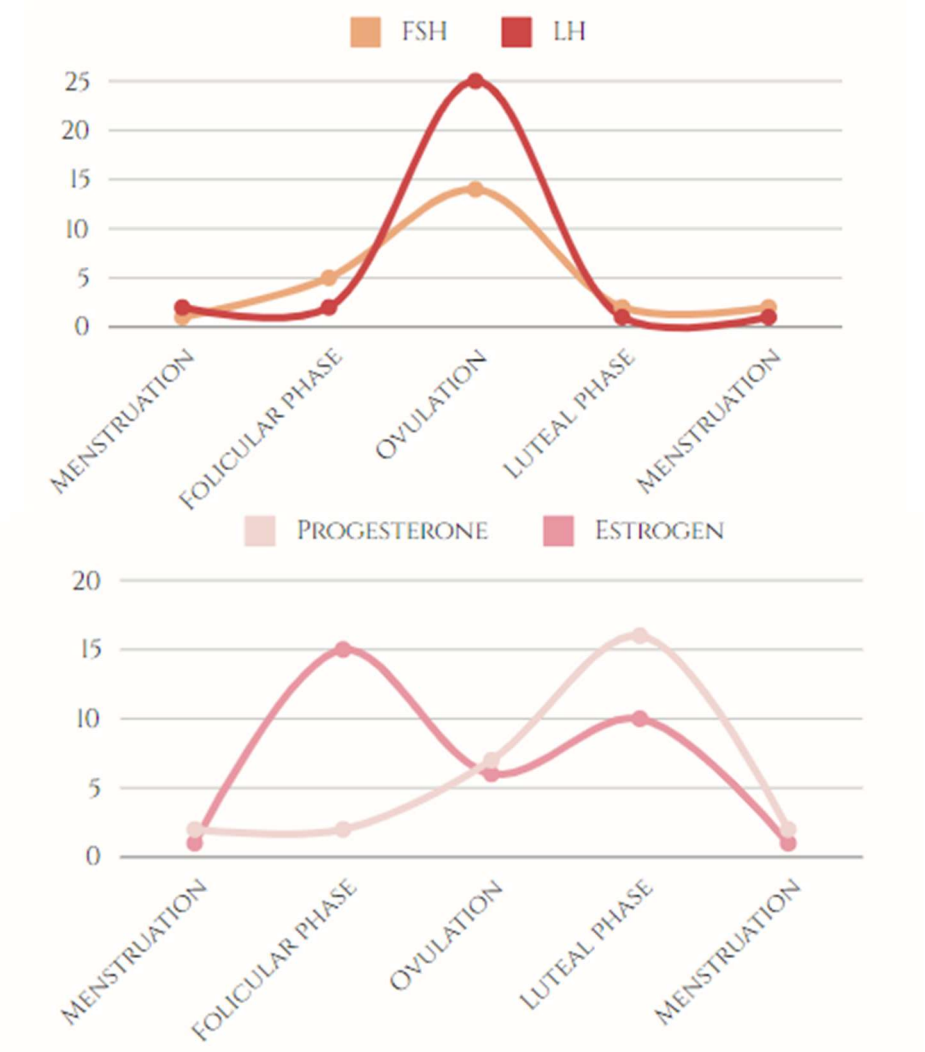

Figure 2. Hormone concentrations in individual phases of the cycle based on (Rogan, 2023).

The role of estrogen, progesterone, and other hormones in the menstrual cycle

Estrogen is mainly responsible for stimulating the recovery of the endometrium and the secretion of LH and FSH before ovulation. It is produced mainly in the ovaries but can also be produced in the brain. It is crucial for regulating the menstrual cycle

and affects cell proliferation and metabolism. In addition, it has a positive effect on perceived emotions and increases libido (Hromatko et al., 2023).

Progesterone secreted during the luteal phase is responsible for the development and eventual maintenance of pregnancy. Its concentration determines the onset of the next menstrual period because, when fertilization occurs, high levels of progesterone will halt the next cycle. Studies indicate the effectiveness of luteal phase support and progesterone treatment in increasing the chance of pregnancy (Souza et al., 2024).

LH and FSH are responsible for mid-cycle egg release (Handy et al., 2022).

3. Hormones and emotions in different phases of the cycle

A publication by Bernal et al. suggested the need to distinguish the ovulatory phase to fully analyze behavior and neurocognitive processes, which are influenced by both estrogen and progesterone. Changes in their concentrations are important not only in terms of the early follicular phase at low hormone concentrations or the luteal phase at higher concentrations but also during ovulation (Bernal et al., 2022). The relevance of the influence of individual hormones is also pointed out by Hirschberg, emphasizing the different dietary behaviors depending on the phase of the cycle (Hirschberg et al., 2012).

3.1. Follicular phase: Moods, energy and creativity levels

The follicular phase after monthly bleeding, is characterized by dominant levels of estrogen, which stimulate an increase in LH and FSH concentrations (Handy et al., 2022). Estrogen exerts various effects on the nervous system, affecting pain sensation, mood, and cognitive function. Research indicates that estrogen has a positive effect on mood-imaging and has shown menstrual cycle-induced changes in brain areas affecting emotion control and responses to emotional stimuli (Comasco et al., 2014). The reactivity of the brain's reward center thus appears to be highest during the follicular phase (Handy et al., 2022). However, it is worth noting that, due to changes in estrogen concentrations over the course of the follicular phase, the emotions experienced may change during the follicular phase. Studies have indicated a significant increase in positive states and emotions such as joy, increased concentration, and energy while decreasing negative ones in the form of anxiety, lowered mood, and feelings of fatigue in the late follicular phase relative to the early days of the cycle (Hromatko et al., 2023).

Meta-analyses also indicate higher cortisol levels in the follicular phase of the cycle than in the luteal phase (Hamidovic et al., 2020). The occurrence of MRS (menstrual-related symptoms) at the beginning of the follicular phase is also highlighted, which often forces women to abandon their responsibilities, including work (Schoep et al., 2019). Some women may experience increased fatigue during the first days of the cycle, which affects sleep duration relative to the luteal phase (Rugvedh et al., 2023). Sleep quality may be affected by feeling MRS, which should be considered in future studies in this area (Sharkey et al., 2023).

3.2. Ovulatory phase: Changes in mood and confidence

The release of a mature ovum ready for fertilization, evolutionarily, is supposed to lead to reproduction and the conception of a child. There is then an increase in self-confidence, self-esteem, and attractiveness, which is also related to secreted estrogen. Schleifenbaum et al. conducted a study in which women's self-esteem was assessed during different phases of the menstrual cycle. The results indicated a significant increase in self-esteem during the ovulatory phase in women who were not taking oral hormonal agents (Schleifenbaum et al., 2021). At the same time, this study, highlighting the increase in self-esteem during ovulation among women with a natural cycle, stands in opposition to other studies, where no significant changes related to ovulation were shown (Arslan et al., 2018).

Similar results have been found in other studies, which confirm that the ovulatory phase may be associated with improved well-being and increased positive emotions. Women in this phase were more likely to make risky decisions, which may indicate an increase in self-confidence and optimism (DeBruine et al., 2005).

The mechanisms underlying these changes may be related to evolutionary adaptations aimed at increasing the chances of begetting offspring by enhancing a woman's attractiveness.

Findings from this research have important implications for understanding how hormonal fluctuations throughout the menstrual cycle can affect women's mental health and social functioning. Future research should continue to explore these relationships to better understand how hormonal fluctuations can affect behavior and well-being in various aspects of life.

3.3. Luteal phase: PMS (premenstrual syndrome)-motional symptomatology

Research has been conducted for many years on the concept of PMS, a menstrual syndrome that affects up to 40% of menstruating women. The cause of the condition is not fully understood, but research suggests PMS occurs because of an abnormal neurotransmitter response with normal ovarian function. Some of the most common symptoms reported by women are swelling, breast pain, migraine headaches, and significant deterioration and mood swings. According to the study by Lundin et al., the occurrence of the latter symptom in the second phase of the cycle is influenced by fluctuations in progesterone levels. Although the unpleasant symptoms disappear on their own within the first few days after the start of a new cycle, for many, they are extremely unpleasant, negatively affecting quality of life. The most reported symptoms involving mood changes are constant feelings of anxiety, difficulty concentrating, excessive sensitivity, feelings of anger, and depressive states (Lundin et al., 2017). In contrast, anger is the only emotion that significantly increases during the perimenopausal period (Meers et al., 2024). In addition to the symptoms, PMS positively correlates with the occurrence of depression, stress, sleep, and appetite disorders (Yi Su Jeong et al., 2023). In addition, nearly 9. out of 10 women reported somatic symptoms, which accounted for most of all symptoms recorded during the breakthrough of menstrual cycles (Ainsworth et al., 2023). A few studies have observed a decrease in blood serotonin levels, both platelet serotonin and whole

serotonin, and its metabolites, which in turn directly affect the mood of the subjects (Gudipally et al., 2023; Majoribanks et al., 2013; Nappi et al., 2022; Tiranini et al., 2022).

It is also worth distinguishing the existence of PMDD (premenstrual dysphoric disorder), which is a much more severe and treatment-requiring form of PMS. PMDD is a psychiatric disorder included in the DSM-5, with both pharmacological treatment, which most often includes SSRIs, and, in the case of a milder form of the condition, non-pharmacological treatment. It is a combination of psychotherapy, dietary changes, incorporating physical activity, and ensuring adequate sleep (Gudipally et al., 2023). Neuroimaging also shows changes in prefrontal cortex activity in response to the onset of negative stimuli or an increase in amygdala activity in similar situations (Monteiro et al., 2024).

Despite the prevalence of PMS along with PMDD, it has been suggested that the intensity of women's mood changes occurs in the middle of the menstrual cycle, i.e., during the late follicular phase, rather than during the final luteal phase (Hromatko et al., 2023). However, studies presenting the opposite conclusion are available (Ainsworth et al., 2023).

4. Behavior and functioning

4.1. Willingness to take risks and make decisions at different phases of the cycle

The mechanisms that link these two aspects to the menstrual cycle are rooted in the neurobiological effects of hormones on the brain.

Estrogen can increase activity in areas of the brain that are associated with reward and motivation, such as the prefrontal cortex and the nucleus accumbent, which can promote risk-taking. Progesterone and its metabolites, on the other hand, can modulate GABA neurotransmitter activity, which can lead to more conservative decisions.

Research indicates that during the ovulatory phase, where higher levels of estrogen are observed, women may be more willing to take risks. DeBruine et al. (2005) conducted a study that showed that women in the ovulatory phase are more likely to make risky decisions compared to other phases of the cycle. This is linked to estrogen's enhancement of feelings of confidence and optimism.

In contrast, during the luteal phase, rising progesterone levels can reduce risk propensity and increase anxiety and caution. This was reflected in a study by White et al., which found that during this phase, women exhibit a more conservative approach to decision-making (White et al., 2017). It was shown that during the luteal phase, closer to the onset of menstruation, psychosis symptoms worsened. In addition, it was noted that most women seeking psychiatric counseling or appearing in a psychiatric ward were in the luteal phase.

4.2. Impact on social and interpersonal interactions

As mentioned earlier, secreted hormones throughout the menstrual cycle affect the feelings of various emotions. In the first half of the cycle, due to rising estrogen, women may feel more energy, a desire to connect with others, and a greater sex drive.

In contrast, progesterone, which has a calming effect on the nervous system, can cause greater feelings of fatigue and decreased motivation to engage in social interactions.

Studies have shown that during the ovulatory phase, when estrogen levels are high, women may be more sociable and willing to make social connections. A study by Haselton et al. (2007) found that women in this phase of the cycle are more likely to engage in social interactions and are more open to new acquaintances. High estrogen levels may increase feelings of attractiveness and self-confidence, which in turn promotes pro-social behavior.

In contrast, during the luteal phase, when progesterone levels rise, women may tend to be more introspective and less willing to participate in social interactions. This was reflected in a study by Neave et al. (2008), which found that during this phase, women are more likely to avoid confrontation and may be less assertive in interpersonal interactions.

The influence of the menstrual cycle on social interactions is also evident in the context of romantic relationships. During the ovulatory phase, women may show more interest in seeking partners and be more open to flirtation and romance. Miller et al. (2007) showed that during this phase, women are more likely to take action to attract the attention of potential partners. In contrast, during the luteal phase, women may be focused on stable, long-term relationships and show a greater desire for security and emotional support.

4.3. Changes in physical and social activities

Physical activity is recognized by many organizations as a possible preventive factor for many diseases, and it also has a place in the pyramid of healthy eating. In contrast, as Passoni et al. point out, excessive physical activity poses a threat to women's health. This is related because for both optimal exercise and reproductive function, energy supplied from food is needed (Passoni et al., 2024). Even if a woman does not change anything in her nutrition, when physical activity is turned off at the same time, an energy deficit is generated, which can consequently impair the secretion of sex hormones by suppressing the hypothalamic-pituitary-ovarian axis. If such a condition is maintained long-term, menstruation can disappear altogether.

Due to hormonal changes and their impact on mood, it is recommended to modify the frequency and intensity of training units throughout the cycle. In a study by Hackney AC et al. (2019), it was shown that during the follicular phase, women exhibit significantly higher and better recovery after a 90-minute running workout at an intensity of 70%. Therefore, it can be concluded that a better choice would be to introduce strength or high-intensity training for the time after menstruation until ovulation.

During the middle luteal phase and in the first days of the cycle, the body expends energy sequentially to prepare the endometrium for the development of pregnancy and later to exfoliate it. Before menstruation, too, due to the frequent occurrence of PMS, it is recommended that you reduce the intensity of your workout and choose activities that will help relax your muscles and thus reduce pain. The same strategy, combined with light aerobic activity in the form of walking, can also be implemented during monthly bleeding. A review by Beníčková et al. suggests that it is not only the phase

of the cycle and the time of day that matter in terms of training capacity (Beníčková et al., 2024).

The study highlights women's absenteeism from work related to the onset of MRS. Many women admit the need to miss a day (or more) of work due to unpleasant menstrual symptoms, such as lower abdominal pain, back pain, or feeling tired. Some of them indicate that this need occurs every cycle (Schoep et al., 2019). Sometimes younger women choose not to be absent from school despite experiencing unpleasant symptoms (Hoppenbrouwers et al., 2015).

The menstrual cycle affects the social life of women worldwide, with the effect of hormone fluctuations on social behavior depending on the phase of the cycle highlighted. During the luteal phase, higher levels of social anxiety are observed among women compared to the follicular phase, when this level is lower (Wang et al., 2021). Despite its occurrence, there is often a need to strengthen ties with loved ones (Maner et al., 2014). The increase in progesterone, which is observed during this phase and exhibits a calming effect on the nervous system, may be the reason for increased feelings of fatigue and a decreased desire to engage in social life.

Lower levels of social anxiety during the follicular phase may enhance women's pro-social behavior. During the peri-ovulatory period, they may be prepared to engage in new relationships, including intimate ones, and unconsciously choose appearance-enhancing products, such as a particular type of clothing (Durante et al., 2011) (**Table 1**).

Table 1. Review of selected studies on the impact of the menstrual cycle on emotions.

1st author	Year	Study title	Design	Main results
Schleifenbaum et al.	2021	Women feel more confident during the ovulatory phase: Evidence from a large-scale survey	Large-scale survey	Significant increase in self-esteem during ovulatory phase in non-hormonal contraceptive users.
DeBruine et al.	2005	The impact of hormonal contraceptive use on women's risk-taking behavior during the ovulatory phase	Behavioral experiments	Increased risk-taking behavior during ovulatory phase.
White et al.	2017	Hormonal influences on decision-making and risk-taking in the menstrual cycle	Behavioral experiments	More conservative decision-making in luteal phase.
Reilly et al.	2016	Exacerbation of psychosis during the perimenstrual phase of the menstrual cycle: Systematic review and meta-analysis.	Clinical observations	Worsening of psychotic symptoms in luteal phase; majority of women in psychiatric care during luteal phase.
Haselton et al.	2007	Ovulatory shifts in human female ornamentation: Near ovulation, women dress to impress	Behavioral observations	Increased sociability and openness to new relationships during the ovulatory phase.
Neave et al.	2008	Hormones and behavior: The influence of phase of the menstrual cycle on behavioral tendencies	Behavioral observations	More introspective and less assertive during the luteal phase.

Table 1. (*Continued*).

1st author	Year	Study title	Design	Main results
Miller et al.	2007	Ovulatory cycle effects on tip earnings by lap dancers: Economic evidence for human estrus?	Economic analysis	Increased earnings in lap dancers during ovulatory phase, indicating higher attractiveness.
Hromatko et al.	2023	A Mid-Cycle Rise in Positive and Drop in Negative Moods among Healthy Young Women: A Pilot Study.	Prospective study	Increase in positive states and emotions was demonstrated, with decrease in negative ones depending on the phase.
Ainsworth et al.	2023	Global Menstrual Cycle Symptomatology as Reported by Users of a Menstrual Tracking Mobile Application	Cohort study	PMS positively correlates with depression, stress, sleep and appetite disorders.
Karali et al.	2024	Effects of Laughter Yoga on Premenstrual Symptoms.	Quasi-experimental study	Laughter yoga helps to reduce PMS symptoms.
Tauseef et al.	2024	Is Trait Rumination Associated with Affective Reactivity to the Menstrual Cycle? A Prospective Analysis	Prospective analysis	The tendency to have obsessive thoughts depends on the phase of the cycle.
Pletzer et al.	2023	Emotion Recognition and Mood along the Menstrual Cycle	Clinical observations	Menstrual cycle does not seem to have an impact in emotion recognition performance while during menses mood worsening is the strongest.
Quaglia et al.	2023	Association between Dietary Habits and Severity of Symptoms in Premenstrual Syndrome	Behavioral observations	Only slight differences in food choices were observed during different phases of the cycle.
Russman Block et al.	2024	Ovarian Hormones Reduce the Negative Association between Worry and Cognitive Control: A Combined Neural and Behavioral Investigation	Behavioral observations	Ovarian hormones seem to have a protective effect between worry and cognitive control.
Gloe et al.	2021	Examining the Role of Ovarian Hormones in the Association between Worry and Working Memory across the Menstrual Cycle	Clinical observations	Higher estrogen levels impair short-term memory and increase anxiety levels
Rugvedh et al.	2023	The Menstrual Cycle's Influence on Sleep Duration and Cardiovascular Health: A Comprehensive Review	Comprehensive Review	During ovulation, sleep often shortens compared to the early follicular phase
Bürger et al.	2024	Perceived associations between the menstrual cycle and Attention Deficit Hyperactivity Disorder (ADHD): A qualitative interview study exploring lived experiences	Qualitative interview study	Participants reported experiencing ADHD symptom more severe during the mid-luteal phase

5. Moderating factors

5.1. Individual differences in responses to hormonal changes

The menstrual cycle affects various aspects of women's functioning, including their mood, behavior, and social interactions. While there are general patterns of hormonal changes that can affect emotions and behavior, individual responses to these changes can vary widely depending on a range of biological, psychological, and

environmental factors. Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that appears in childhood and persists into adulthood. As epidemiological data indicate, women are much more often affected, which is also related to the rate of depression. A study by Bürger et al. indicates that the severity of symptoms characteristic of ADHD is related to the phase of the cycle. Well, female participants indicated experiencing stronger symptoms being in the middle luteal phase (Bürger et al., 2024).

5.2. Biological factors

Individual differences in levels of hormones such as estrogen and progesterone can lead to a variety of emotional and behavioral responses. Some women may experience a significant increase in confidence and sociability during the ovulatory phase, while others may not notice such changes. Research suggests that genetic differences in hormone receptors may play a role in modulating these effects (Schleifenbaum et al., 2021). When addressing genetic factors on an individual basis, it is also worth noting the co-occurrence of intellectual disability. A study by Çınar et al. (2023) found that girls with genetic intellectual disability syndrome had a significantly decreased quality of life after the onset of menstruation, as well as an increase in the amount of help needed.

5.3. Psychological factors

Psychological factors such as personality, stress levels, and previous emotional experiences and trauma can also influence how women respond to hormonal changes during the menstrual cycle. Women with higher levels of anxiety may experience greater mood swings and stronger negative reactions during the luteal phase, when progesterone levels are high (White et al., 2017). Epidemiological data shows that women are more likely to experience post-traumatic stress disorder (PTSD) under the influence of severe stress and trauma. The literature indicates that this is related to estradiol, which influences better memory and recall, which may result in deeper rooting of the traumatic situation (Peyrot et al., 2024).

5.4. Environmental factors

A woman’s environment can also influence her responses to hormonal changes. Social support and the presence of external stressors can modulate how a woman experiences emotional and behavioral changes during the cycle. It has been shown that women who receive strong social support can better cope with the negative effects of the luteal phase (Haselton et al., 2007).

6. Psychosocial factors affecting perception and experience of the menstrual cycle

Perceptions and experiences of the menstrual cycle can be significantly modified by a variety of psychosocial factors. These include aspects such as social support, cultural norms, education, and individual psychosocial characteristics. Understanding these factors is key to effectively promoting women’s health and well-being.

6.1. Social support

Support from family, friends, and the community can play an important role in shaping the perceptions and experiences women have during their cycle. Studies have shown that women who receive strong emotional and practical support are less likely to report negative premenstrual symptoms and cope better with mood swings (Uskul and Over, 2014). Social support can also reduce stress levels and improve overall well-being.

6.2. Cultural norms

Social and cultural norms about menstruation can significantly affect how women perceive and experience their cycle. In some cultures, menstruation is a taboo subject, which can lead to feelings of shame and isolation. In contrast, in cultures where menstruation is accepted and openly discussed, women may experience less cycle-related stress and discomfort. Research shows that negative cultural beliefs about menstruation can exacerbate cycle-related physical and emotional symptoms (Chrisler, 2011).

6.3. Level of education

Education about the menstrual cycle and reproductive health plays a key role in shaping women's experiences. Education can also increase confidence and reduce anxiety associated with natural hormonal changes. Women who are more knowledgeable about their bodies' processes are often better able to cope with cycle symptoms and make more informed decisions about their health (Chandra, 2013). A study by Kvalem et al. also indicated that perceiving menstruation as natural physiology was associated with a preponderance of positive emotions and less pain during the first days of the cycle. The perception of menstruation as a nuisance, on the other hand, was associated with lower levels of education, and these women were significantly more likely to experience negative emotions and menstruation was more painful (Kvalem et al., 2024).

6.4. Individual psychological characteristics

Individual psychological differences, such as levels of anxiety, depression, or mental toughness, can affect how women experience the menstrual cycle. Women with higher levels of anxiety and depression may be more prone to negative premenstrual symptoms such as irritability, fatigue, and mood changes (Romans et al., 2012). In contrast, women with high levels of psychological resilience may be better able to cope with mood swings and cycle-related stress. Patients' cycle monitoring may also benefit from psychological therapy. As Ramey and Erica suggest, it is possible to adjust treatment depending on the phase of the cycle, and 7 to 10 days before a scheduled period, it is worth considering increasing the frequency of visits (Ramey and Erica, 2023).

7. Summary

The menstrual cycle is a complex biological process that affects a wide range of women's behaviors and experiences. Research shows that hormonal fluctuations

associated with different phases of the menstrual cycle can affect emotions, behavior, and social and interpersonal interactions. This publication discusses these aspects, focusing on the cycle's impact on emotions, risk-taking, social interactions, and individual responses to the changes taking place.

During the ovulatory phase, women are much more likely to experience an increase in confidence, sociability, and willingness to take risks. Studies by Schleifenbaum et al. (2021) and DeBruine et al. (2005) are examples that support these observations. On the other hand, during the luteal phase, with premenstrual syndrome (PMS) often accompanying it, women often exhibit greater introspection, fatigue, and reduced assertiveness, as indicated in studies by Reilly et al. (2016) and Neave et al. (2008). In addition, during this time, there is increased anxiety and fear, a desire for stimulants, increased symptoms of depression or bipolar disorder, and increased impulsivity (Ramey, 2023).

Social and interpersonal interactions also change depending on the phase of the cycle. During the ovulatory phase, women are more open to new relationships and social interactions, which may be due to higher estrogen levels. Research by Haselton et al. (2007) indicates that women are more sociable and inclined to make social connections during this period. In contrast, during the luteal phase, women may avoid confrontation and be less inclined to engage in social interactions, as a study by Neave et al. (2008) confirms.

Individual differences in responses to hormonal changes are significant and may be due to biological, psychological, and environmental factors. There are also genetic differences in hormone receptors that can modulate individual responses to changes during the cycle. Psychological factors such as levels of anxiety and depression and environmental factors in the form of social support and cultural norms also play a role in shaping these responses. White et al. (2017) and Romans et al. (2012) highlight that women with higher levels of anxiety and depression may be more prone to premenstrual symptoms.

The influence of psychosocial factors on the perception and experience of the menstrual cycle is also very important. Social support, accepted cultural norms, level of education, and individual psychological characteristics have a significant impact on the perception and experience of the cycle. Women who receive strong social support and are more knowledgeable about their cycle may be much better able to cope with their symptoms. Studies by Uskul and Over (2014), Chrisler (2011), and Chandra et al. (2013) show that education and social support can reduce the negative effects associated with the menstrual cycle. Adequate education for women will modify individual perceptions of their cycle, and as Kvalem et al. (2024) point out, seeing it as natural and positive has a positive impact on perceived symptoms and well-being.

In summary, the menstrual cycle has a multifaceted impact on women's lives. Understanding the individual and psychosocial factors that modulate these influences is key to developing effective support and intervention strategies. Further research is unexplored to further our knowledge on this topic and contribute to improving women's health and well-being.

8. Implications for mental health and therapeutic interventions

The hormonal fluctuations that accompany the menstrual cycle can affect mood, stress levels, and the ability to cope with daily challenges. It is therefore crucial for mental health professionals to be aware of these relationships and incorporate them into their clinical practice.

One of the most important conclusions is that there is a need to individualize the therapeutic approach. This has to do with hormonal changes that can vary widely between women, and therapies should be tailored to each patient's specific needs and experiences. For example, women who experience severe premenstrual symptoms such as irritability, fatigue, or depression may benefit from behavioral-cognitive therapy (CBT), which helps manage emotional symptoms and improve daily functioning (Bhatia and Bhatia, 2002). Increasing the frequency of attendance at therapy during the luteal phase may also be helpful (Ramey and Erica, 2023).

Pharmacotherapy can also be an effective intervention for women with severe menstrual cycle symptoms. Antidepressants such as selective serotonin reuptake inhibitors (SSRIs) can be used to treat premenstrual dysphoric disorder (PMDD), which is characterized by severe mood swings and emotional disturbances (Yonkers et al., 2008). After consultation with a gynecologist, hormone replacement therapy (HTZ) can also be considered, which alleviates symptoms by halting a woman's natural cycle (Freeman et al., 1995). Since depression in women often correlates with estrogen deficiency, opting for estrogen preparations may be beneficial (Sun et al., 2024).

Education and social support are key components of therapeutic interventions. Educating patients about the menstrual cycle and its impact on emotions and behavior can help increase their awareness and coping skills to manage their symptoms. Support programs that offer access to support groups and counseling can also significantly improve the quality of life for those struggling during the menstrual cycle (Chrisler, 2011).

In the context of work and education, it is also important for institutions to be aware of the impact of the menstrual cycle on women's productivity and well-being. Flexible working hours, the option to work remotely, or psychological support in the workplace can help create a more supportive environment for women (Allen et al., 2011).

Further research should focus on better understanding the biological and psychosocial mechanisms underlying individual responses to hormonal changes. Such research may contribute to the development of more precise and effective therapeutic interventions that are better able to address women's needs, depending on the phase of the menstrual cycle.

9. Perspectives

Research on the impact of the menstrual cycle on women's emotions and behavior should continue to expand and address several key areas. First and foremost, it is necessary to further explore the biological mechanisms that underlie emotional and behavioral variability during different phases of the cycle. This includes research

into the role of specific hormones, such as estrogen, progesterone, and their metabolites, and their effects on neurotransmission and brain function.

Further research should also consider individual genetic differences that may affect women's responses to hormonal changes. Analysis of genetic polymorphisms related to hormone receptors could provide valuable information on the predisposition to increased premenstrual symptoms.

Another important direction is to study the influence of psychosocial factors such as stress, social support, and cultural norms on the menstrual cycle experience. This research should consider cultural and continental diversity to better understand their impact on perception and responses to hormonal changes.

It is also important to develop and test new therapeutic interventions, both pharmacological and non-pharmacological, that can be used to treat menstrual cycle disorders. Clinical research on the effectiveness of behavioral-cognitive therapy, mindfulness, yoga, breath work, and other healthy lifestyle-based interventions can contribute to the development of more holistic therapeutic approaches.

For women's mental and physical health, doctors and therapists should be aware of the impact of hormonal changes on their well-being and take this information into account when diagnosing and planning treatment. Monitoring symptoms during different phases of the cycle, even if only with the help of a phone app, can help tailor therapy more precisely.

Educating patients about the physiology of the menstrual cycle and what changes occur throughout it is extremely important. Women should be informed about the possibility of specific symptoms during a particular phase of the cycle and should know ways to deal with them in non-pharmacological and pharmacological ways. Healthy lifestyle support, including diet, exercise, and stress-reduction techniques, can greatly improve patients' quality of life.

In the social context, it is important to promote awareness and strive to normalize women's menstrual cycle, including its impact on behavior. Educational institutions and workplaces should strive to create a welcoming and supportive environment that considers the needs of women in different phases of the cycle. Flexible working hours, the possibility of working remotely, and psychological support can contribute to better professional and social functioning and reduce the chance of job burnout.

Finally, it is important to conduct education and outreach campaigns that reduce the stigma of menstruation and promote open discussion of the issue. Increasing awareness and understanding in society can help improve women's well-being and create a more supportive social environment.

Conflict of interest: The authors declare no conflict of interest.

References

Ainsworth, A., Peven, K., Bamford, R., et al. (2023). Global Menstrual Cycle Symptomatology as Reported by Users of a Menstrual Tracking Mobile Application. Journal of Psychology p. 20-35 https://doi.org/10.21203/rs.3.rs-3087510/v1

Allen, T. D., Johnson, R. C., Kiburz, K. M., et al. (2012). Work–Family Conflict and Flexible Work Arrangements: Deconstructing Flexibility. Personnel Psychology, 66(2), 345–376. https://doi.org/10.1111/peps.12012

Beníčková, M., Gimunová, M., Paludo, A. C. (2024). Effect of circadian rhythm and menstrual cycle on physical performance in women: a systematic review. Frontiers in Physiology, 15. https://doi.org/10.3389/fphys.2024.1347036

Bernal, A., and Paolieri, D. (2022). The influence of estradiol and progesterone on neurocognition during three phases of the menstrual cycle: Modulating factors. Behavioural Brain Research, 417, 113593. https://doi.org/10.1016/j.bbr.2021.113593

Bhatia, S. C., and Bhatia, S. K. (2002). Diagnosis and treatment of premenstrual dysphoric disorder. American Family Physician, 66(7), 1239–1248.

Bürger, I., Erlandsson, K., and Borneskog, C. (2024). Perceived associations between the menstrual cycle and Attention Deficit Hyperactivity Disorder (ADHD): A qualitative interview study exploring lived experiences. Sexual and Reproductive Healthcare, 40, 100975. https://doi.org/10.1016/j.srhc.2024.100975

Chandra, P. S. (2013). Knowledge about menstruation and reproductive health among adolescent girls in rural India. Journal of Pediatric and Adolescent Gynecology, 26(3), 163-167.

Chrisler, J. C. (2011). Leaks, Lumps, and Lines. Psychology of Women Quarterly, 35(2), 202–214. https://doi.org/10.1177/0361684310397698

Çınar, H. Ü., Kızılkan, M. P., Akalın, A., et al. (2023). Assessing the Menstrual Cycle and Related Problems in Adolescents with a Genetic Syndrome Associated with Intellectual Disability. Journal of Pediatric and Adolescent Gynecology, 36(4), 363–371. https://doi.org/10.1016/j.jpag.2023.02.005

Comasco, E., Frokjaer, V. G., and SundstrÃ¶m-Poromaa, I. (2014). Functional and molecular neuroimaging of menopause and hormone replacement therapy. Frontiers in Neuroscience, 8. https://doi.org/10.3389/fnins.2014.00388

Debruine, L. M. (2005). The impact of hormonal contraceptive use on women's risk-taking behavior during the ovulatory phase. Evolution and Human Behavior, 26(3), 272-280.

Durante, K. M., Griskevicius, V., Hill, S. E., et al. (2011). Ovulation, Female Competition, and Product Choice: Hormonal Influences on Consumer Behavior. Journal of Consumer Research, 37(6), 921–934. https://doi.org/10.1086/656575

Freeman, E. W. (1995). Efficacy of serotonin reuptake inhibitors in treatment of premenstrual dysphoria: a systematic review and meta-analysis. Archives of Women's Mental Health, 1(1), 71-79.

Gloe, L. M., Kashy, D. A., Jacobs, E. G., et al. (2021). Examining the role of ovarian hormones in the association between worry and working memory across the menstrual cycle. Psychoneuroendocrinology, 131, 105285. https://doi.org/10.1016/j.psyneuen.2021.105285

Hackney, A. C., Kallman, A. L., and Ağgön, E. (2019). Female sex hormones and the recovery from exercise: Menstrual cycle phase affects responses. Biomedical Human Kinetics, 11(1), 87–89. https://doi.org/10.2478/bhk-2019-0011

Hamidovic, A., Karapetyan, K., Serdarevic, F., et al. (2020). Higher Circulating Cortisol in the Follicular vs. Luteal Phase of the Menstrual Cycle: A Meta-Analysis. Frontiers in Endocrinology, 11. https://doi.org/10.3389/fendo.2020.00311

Handy, A. B., Greenfield, S. F., Yonkers, K. A., et al. (2022). Psychiatric Symptoms Across the Menstrual Cycle in Adult Women: A Comprehensive Review. Harvard Review of Psychiatry, 30(2), 100–117. https://doi.org/10.1097/hrp.0000000000000329

Haselton, M. G., Mortezaie, M., Pillsworth, E. G., et al. (2007). Ovulatory shifts in human female ornamentation: Near ovulation, women dress to impress. Hormones and Behavior, 51(1), 40–45. https://doi.org/10.1016/j.yhbeh.2006.07.007

Hirschberg, A. L. (2012). Sex hormones, appetite and eating behaviour in women. Maturitas, 71(3), 248–256. https://doi.org/10.1016/j.maturitas.2011.12.016

Hoppenbrouwers, K., Roelants, M., Meuleman, C., et al. (2015). Characteristics of the menstrual cycle in 13-year-old Flemish girls and the impact of menstrual symptoms on social life. European Journal of Pediatrics, 175(5), 623–630. https://doi.org/10.1007/s00431-015-2681-7

Hromatko, I., and Mikac, U. (2023). A Mid-Cycle Rise in Positive and Drop in Negative Moods among Healthy Young Women: A Pilot Study. Brain Sciences, 13(1), 105. https://doi.org/10.3390/brainsci13010105

Karali, E., and Gürkan, Ö. C. (2024). Effects of laughter yoga on premenstrual symptoms. Alternative Therapies in Health and Medicine, 30(2), 6-12.

Kvalem, I. L., Dahr Nygaard, I. M., Træen, B., et al. (2024). Menstrual attitudes in adult women: A cross-sectional study on the association with menstruation factors, contraceptive use, genital self-image, and sexual openness. Women's Health, 20. https://doi.org/10.1177/17455057241249553

Lundin, C., Danielsson, K. G., Bixo, M., et al. (2017). Combined oral contraceptive use is associated with both improvement and worsening of mood in the different phases of the treatment cycle—A double-blind, placebo-controlled randomized trial. Psychoneuroendocrinology, 76, 135–143. https://doi.org/10.1016/j.psyneuen.2016.11.033

Maner, J. K., and Miller, S. L. (2014). Hormones and social monitoring: Menstrual cycle shifts in progesterone underlie women's sensitivity to social information. Evolution and Human Behavior, 35(1), 9–16. https://doi.org/10.1016/j.evolhumbehav.2013.09.001

Marjoribanks, J., Brown, J., O'Brien, P. M. S., et al. (2013). Selective serotonin reuptake inhibitors for premenstrual syndrome. Cochrane Database of Systematic Reviews. https://doi.org/10.1002/14651858.cd001396.pub3

Meers, J. M., Bower, J., Nowakowski, S., et al. (2024). Interaction of sleep and emotion across the menstrual cycle. Journal of Sleep Research. Portico. https://doi.org/10.1111/jsr.14185

Miller, G., Tybur, J. M., and Jordan, B. D. (2007). Ovulatory cycle effects on tip earnings by lap dancers: economic evidence for human estrus?. Evolution and Human Behavior, 28(6), 375–381. https://doi.org/10.1016/j.evolhumbehav.2007.06.002

Monteiro, D. C., Ramos, C. da S., Alves, L. E. N. N., et al. (2024). Functional and structural neuroimaging in premenstrual dysphoric disorder: A systematic review. Journal of Psychiatric Research, 175, 205–210. https://doi.org/10.1016/j.jpsychires.2024.05.024

Nappi, R. E., Cucinella, L., Bosoni, D., et al. (2022). Premenstrual Syndrome and Premenstrual Dysphoric Disorder as Centrally Based Disorders. Endocrines, 3(1), 127–138. https://doi.org/10.3390/endocrines3010012

Neave, N. (2008). Hormones and behavior: The influence of phase of the menstrual cycle on behavioral tendencies. Journal of Neuroendocrinology, 20(5), 683-692.

Passoni, P., Inzoli, A., De Ponti, E., et al. (2024). Association between Physical Activity and Menstrual Cycle Disorders in Young Athletes. International Journal of Sports Medicine, 45(07), 543–548. CLOCKSS. https://doi.org/10.1055/a-2278-3253

Peyrot, C., Provencher, J., Duplessis Marcotte, F., et al. (2024). Using unconditioned responses to predict fear acquisition, fear extinction learning, and extinction retention patterns: Sex hormone status matters. Behavioural Brain Research, 459, 114802. https://doi.org/10.1016/j.bbr.2023.114802

Pletzer, B., and Noachtar, I. (2023). Emotion recognition and mood along the menstrual cycle. Hormones and Behavior, 154, 105406. https://doi.org/10.1016/j.yhbeh.2023.105406

Quaglia, C., Nettore, I. C., Palatucci, G., et al. (2023). Association between Dietary Habits and Severity of Symptoms in Premenstrual Syndrome. International Journal of Environmental Research and Public Health, 20(3), 1717. https://doi.org/10.3390/ijerph20031717

Ramey, E. S. (2023). Tracking Menstrual Cycles for Mood Insight and Suicide Prevention. Journal of Psychosocial Nursing and Mental Health Services, 61(7), 5–6. https://doi.org/10.3928/02793695-20230111-01

Reed, B. G., Carr, B. R., Feingold, K.R.,et al. (editors). (2018). The normal menstrual cycle and the control of ovulation. MDText.com, Inc

Reilly, T. J., Sagnay de la Bastida, V. C., Joyce, D. W., et al. (2019). Exacerbation of Psychosis During the Perimenstrual Phase of the Menstrual Cycle: Systematic Review and Meta-analysis. Schizophrenia Bulletin, 46(1), 78–90. https://doi.org/10.1093/schbul/sbz030

Rogan, M. M., and Black, K. E. (2022). Dietary energy intake across the menstrual cycle: a narrative review. Nutrition Reviews, 81(7), 869–886. https://doi.org/10.1093/nutrit/nuac094

Romans, S., Clarkson, R., Einstein, G., et al. (2012). Mood and the Menstrual Cycle: A Review of Prospective Data Studies. Gender Medicine, 9(5), 361–384. https://doi.org/10.1016/j.genm.2012.07.003

Rugvedh, P., Gundreddy, P., and Wandile, B. (2023). The Menstrual Cycle's Influence on Sleep Duration and Cardiovascular Health: A Comprehensive Review. Cureus. https://doi.org/10.7759/cureus.47292

Russman Block, S. R., Klump, K. L., Beltz, A. M., et al. (2024). Ovarian hormones reduce the negative association between worry and cognitive control: A combined neural and behavioral investigation. Psychoneuroendocrinology, 161, 106947. https://doi.org/10.1016/j.psyneuen.2023.106947

Schleifenbaum, L., Driebe, J. C., Gerlach, T. M., et al. (2021). Women feel more attractive before ovulation: evidence from a large-scale online diary study. Evolutionary Human Sciences, 3. https://doi.org/10.1017/ehs.2021.44

Souza, M. do C. B. de, Antunes, R. de A., Souza, M. M. de, et al. (2024). Corpus luteum and progesterones in embryo transfer cycles: current challenges of different luteal phase support protocols. JBRA Assisted Reproduction, 28(2). https://doi.org/10.5935/1518-0557.20240044

Sun, Q., Li, G., Zhao, F., et al. (2024). Role of estrogen in treatment of female depression. Aging. https://doi.org/10.18632/aging.205507

Tauseef, H. A., Schmalenberger, K. M., Barone, J. C., et al. (2024). Is trait rumination associated with affective reactivity to the menstrual cycle? A prospective analysis. Psychological Medicine, 54(8), 1824–1834. https://doi.org/10.1017/s0033291723003793

Tiranini, L., and Nappi, R. E. (2022). Recent advances in understanding/management of premenstrual dysphoric disorder/premenstrual syndrome. Faculty Reviews, 11. https://doi.org/10.12703/r/11-11

Uskul, A. K., and Over, H. (2014). Women's mental health and well-being during the menstrual cycle: The role of perceived social support and self-compassion. Journal of Health Psychology, 19(11), 1343-1351.

Wang, J.X., Zhuang, J.Y., Fu, L., et al. (2021). Social Orientation in the Luteal Phase: Increased Social Feedback Sensitivity, Inhibitory Response, Interpersonal Anxiety and Cooperation Preference. Evolutionary Psychology, 19(1), 147470492098686. https://doi.org/10.1177/1474704920986866

White, T. L. (2017). Hormonal influences on decision making and risk-taking in the menstrual cycle. Journal of Behavioral Decision Making, 30(4), 736-748.

Yi, S. J., Kim, M., and Park, I. (2023). Investigating influencing factors on premenstrual syndrome (PMS) among female college students. BMC Women's Health, 23(1). https://doi.org/10.1186/s12905-023-02752-y

Yonkers, K. A. (2008). Efficacy of new treatments for premenstrual dysphoric disorder. Journal of Clinical Psychiatry, 69(8), 1144-1152.