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# WORK PRODUCTIVITY AND COGNITIVE LOAD ACROSS MENSTRUAL CYCLE PHASES: A NARRATIVE LITERATURE REVIEW

***Marta Brzęcka*** *(Corresponding Author, Email: martab2010@wp.pl)*
*Warszawski Uniwersytet Medyczny, Warsaw, Poland*
*ORCID ID: 0009-0007-1853-1415*

***Stanisław Rogiński***
*Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu, Poznań, Poland*
*ORCID ID: 0009-0007-7867-512X*

***Miłosz Rogiński***
*Gdański Uniwersytet Medyczny, Gdańsk, Poland*
*ORCID ID: 0009-0007-1863-1416*

***Karol Krupiniewicz***
*Wojewódzki Szpital Specjalistyczny im. Janusza Korczaka w Słupsku, Słupsk, Poland*
*ORCID ID: 0009-0004-4255-4412*

***Mariusz Suchcicki***
*Szpital Kliniczny Ministerstwa Spraw Wewnętrznych i Administracji z Warmińsko-Mazurskim Centrum Onkologii w Olsztynie, Olsztyn, Poland*
*ORCID ID: 0009-0008-6988-4664*

***Marek Wojciechowicz***
*Gdański Uniwersytet Medyczny, Gdańsk, Poland*
*ORCID ID: 0009-0000-3963-6805*

***Antoni Liebert***
*Warszawski Uniwersytet Medyczny, Warsaw, Poland*
*ORCID ID: 0009-0004-8778-1803*

***Anna Dominiczak***
*Warszawski Uniwersytet Medyczny, Warsaw, Poland*
*ORCID ID: 0009-0008-5984-2866*

***Katarzyna Mazurek***
*Warszawski Uniwersytet Medyczny, Warsaw, Poland*
*ORCID ID: 0009-0007-4656-0897*

***Łukasz Chojnowski***
*Szpital Morski im. PCK, Gdynia, Poland*
*ORCID ID: 0009-0005-6077-8636*

**ABSTRACT**

Hormonal fluctuations across the menstrual cycle are increasingly recognized as meaningful contributors to variations in cognition, emotional regulation, and daily functioning. However, empirical evidence remains fragmented across disciplines, with studies differing widely in methodological rigor, outcome measures, and approaches to menstrual phase classification. This lack of integration limits the field's ability to draw coherent conclusions about how cycle-related changes influence cognitive load and work productivity—domains of growing significance for women's health and occupational wellbeing. This narrative review addresses this gap by synthesizing findings from nineteen empirical studies spanning neuroscience, psychology, occupational health, and digital menstrual tracking.

A structured search of PubMed, Scopus, and Web of Science was used to identify eligible studies. Data were then extracted using a standardized analytical protocol. The findings reveal domain-specific patterns of cognitive variation, with the most consistent differences observed in reaction time, attentional stability, and temporal anticipation. Cognitive-emotional processes—including rumination, stress reactivity, and negative attentional bias—showed particularly pronounced fluctuations during the luteal and premenstrual phases, especially among individuals with PMS or PMDD, and were associated with reduced efficiency, motivation, and routine management. Digital tracking tools provided additional insight into menstrual variability but demonstrated methodological limitations that affect their reliability for studying cognitive and functional outcomes.

Overall, the evidence indicates that menstrual-cycle-related changes in cognition and emotional processing interact with symptom burden to shape cognitive load and everyday productivity. Strengthening methodological rigor, incorporating validated measures, and improving menstrual health literacy may enhance both research precision and practical strategies for supporting individuals across menstrual cycle phases.

**KEYWORDS**

Menstrual Cycle, Cognitive Load, Work Productivity, PMS/PMDD, Cognitive Performance

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## 1. Introduction

The menstrual cycle is a complex biopsychological process characterized by dynamic hormonal fluctuations that influence multiple physiological and behavioral systems. Although traditionally conceptualized as a predictable 28-day pattern, large datasets from mobile cycle-tracking applications demonstrate substantial inter- and intra-individual variability in cycle length, ovulation timing, and symptom patterns (Symul et al., 2019; Schantz et al., 2021). Such variability challenges calendar-based assumptions commonly used in menstrual cycle research and complicates the interpretation of studies that do not include hormonal verification or continuous symptom tracking (Bucher et al., 2025).

Emerging evidence suggests that menstrual cycle phases may be associated with measurable fluctuations in cognitive functioning. Neuropsychological research indicates that processes such as attention, spatial reasoning, and anticipatory control can shift across the cycle, sometimes in alignment with hormonal changes (Ronca et al., 2025; Sawicka et al., 2025). Experimental studies report differences in reaction times, attentional stability, and accuracy across phases, although findings are not always consistent due to methodological heterogeneity, small sample sizes, and variable phase-classification methods (Le et al., 2020; Avila-Varela et al., 2024). These inconsistencies underscore ongoing challenges in identifying robust cognitive patterns linked to menstrual physiology.

Premenstrual disorders further illustrate the cognitive and emotional dimensions of menstrual-cycle-related functioning. Research on premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD) documents affective instability, difficulties in emotional regulation, and increased cognitive-emotional load

during the late luteal phase (Henderson et al., 2025). Qualitative work reveals that many women experience disruptions in daily routines, reduced motivation, challenges in task management, and social withdrawal during symptomatic phases (Park et al., 2023). These functional impairments are influenced not only by mood symptoms but also by the cognitive effort required to manage fluctuating energy levels, physical discomfort, and interpersonal stressors associated with the menstrual cycle.

The workplace represents a particularly important context in which these cognitive and emotional fluctuations may have meaningful impact. Menstrual symptoms, especially among individuals experiencing PMS or PMDD, are associated with decreased productivity, presenteeism, and absenteeism (Park et al., 2023; Henderson et al., 2025). Symptoms such as fatigue, irritability, impaired concentration, and dysphoria can increase cognitive load during work tasks, thereby affecting occupational participation and performance (Park et al., 2023). Addressing these factors is essential for improving workplace wellbeing and minimizing productivity losses.

Digital menstrual-health tracking tools have become increasingly prominent in both research and personal health management. Large-scale evaluations demonstrate that such applications can enhance menstrual-cycle literacy, support symptom monitoring, and provide accessible platforms for self-management (Cunningham et al., 2024). Their extensive datasets also offer new opportunities for population-level research on menstrual patterns and functioning (Symul et al., 2019; Schantz et al., 2021). However, significant limitations—including inconsistent functionality, lack of validated measures, limited inclusiveness, and concerns about data privacy—constrain their reliability as scientific instruments (Bucher et al., 2025; Cunningham et al., 2024). These challenges highlight the need for careful methodological consideration when integrating app-based data into research on cognition or work productivity.

Taken together, current evidence indicates that menstrual cycle phases can influence cognitive processing, emotional regulation, and daily functioning, yet findings remain fragmented across disciplines. Research examining work productivity and cognitive load remains limited, often relying on small samples, self-report measures, or heterogeneous methodological approaches. Moreover, few studies integrate neuropsychological, occupational, hormonal, and digital-health perspectives despite their clear interconnections.

The aim of this narrative review is therefore to synthesize empirical findings from nineteen peer-reviewed studies across neuroscience, psychology, occupational health, and digital health to develop an integrated understanding of how menstrual cycle phases influence cognitive performance, cognitive load, and work productivity. By bringing together diverse methodological approaches and perspectives, this review seeks to clarify underlying mechanisms, identify practical implications for workplace wellbeing, and highlight methodological considerations that should guide future research in this domain.

## 2. Methods

### 2.1. Search Strategy

This narrative review synthesized empirical and theoretical literature examining relationships between menstrual cycle phases, cognitive performance, cognitive load, and work productivity. We conducted a structured search in PubMed, Scopus, and Web of Science, which were selected for their comprehensive coverage of biomedical, psychological, and interdisciplinary research. Searches were carried out between January and March 2025 using combinations of keywords such as “menstrual cycle,” “cognitive performance,” “cognitive load,” “work productivity,” “PMS,” “PMDD,” “menstrual tracking apps,” and “menstrual health.” Controlled vocabulary terms were also used where applicable (e.g., MeSH terms in PubMed). We screened reference lists of included articles and relevant systematic reviews to ensure that no additional studies were overlooked. Only articles with accessible full texts were eligible for inclusion.

### 2.2. Inclusion and Exclusion Criteria

Inclusion criteria

Studies were included if they met the following criteria:

- Population: individuals experiencing natural menstrual cycles, PMS, or PMDD.
- Topic relevance: studies examining at least one of the following domains:
  - cognitive performance (e.g., attention, memory, executive functions),
  - cognitive load or cognitive-emotional processes,
  - work productivity, functioning, or daily activity patterns,

◦ menstrual health literacy or digital menstrual tracking relevant to cognitive or functional outcomes.

- Study type: empirical research (experimental, observational, qualitative, cross-sectional, longitudinal, RCT), systematic reviews, or high-quality review articles.
- Language: English.
- Availability: full-text accessible for detailed analysis.

Exclusion criteria

Studies were excluded if they:

- focused exclusively on clinical populations unrelated to menstrual health (e.g., endocrine disorders not involving menstrual cycling),
- did not differentiate menstrual phases or did not assess relevant cognitive or behavioral outcomes,
- were conference abstracts, case reports, editorials, or opinion pieces,
- used only predictive models without empirical data,
- were duplicate reports from the same dataset without additional results.

### 2.3. Study Selection Process

The initial search yielded several hundred records across the databases. After removal of duplicates, titles and abstracts were screened for relevance based on the criteria outlined above. Then we reviewed full texts of potentially eligible studies in detail to confirm inclusion. Ultimately, nineteen articles met all criteria and formed the evidence base for this review. These studies represent a diverse range of methodologies—including neuropsychological testing (e.g., Ronca et al., 2025), cognitive–emotional assessments in PMDD (Henderson et al., 2025), occupational and qualitative research (Park et al., 2023), randomized controlled trials (Cunningham et al., 2024), and large-scale digital menstrual tracking analyses (Symul et al., 2019; Bucher et al., 2025).

### 2.4. Data Extraction

To ensure consistency and minimize interpretive bias, we analyzed each full-text article using a structured data extraction protocol. Extracted information included:

- study design and methodology,
- sample characteristics and menstrual cycle classification methods,
- cognitive, emotional, behavioral, or productivity-related outcomes,
- key findings and effect patterns across cycle phases,
- relevance to cognitive load and occupational functioning,
- strengths, limitations, and methodological considerations.

For qualitative studies, thematic patterns and interpretive frameworks were extracted. For experimental studies, task paradigms, outcome measures, and phase comparisons were catalogued. For digital health and app-based studies, algorithmic transparency, symptom-tracking features, educational content, and data-quality issues were evaluated. We summarized each article in a detailed analytic memo, which served as the foundation for thematic synthesis.

### 2.5. Narrative Synthesis Approach

Given the heterogeneity of study types, populations, and outcomes, a narrative synthesis approach was used rather than a quantitative meta-analysis. We grouped studies into four thematic domains aligned with the aims of the review:

1. cycle physiology and variability,
2. cognitive performance across menstrual phases,
3. PMS/PMDD, cognitive-emotional load, and functional impact,
4. digital menstrual tracking and methodological considerations.

Within each domain, we compared, contrasted, and contextualized findings. Emphasis was placed on identifying consistent patterns, theoretical mechanisms, and cross-disciplinary linkages. Divergent results were examined in relation to methodological differences such as phase verification, sample size, measurement tools, and study design. The synthesis aimed to integrate neurocognitive, psychological, occupational, and digital-health perspectives to provide a comprehensive understanding of how menstrual cycle phases influence cognitive load and productivity.

## 3. Results

### 3.1. Cycle Physiology and Variability

Understanding menstrual cycle physiology is essential for interpreting fluctuations in cognition, emotional processing, and daily functioning. Evidence from large-scale digital datasets, mobile health applications, and epidemiological reviews demonstrates that menstrual cycles are far more variable across individuals than traditionally assumed. This variability directly affects the accuracy of phase classification in research and, consequently, the interpretation of behavioral findings.

Analyses of millions of digitally recorded cycles show that ovulation seldom occurs on the conventionally presumed day 14. Instead, it is distributed across a broad temporal range for most individuals (Symul et al., 2019). These data reveal substantial variation in the follicular phase and meaningful, though smaller, variability in the luteal phase. Notably, about one-fifth of cycles include a luteal phase of ten days or fewer—considerably higher than rates reported in earlier clinical studies. Such findings indicate that inter- and intra-individual variability in cycle length is the norm rather than an exception.

Epidemiological work further underscores the methodological challenges posed by this variability. Schantz et al. (2021) noted that many menstrual-cycle studies rely on calendar-based assumptions rather than biological verification, even though factors such as stress, age, parity, lifestyle, and overall health significantly influence cycle length. Relying solely on self-reported or app-predicted phases increases the risk of misclassification, reducing statistical power and contributing to inconsistencies in cognitive and behavioral research.

The degree of variability observed across users is also shaped by the tools used to track cycles. Although menstrual tracking applications allow for unprecedented population-level observation, issues such as missing data, irregular symptom logging, and nontransparent algorithms limit their scientific reliability (Schantz et al., 2021; Bucher et al., 2025). Bucher et al. (2025) reported considerable discrepancies in how apps estimate fertile windows, interpret cycle data, and educate users about physiological processes. Only a minority employ validated symptom-tracking measures, and many depend on simplified calendar-based predictions despite well-documented cycle irregularity.

Even with these limitations, large-scale digital datasets remain valuable for identifying broad physiological patterns. For instance, Symul et al. (2019) observed consistent shifts in basal body temperature and cervical mucus characteristics across cohorts, findings that support established biological models of ovulation and luteal transformation. These results illustrate how digital health data can complement physiological research while simultaneously highlighting the magnitude of variability across individuals.

Taken together, the literature underscores that menstrual cycle variability is a key factor influencing cognitive, emotional, and functional outcomes. Inaccurate or inconsistent phase-classification methods may lead to apparent discrepancies in research findings, particularly in studies examining subtle changes in attention, processing speed, or emotional regulation—domains where precise alignment with hormonal fluctuations is essential.

In sum, evidence from population-level digital tracking, epidemiological reviews, and app-evaluation studies converges on three core conclusions:

1. Cycle phases are highly variable, and the classical 28-day cycle with mid-cycle ovulation represents only a minority of patterns.
2. Phase misclassification is a major methodological barrier contributing to inconsistent results in cognitive and productivity research.
3. Digital tracking tools are valuable but require refinement to serve as reliable instruments for studying cognitive load and work functioning across menstrual phases.

### 3.2. Cognitive Performance Across Menstrual Cycle Phases

Evidence from the reviewed studies shows that cognitive performance across the menstrual cycle reflects an interaction between hormonal fluctuations, symptom burden, and broader neurocognitive dynamics. Although results vary by methodology, several consistent patterns emerge regarding attention, reaction time (RT), neural flexibility, and functional correlates of cognitive load.

One of the clearest findings concerns attentional stability and RT. Ronca et al. (2025) reported that individuals often perform faster and with greater consistency during menstruation compared with the luteal phase. Their temporal anticipation paradigm showed that RTs slowed and became more variable approaching the late luteal phase, suggesting that anticipatory processing is sensitive to hormonal fluctuations. Complementary evidence indicates that symptom burden contributes independently to cognitive variation:

increases in self-reported menstrual symptoms were associated with slower RTs and reduced temporal prediction accuracy (Ronca et al., 2025), demonstrating that cognitive performance is shaped by both physiological and experiential factors.

Neurodynamic research offers additional mechanistic insight. Avila-Varela et al. (2024) observed marked changes in whole-brain functional dynamics across the cycle, with neural complexity peaking during the pre-ovulatory phase. Elevated metastability and intrinsic ignition during this period are interpreted as indicators of enhanced neural flexibility associated with higher estradiol levels. In contrast, reduced complexity during the early follicular and mid-luteal phases suggests lower global integration, which may influence performance on tasks requiring rapid cognitive adaptation. These findings help explain why behavioral results can appear small or inconsistent: cycle-related cognitive differences may stem from widespread changes in neural organization rather than discrete impairments in specific domains.

Studies involving individuals with premenstrual disorders provide further context. Henderson et al. (2025) found that although objective cognitive deficits in PMDD are inconsistent, cognitive-emotional processes—such as rumination, negative attentional bias, and heightened stress reactivity—show reliable premenstrual increases. These patterns imply that cognitive load may rise during symptomatic phases even when standardized task scores do not reflect substantial impairment. Qualitative accounts by Park et al. (2023) echo this interpretation: participants described reduced concentration, lower task efficiency, and increased effort required to sustain performance during the late luteal phase. Such findings emphasize that cognitive functioning encompasses not only measurable task outcomes but also the subjective cognitive effort required under varying emotional or physical conditions.

Additional perspectives come from research on functional outcomes and menstrual health literacy. Sawicka et al. (2025) reported that individuals using hormonal contraception who also experienced PMS displayed fluctuations in mood, energy, and concentration that influenced daily cognitive functioning, highlighting the role of symptom patterns in shaping attentional and executive capacities. Furthermore, digital health interventions evaluated by Cunningham et al. (2024) demonstrated that improved menstrual health literacy can support more effective symptom management, potentially reducing the cognitive burden associated with uncertainty or inconsistent expectations about cycle-related changes. These findings indicate that cognitive performance across the cycle is influenced not only by biological factors but also by individuals ' understanding and interpretation of their own symptoms.

Taken together, evidence across neuropsychological, neurodynamic, symptomatic, and functional domains suggests that menstrual cycle phases influence cognitive performance through interconnected hormonal, neural, and experiential mechanisms. Although not all cognitive domains display strong or consistent cycle-related effects, converging findings indicate that attentional stability, reaction time, cognitive-emotional load, and neural flexibility each follow phase-dependent patterns. These insights provide a foundation for interpreting subsequent analyses of cognitive load and occupational functioning.

### 3.3. PMS/PMDD, Cognitive-Emotional Load, and Functional Impact

Premenstrual symptoms, particularly among individuals with PMS and PMDD, are consistently linked to heightened cognitive-emotional load and disruptions in daily and occupational functioning. Although standard cognitive tests do not always reveal clear objective impairments, converging evidence shows that premenstrual shifts in emotional reactivity, stress processing, and symptom burden can significantly reduce cognitive efficiency.

Reviews of PMDD suggest that changes in emotional–cognitive processes are among the most robust findings. Henderson et al. (2025) reported marked premenstrual increases in rumination, negative attentional bias, and heightened stress reactivity—processes that draw heavily on attentional and working-memory resources and limit the capacity available for demanding tasks. These effects often arise even when laboratory tasks show stable performance, indicating that subjective cognitive load may better capture premenstrual functioning than accuracy scores alone.

Findings from a quasi-experimental study add further support. Rabbani et al. (2025) observed that individuals with PMS or PMDD performed noticeably better after menstruation on measures of abstraction, language, and general cognition. In contrast, the premenstrual phase was associated with reduced efficiency, suggesting that physical discomfort and emotional strain contribute directly to cognitive load beyond hormonal influences.

Qualitative research provides additional insight into how these burdens unfold in everyday contexts. Park et al. (2023) reported that women experiencing PMS often describe reduced concentration, lower

motivation, difficulty maintaining routines, and increased emotional volatility before menstruation. Many noted that tasks requiring planning or sustained attention demanded disproportionate effort, revealing meaningful impacts on executive functioning. Reports of guilt, tension in relationships, and social withdrawal further highlight the psychosocial facets of premenstrual difficulties.

Occupational studies echo these patterns. Large-scale surveys have shown that menstrual symptoms—particularly those related to PMS and PMDD—are associated with reduced productivity, higher presenteeism, and increased absenteeism. For example, Schoep et al. (2019) documented notable productivity losses across a nationwide cohort, while Ponzo et al. (2023) and Raves et al. (2025) found strong links between symptom severity and perceived declines in work efficiency. Similar findings have been reported in workplace-based studies of absenteeism and presenteeism (Loukzadeh et al., 2024; Koh et al., 2025; Iida et al., 2025), and research on menstrual disorders points to broader effects on workforce participation (Alemu et al., 2025). These results align with qualitative accounts indicating that even when individuals continue working through symptoms, the additional cognitive and emotional effort increases overall cognitive load.

Research on psychosocial and educational interventions offers further perspective. Sawicka et al. (2025) found that fluctuations in mood, irritability, and self-regulation among individuals with PMS were closely tied to perceived difficulties with concentration and daily functioning. Digital health interventions also appear beneficial: improving menstrual health literacy has been shown to reduce uncertainty and emotional strain and may consequently lessen cognitive load (Cunningham et al., 2024). These findings underscore that cognitive-emotional experiences across the cycle arise from both physiological and psychosocial influences.

Taken together, the literature highlights three central themes. First, cognitive-emotional processes—such as rumination, stress reactivity, and negative attentional bias—show the most consistent premenstrual shifts, particularly among individuals with PMS or PMDD (Henderson et al., 2025; Park et al., 2023). Second, symptom severity is a key determinant of cognitive efficiency, with increased premenstrual burden reliably associated with reduced functioning (Rabbani et al., 2025; Schoep et al., 2019; Ponzo et al., 2023; Loukzadeh et al., 2024). Third, these cognitive-emotional and symptomatic changes contribute to meaningful disruptions in daily life and occupational performance, highlighting the need to integrate emotional, cognitive, and functional perspectives when examining menstrual-cycle-related variability in productivity and wellbeing.

### 3.4. Digital Menstrual Tracking and Methodological Considerations

Digital menstrual tracking applications are widely used tools for monitoring cycle patterns, symptoms, fertility indicators, and daily wellbeing. Their growing popularity has generated large volumes of self-tracked data, offering researchers valuable longitudinal insights into menstrual physiology and its behavioral correlates. However, the reviewed studies consistently highlight substantial variability in data quality, methodological rigor, and algorithmic accuracy, all of which have important implications for research on cognitive load and productivity.

Analyses of large-scale datasets illustrate both the strengths and limitations of app-based tracking. Symul et al. (2019) examined millions of user-recorded cycles and found considerable variability in ovulation timing and phase length across individuals. Their findings aligned with established physiological markers—such as basal body temperature changes and cervical mucus patterns—suggesting that self-tracked data can reflect meaningful biological signals. At the same time, missing temperature or symptom logs were common and significantly reduced the accuracy of ovulation estimates, underscoring the need for consistent user engagement to ensure data reliability.

Epidemiological reviews raise additional concerns about sample composition and data completeness. Schantz et al. (2021) noted that app users are typically younger, White, educated, and predominantly from Western countries, which limits the generalizability of app-derived findings. High attrition rates, sporadic engagement, and incomplete symptom entries introduce further bias, complicating efforts to examine subtle cognitive or emotional fluctuations across menstrual phases.

Systematic evaluations of menstrual app functionality reveal marked inconsistencies between platforms. Bucher et al. (2025) found that many applications rely on simplified prediction algorithms, lack validated symptom-tracking instruments, or provide medically imprecise educational content. Privacy concerns were also prominent, with several apps sharing user data with third parties, raising ethical questions about their suitability for research involving sensitive health information. Collectively, these limitations constrain the reliability of app-based data for scientific studies.

Despite these challenges, digital tools can meaningfully support menstrual health literacy and self-management. Cunningham et al. (2024) reported that a menstrual health app improved users ’understanding

of menstrual physiology, enhanced symptom awareness, and promoted emotional wellbeing, with reductions in absenteeism among individuals with PMS or PMDD. These findings suggest that digital tracking tools may help users anticipate and manage symptoms more effectively, thereby reducing perceived cognitive load and functional disruptions. However, the study did not assess whether these improvements translate into measurable cognitive performance changes, highlighting a key area for future research.

Across the reviewed literature, several methodological considerations emerge:

1. Incomplete and inconsistent data reduce phase-determination accuracy.
2. Missing temperature logs, irregular symptom entries, and sporadic engagement compromise the reliability of app-based phase estimation (Symul et al., 2019; Schantz et al., 2021).
3. Algorithmic opacity and lack of validated measures limit scientific utility.
4. Many apps use non-transparent cycle-prediction models and rarely incorporate validated symptom scales, reducing comparability across studies (Bucher et al., 2025).
5. User demographics introduce selection bias.
6. App users do not represent the broader population, restricting generalizability and potentially skewing assessments of cognitive or functional outcomes (Schantz et al., 2021).
7. Digital tools may improve self-awareness and functional outcomes.
8. Enhanced cycle literacy and symptom management may reduce absenteeism and emotional strain, particularly in PMS/PMDD populations (Cunningham et al., 2024).

Overall, digital menstrual tracking offers promising opportunities for studying cognitive load, emotional processing, and productivity across menstrual phases. Yet the methodological limitations outlined across studies underscore the need for caution when interpreting app-derived findings. Future research would benefit from integrating validated physiological measures, standardizing symptom-tracking protocols, and improving transparency and inclusiveness within tracking technologies.

## 4. Discussion

This narrative review synthesized evidence from neurophysiological, psychological, occupational, and digital health research to examine how menstrual cycle phases influence cognitive performance, cognitive-emotional load, and work productivity. Across the 20 included studies, patterns emerged indicating that menstrual cycle–related variations in cognition and functioning are multifaceted and shaped by interactions among hormonal dynamics, symptom burden, neural modulation, and psychosocial context. Although effects differ across individuals and methodologies, the overall evidence supports meaningful phase-dependent differences, particularly during the luteal and premenstrual phases.

### 4.1. Integrative Interpretation of Findings

The reviewed research shows that menstrual cycle effects on cognition vary depending on the processes examined. Experimental findings indicate that reaction time, temporal anticipation, and attentional stability frequently differ across phases, with relatively more stable performance during menstruation and reduced stability during the late luteal phase (Ronca et al., 2025). These behavioral changes align with neuroimaging evidence demonstrating increased global network flexibility during the pre-ovulatory phase compared with early follicular and mid-luteal phases (Avila-Varela et al., 2024). Together, these findings suggest that cognitive performance reflects not only immediate hormonal levels but also broader changes in neural integration.

Interpretation of cognitive outcomes must also account for symptom severity and emotional processing. Research on PMS and PMDD shows that premenstrual increases in rumination, stress sensitivity, and negative attentional bias exert additional demands on cognitive resources (Henderson et al., 2025). These emotional-cognitive processes often fluctuate more consistently than objective task scores. Qualitative findings support this perspective: women describe reduced concentration, difficulty planning, and greater cognitive effort during the premenstrual phase even when performance remains stable (Park et al., 2023). Overall, cognitive-emotional load appears to provide a more comprehensive representation of menstrual-related functioning than accuracy-based measures alone.

Taken together, hormonal variation influences neural dynamics, which interact with emotional processing and symptom burden to shape cognitive capacity. This multidimensional model helps explain discrepancies across studies and underscores the need to consider both behavioral and experiential outcomes.

### 4.2. Implications for Workplace Functioning

The findings of this review have important implications for understanding work productivity. Although objective cognitive impairments across the menstrual cycle are often subtle, increases in emotional fatigue, attentional instability, and symptom burden can meaningfully affect task performance. Occupational studies consistently show that menstrual symptoms—particularly those associated with PMS and PMDD—are linked to reduced productivity, higher presenteeism, and increased absenteeism (Schoep et al., 2019; Ponzo et al., 2023; Loukzadeh et al., 2024; Koh et al., 2025; Iida et al., 2025). Qualitative accounts further indicate that women frequently exert additional cognitive effort to maintain usual work standards during more symptomatic phases, suggesting that the cognitive load required for routine tasks increases even when measurable performance outcomes appear unchanged (Park et al., 2023; Hardy & Hunter, 2021).

Work that involves sustained attention, rapid decision-making, complex planning, or emotional regulation may be especially challenging during the late luteal phase. PMDD-related emotional reactivity appears to further exacerbate these demands, increasing vulnerability to workplace strain and reducing the efficiency with which cognitive resources can be allocated (Henderson et al., 2025). These findings highlight the importance of considering subjective and functional indicators—not only objective task performance—when evaluating the occupational impact of menstrual cycle–related fluctuations.

Promisingly, interventions aimed at improving menstrual health literacy show beneficial effects. Cunningham et al. (2024) found that users of a menstrual health app demonstrated greater understanding of their symptoms and reported reduced absenteeism, suggesting that enhanced self-awareness and anticipatory planning may help individuals manage cognitive resources more effectively during more demanding phases.

### 4.3. Implications for Digital Health and Menstrual Tracking

Digital menstrual tracking tools offer valuable opportunities for self-management and research. Large-scale datasets from these applications have improved understanding of menstrual variability, confirming substantial differences in ovulation timing and phase length across individuals (Symul et al., 2019). Nonetheless, findings across reviewed studies show that app-derived data must be interpreted cautiously. Missing entries, inconsistent symptom tracking, and irregular user engagement substantially reduce the accuracy of phase estimation (Symul et al., 2019; Schantz et al., 2021).

Additional methodological concerns arise from app design and user characteristics. Assessments of commercial menstrual apps reveal inconsistencies in algorithmic transparency, limited use of validated symptom measures, and frequent sharing of user data (Bucher et al., 2025). Moreover, users tend to represent a narrow demographic—primarily younger, educated individuals—limiting generalizability (Schantz et al., 2021). Despite these limitations, digital health interventions have shown psychosocial benefits, as improved health literacy can enhance self-management and may help reduce perceived cognitive load (Cunningham et al., 2024).

Overall, digital tools hold considerable potential, but methodological limitations must be addressed before app-derived data can reliably inform research on cognition or productivity.

### 4.4. Strengths and Limitations of Current Evidence

The reviewed literature has several strengths. Multimethod evidence from experimental tasks, neuroimaging, qualitative interviews, and occupational studies provides complementary insights into menstrual-cycle-related cognitive and functional changes. This interdisciplinary convergence helps illuminate interactions among hormonal fluctuations, neural dynamics, symptoms, and contextual factors. Neurophysiological methods offer mechanistic explanations for behavioral findings (Avila-Varela et al., 2024), while qualitative studies contextualize cognitive-emotional fluctuations within lived experience (Park et al., 2023).

Nonetheless, limitations constrain interpretation. Phase misclassification remains a significant challenge, as many studies rely on calendar-based rather than hormonal verification methods (Schantz et al., 2021; Bucher et al., 2025). Sample sizes are often small, limiting statistical power and generalizability. Cognitive measures vary widely across studies, complicating synthesis. Digital tracking data introduce methodological concerns including incomplete entries, algorithmic opacity, and demographic skew. Finally, few studies measure work productivity directly, leaving gaps in understanding how cognitive and emotional fluctuations influence occupational performance.

### 4.5. Research Gaps and Future Directions

Future research should incorporate hormonal verification, standardized cognitive assessments, and validated symptom measures to improve methodological consistency. Longitudinal designs tracking multiple cycles will help clarify the temporal stability of cognitive fluctuations and their relationship to symptom severity. Because functional impacts are highly context-specific, ecologically valid approaches—such as digital phenotyping and naturalistic productivity assessments—may offer deeper insight into real-world cognitive demands.

Digital menstrual tracking tools hold promise for large-scale research, but improvements in algorithm transparency, validated symptom frameworks, and user diversity are needed. Integrating app-based data with physiological markers—such as hormone assays or wearable sensors—may enhance the precision of phase classification and clarify links to cognitive variation.

Finally, individual differences warrant further attention. Although PMS and PMDD clearly influence cognitive-emotional load, little research explains why only some individuals experience pronounced premenstrual difficulties. Understanding moderating factors—including stress, sleep, pain sensitivity, and neurobiological traits—may support more personalized approaches to menstrual health and workplace wellbeing.

## 5. Conclusions

This narrative review integrated evidence from neuroscience, psychology, occupational health, and digital health research to examine how menstrual cycle phases influence cognitive performance, cognitive-emotional load, and work productivity. Across the 20 reviewed studies, several consistent patterns emerged despite methodological variability. The findings collectively indicate that menstrual cycle–related changes in cognition are nuanced and domain-specific, with the most robust effects observed in attentional stability, reaction time, and cognitive-emotional processes rather than in broad cognitive deficits.

The luteal and premenstrual phases appear to be particularly relevant for understanding fluctuations in cognitive load and daily functioning. Although many cognitive tasks show only modest cycle-related changes, individuals experiencing PMS or PMDD consistently report increased emotional strain, reduced regulatory capacity, and difficulties maintaining routines and productivity. These cognitive-emotional burdens can meaningfully affect work performance, even in the absence of measurable impairments in laboratory-based cognitive tasks. As such, understanding menstrual cycle influences requires an integrated perspective that accounts for symptom severity, emotional regulation, and contextual demands.

Digital menstrual tracking tools contribute important insights into cycle variability and user experiences, yet their methodological shortcomings—such as incomplete data, limited inclusiveness, and unvalidated symptom measures—highlight the need for caution when using app-derived data to study cognitive or productivity outcomes. Nonetheless, evidence suggests that improving menstrual health literacy through digital tools may support users in managing symptoms and reducing functional impairments, particularly among those with PMS or PMDD.

Taken together, the findings underscore that menstrual-cycle-related cognitive and functional changes arise from the interaction of hormonal, neurobiological, emotional, and behavioral factors. These interactions influence not only cognitive performance but also the cognitive effort required to meet daily and occupational demands.

Future research should prioritize methodological rigor by incorporating hormonal verification, standardized cognitive measures, and validated symptom assessments. Studies that combine physiological monitoring with ecologically valid assessments of real-world functioning will be especially valuable. Additionally, greater attention to individual differences and the role of contextual factors—such as stress, sleep, and workplace demands—will be essential for developing more precise and supportive strategies to address menstrual health in occupational and educational settings.

In conclusion, menstrual cycle phases can meaningfully shape cognitive-emotional processes and everyday functioning, with important implications for wellbeing and productivity. Recognizing these cyclical patterns and improving the tools used to track and study them will enhance both scientific understanding and practical approaches to supporting individuals across the menstrual cycle.

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**Authors 'Contributions**

All authors contributed to the article.

**Conceptualization:** Brzęcka M., Rogiński S.

**Methodology:** Brzęcka M., Liebert A., Rogiński S., Krupiniewicz K., Dominiczak A., Mazurek K.

**Software:** Mazurek K., Dominiczak A., Wojciechowicz M.

**Formal Analysis:** Brzęcka M., Liebert A., Rogiński S., Krupiniewicz K.

**Investigation:** Mazurek K., Dominiczak A., Wojciechowicz M.

**Resources:** Brzęcka M., Liebert A., Dominiczak A., Wojciechowicz M.

**Data Curation:** Brzęcka M., Liebert A., Dominiczak A., Wojciechowicz M.

**Writing – Original Draft Preparation:** Brzęcka M., Liebert A., Rogiński S.

**Writing – Review & Editing:** Krupiniewicz K., Wojciechowicz M., Dominiczak A., Mazurek K.

**Visualization:** Brzęcka M., Liebert A., Rogiński S., Dominiczak A., Mazurek K.

**Supervision:** Brzęcka M., Liebert A., Rogiński S., Krupiniewicz K., Wojciechowicz M., Dominiczak A., Mazurek K.

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