Women *Fitness* Cycle

Physical activity and exercise recommendations across the menstrual cycle

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Title Physical activity and exercise recommendations across the menstrual cycle

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1. Executive summary

The Women's Fitness Cycle (WFC) project offers evidence-based recommendations to optimise training for women, taking into account physiological and psychological changes throughout the menstrual cycle. In line with European and global calls for policy change, this initiative addresses the gender gap in exercise and sport, as women engage significantly less than men. Women face unique barriers in sports participation, including menstrual cycle-related fluctuations, which affect performance capacity and motivation. Therefore, the WFC recommendations aim to empower women and coaches to improve performance and support consistent participation in exercise and sport throughout the menstrual cycle. By integrating current scientific insights, these recommendations aim to help eumenorrheic women and their coaches tailor exercise programs to menstrual cycle phases, ultimately enhancing performance, well-being, and long-term sports participation.

To develop evidence-based recommendations, two systematic reviews were conducted to gather the most up-to-date and reliable evidence. A systematic review with meta-analysis on physiological performance across menstrual phases (91 studies, including 24 in meta-analysis) revealed that aerobic capacity is slightly lower and sprint times are slower during the menstrual (early follicular) phase compared to mid-cycle phases. However, no consistent differences were found in strength, power, or other fitness measures across the cycle. The overall certainty of evidence was low. A parallel systematic review on psychological outcomes (comprising five studies) found that women often experience reduced mood and motivation, as well as higher perceived exertion, during the premenstrual (late luteal) and menstrual phases. In contrast, the follicular phase tends to be more favourable for their psychological state. Given the heterogeneity and limited data, these psychological findings were synthesised qualitatively.

Using the GRADE framework, the quality of evidence for the physiological outcomes was evaluated. Low quality of evidence was generally found. However, it is generally agreed that recommendations must strongly emphasise personalised and flexible approaches. We advise female athletes and practitioners to monitor their menstrual cycles and adjust training loads as needed, particularly by allowing lighter intensity or more recovery during menses and the late luteal phase, if experiencing fatigue or pain. Conversely, when women feel at their best (often in the mid-cycle), they may plan more intense sessions, while remaining attentive to individual variation. These recommendations emphasise the importance of psychological support strategies and tailoring each approach to the individual.

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2. Introduction

2.1. Background

Promoting equal opportunities in exercise and sport participation for women is a priority in European and international policy frameworks (International Olympic Committee, 2021; UNESCO, 2015). Globally, women's physical activity levels are about 8% lower than men's (Guthold et al., 2018). The drop-off is especially pronounced during young adulthood and continues into later life (Guthold et al., 2018, 2020). This gender gap in exercise and sports is highly explained by gender-specific barriers that limit their engagement. Among these barriers are social and motivational challenges, as well as biological factors unique to women, notably the menstrual cycle, that may impact their participation.

The menstrual cycle can impact a range of physiological functions. Many women experience physical discomfort, pain, fatigue, mood swings, and increased perceived exertion during certain phases of their cycle, which can negatively impact their willingness and ability to train and compete (Paludo et al., 2022). Indeed, understanding how the menstrual cycle interacts with sports performance is essential to support women athletes and active individuals. Some research suggests that having a regular cycle is associated with higher activity levels and that hormonal fluctuations can influence stress responses, energy availability, and perceived effort (Isenmann et al., 2024; McNulty et al., 2020). These insights underscore the importance of training strategies that account for menstrual cycle variations, rather than adopting a one-size-fits-all approach.

It is essential to develop targeted recommendations and supportive environments that recognise the impacts of the menstrual cycles. Integrating scientific knowledge about cycle-related changes into training and policy can ultimately improve women's athletic performance, health, and well-being. The WFC project builds on this premise, aiming to translate emerging evidence into practical guidance for women, coaches, and health professionals.

2.2. Rational

Current guidelines related to physical activity and exercise participation generally do not refer to training independent of sex/gender, and therefore do not consider the effects of the menstrual cycle on training (World Health Organization, 2020). However, the menstrual cycle provokes hormonal fluctuations that can influence physical capacities, namely strength, endurance, coordination, perceived exertion, and psychological ones, including mood,

motivation and affection (Findlay et al., 2020; Isenmann et al., 2024; McNulty et al., 2020; Solli et al., 2020). In sports science, the importance of individualised periodisation of training is recognised, yet the menstrual cycle has seldom been integrated into these programs. As a result, female athletes often lack formal guidance on how to adjust their training or recovery strategies according to their menstrual cycle.

Recent studies have highlighted the significant impacts of menstrual hormones on both physical and psychological aspects of performance (McNulty et al., 2020; Srinivasa Gopalan et al., 2024). For instance, research suggests that aligning training with menstrual phases could enhance performance, reduce injury risk, and improve long-term adherence. Nevertheless, without guidelines, any cycle-specific adjustments in practice have been largely *ad hoc* or based on *trial and error*. The WFC project was conceived to bridge this gap. It responds to the clear need for structured, scientifically grounded recommendations that consider menstrual cycle dynamics in exercise planning. By developing evidence-based recommendations, the project seeks to ensure that the natural hormonal rhythms of eumenorrheic women are actively integrated into training methodologies, rather than ignored. This integration is expected to help optimise women's performance and recovery, minimise avoidable setbacks (such as training on days when capacity might be reduced), and ultimately support women in maintaining their exercise and sports participation.

2.3. Target audience

This document outlines the process and summarises the evidence reviewed to develop exercise recommendations for adult eumenorrheic women across the menstrual cycle. It is primarily intended for the following end-users:

1. Eumenorrheic women (aged 18 and above) who are physically active or engaged in structured training.
2. Coaches, exercise physiologists and other physical activity and exercise professionals who, in their professional practice, work with women athletes.
3. Healthcare professionals, including medical doctors, nurses, physiotherapists, and psychologists.
4. Policymakers and government officials are responsible for formulating laws, defining strategies, and developing national, regional, or municipal plans to promote exercise across the menstrual cycle.

3. Methods

These recommendations were inspired by the World Health Organisation (WHO) methodology for developing guidelines (WHO, 2014), which is an internationally recognised standard for guideline development, to ensure an effective collaboration within the consortium and the highest quality of the resulting guidelines. However, since there was little time for its development, the expert panel was limited to the project's expert researchers. Given so, it was not created a Guideline Review Committee. The contributors to the development of the recommendations are provided in Annexe 1.

3.1. Foreground questions and outcomes

The authors agreed on the scope of the recommendations. They formulated the foreground or key questions using the PICO approach to specify population (P), intervention or exposure (I), comparator (C) and outcome (O). The population of interest (P) was eumenorrheic women ≥18 years old, not on hormonal contraception, engaging in regular exercise or sport. The exposure (I) involved different phases of the menstrual cycle, contrasted (C) with the early follicular phase (menstrual days 1–5) as a reference point. The outcomes were related to both physiological and psychological factors. Three key questions were addressed:

I. How do different menstrual cycle phases affect women's health-related physical fitness performance (e.g. endurance, muscular strength), compared to the menstrual phase?
II. How do menstrual cycle phases affect skill-related fitness components (e.g. speed, agility, coordination), compared to the menstrual phase?
III. How do different menstrual cycle phases influence motivation to exercise and related psychological factors, compared to the menstrual phase?

3.2. Evidence identification and synthesis

A comprehensive literature search was conducted to address the above questions. Following PRISMA guidelines for systematic reviews, the authors searched multiple databases (including PubMed, Web of Science, Scopus, and SPORTDiscus) for relevant studies up to February 2025. Two parallel systematic reviews were undertaken by independent teams, reflecting the dual focus on physiological and psychological outcomes.

3.2.1. Physiological outcomes

The physiological review included 91 studies, of which 24 were included in the meta-analysis. It was found that maximal aerobic capacity (VO_2max) is slightly lower during the menstrual (early follicular) phase compared to mid-cycle phases, with a small but significant effect size. Similarly, sprint performance was modestly worse during menses, as sprint times were slower in the early follicular phase than in late-follicular or ovulatory phases. In contrast, no consistent differences were observed in strength, power, or anaerobic capacity measures across the cycle, for example, studies did not show a reliable change in knee extensor/flexor strength or jump performance between phases. Notably, the meta-analysis reported considerable heterogeneity in results. It graded the certainty of evidence as low for all outcomes, meaning our confidence in the magnitude of these phase effects is limited. In practice, however, even a small drop in endurance or sprint capacity during menstruation could be relevant for elite performance or hard training sessions, which justifies a cautious and individualised approach to training in that phase.

3.2.2. Psychological outcomes

The psychological review included five studies and highlighted that mood and motivation tend to fluctuate with the cycle, often in ways that complement the physiological pattern. Across the studies, women reported worse psychological states in the late luteal (premenstrual) and menstrual phases, including lower positive mood, reduced motivation, higher perceived strain, and more emotional tension. Some cognitive and perceptual aspects were also affected; for instance, concentration, confidence, or perceived readiness to perform were impaired, particularly in the late luteal phase. In contrast, the follicular phase (especially the days after menstruation, up to and around ovulation) was associated with more positive mood and mental state, indicating women often feel more upbeat and ready to train during this phase. The evidence on the ovulatory mid-cycle period was inconclusive due to underrepresentation in studies; however, it generally falls within the broader follicular phase, which has shown favourable psychological effects. Because of the heterogeneity in outcomes and the small number of studies, these findings were synthesised qualitatively rather than meta-analysed. Nonetheless, the consistency of reports of premenstrual/menstrual doldrums and mid-cycle peaks in well-being provides a reasonable basis to adjust training expectations: an athlete's drive and mental focus may naturally ebb low in the days before and during her period, then rebound higher after.

Integrating the physiological and psychological evidence yields a clear practical message: the menstrual (early follicular) and late luteal phases can pose modest challenges for

some women. In contrast, the mid-cycle follicular phase is often more advantageous. For example, many female athletes subjectively report that their performance feels worse during their period and late in the luteal phase immediately preceding it, which aligns with the objective findings of slightly diminished VO_2max and sprint capacity during menstruation, as well as heightened fatigue/tension premenstrually. On the other hand, women frequently report feeling "at their best" around the mid-cycle point, which corresponds to the time when studies observe improved mood and motivation, as well as no physiological deficits. However, it is crucial to emphasise the variability, since not every woman will experience these patterns to the same degree, or at all. Some individuals may notice pronounced menstrual cycle effects on their training, while others feel relatively stable throughout. Moreover, the overall evidence base is limited and of low certainty, so broad generalisations should be avoided. This uncertainty underpins the strong recommendation for a personalised approach: coaches and athletes should use these trends as a starting framework but ultimately rely on the athlete's own tracked data and experience to guide training modifications.

3.3. Grading evidence

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) framework was applied to assess the certainty of evidence. Data from the two systematic reviews and the meta-analysis were collected, summarised, and evaluated using GRADE criteria: study design, risk of bias, inconsistency, indirectness, imprecision, publication bias, and large effects. As it was not possible to conduct a meta-analysis for psychological outcomes due to heterogeneity, the GRADE assessment was limited to the effects of the menstrual cycle on physiological outcomes. Accordingly, we examined the certainty of evidence regarding the impact of the menstrual cycle on both health-related and skill-related physical fitness. The certainty in evidence was assigned based on the following guidance:

- High quality: we are very confident that the true effect lies close to the estimated effect.
- Moderate quality: we are moderately confident in the effect estimate. The true effect is likely to be close to the estimated effect, but there is a possibility that it may be substantially different.
- Low quality: our confidence in the effect estimate is limited. The actual effect may be substantially different from the estimated effect.

- Very low quality: we have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimated effect.

3.4. Evidence to recommendation

The evidence-based recommendation process was achieved through structured group discussions with the project experts. This approach ensured that the recommendations reflected a consensus based on the available evidence and expert judgment. No external review was conducted. The discussions considered the balance of desirable and undesirable outcomes, the certainty of the evidence, values and preferences, and practical implications. Based on these criteria, the group established the overall strength of the recommendations and provided evidence-to-recommendation syntheses explaining the rationale behind each decision.

4. Recommendations

Regular physical activity and exercise are essential for women's health and overall well-being, and should be maintained throughout the year. The following recommendations are intended to complement existing general physical activity guidelines by providing specific considerations for organising exercise and sports across the menstrual cycle. They are intended for eumenorrheic women (those with natural, regular cycles) who exercise regularly, as well as those who coach or support them. Individualisation is paramount, meaning that women experience menstrual phases differently, so training adjustments should be personalised rather than one-size-fits-all. By considering both physiological and psychological fluctuations (e.g. changes in performance capacity, mood, and motivation), coaches and practitioners can help women maximise performance and well-being throughout their cycle.

It is recommended that:

- Exercise training should adopt a flexible and individualised approach throughout the menstrual cycle.
  Strong recommendation, low certainty of evidence
- Aerobic capacity and speed training load may be adjusted during the menstrual phase, but do not need to be completely avoided; adjustments should be based on the woman's symptoms and response.

Weak recommendation, low certainty of evidence

- Strength and power training should be maintained across the cycle, adjusting for individual comfort. Modifications to load, volume, or recovery may be necessary, particularly in the early follicular and late luteal phases.

  Weak recommendation, low certainty of evidence
- Exercise sessions may be performed at a lower intensity during menstruation (early follicular phase) and the premenstrual phase (late luteal), adjusting for individual comfort.

  Weak recommendation, low certainty of evidence

Good practice statements:

- Encourage women to track their menstrual cycles (e.g., using a mobile app, diary) and record any symptoms or perceived changes in their performance.
- Foster open communication about menstrual cycle issues. Coaches and practitioners should create a supportive environment where athletes feel comfortable discussing menstrual symptoms or concerns.
- Capitalise on phases of positive mood and high energy for peak training, while avoiding overtraining.
- Incorporate psychological support strategies into training, particularly during phases when athletes may experience mood changes, irritability, or reduced motivation (late luteal and menstrual phases).

5. Application of recommendations

For the application of these evidence-based recommendations, coaches, practitioners, and athletes should translate them into clear, structured strategies within training plans. This approach will help create a training environment that acknowledges and accommodates female athletes' physiological and psychological needs. By monitoring the menstrual cycle, encouraging open communication, maintaining flexibility in programming, educating all stakeholders, and iteratively refining the approach, coaches and athletes can fully apply the WFC recommendations. Given so, the following actions are recommended:

- **Cycle monitoring:** Emphasise systematic menstrual-cycle tracking and the integration of this information into training planning. Use cycle-tracking data (e.g. smartphone

apps, wearable sensors, or menstrual diaries) to inform weekly and monthly training adjustments, ensuring changes are evidence-informed and athlete-centred.

- **Collaborative planning:** Adopt a collaborative approach in planning and adjusting training. Coaches, athletes, and support staff should regularly review performance data, training logs, and recorded symptoms together to ensure a comprehensive understanding of their progress. This joint review of trends allows the training load to be co-designed in a way that balances performance optimisation with the athlete's well-being. Open communication and athlete involvement in decision-making foster a sense of ownership, ensuring that training modifications are tailored to the athlete's subjective experiences.
- **Flexible programming:** Build adaptability into training schedules so that sessions can be adjusted in real-time according to the athlete's condition. A flexible program means planned workouts are not set in stone; intensity, volume, or even the type of exercise can be modified based on the athlete's current cycle phase and symptom profile. For example, if an athlete experiences heightened fatigue or pain during the late luteal (premenstrual) or early menstrual phase, a scheduled high-intensity session might be replaced with low-intensity training or additional recovery without detriment to long-term progress. Conversely, during phases when the athlete feels at her peak (often around mid-cycle), coaches can capitalise by scheduling more demanding workouts, taking advantage of higher energy and motivation levels (while still ensuring adequate recovery afterwards).
- **Team sports specifications.** Implementing menstrual-informed recommendations in team-based contexts requires specific strategies. Coaches may integrate adaptable drills with variable intensity, station-based formats, or rotational structures, allowing athletes to self-regulate according to their current phase without disrupting group cohesion. Where appropriate and necessary, squad rotation policies can be adjusted to ensure that athletes experiencing pronounced symptoms are not overexposed to high-intensity demands, while still making meaningful contributions to the session.
- **Education and awareness:** Invest in education for both women and coaches staff regarding menstrual physiology and its implications for training. Providing scientifically grounded education ensures that all parties understand the rationale behind cycle-based adjustments, which helps foster buy-in and dispel misconceptions. It is particularly important for coaches (especially male coaches who may have less firsthand experience of menstrual issues) to educate themselves about female endocrine physiology and the wide variability in individual responses. Bringing in health

professionals or sport scientists to deliver workshops, educational materials, or open discussions can further normalise conversations about menstrual health in the training context.

- **Continuous process:** Establish a continuous feedback loop to refine training strategies over time. After integrating menstrual-cycle–aware practices, coaches and women should regularly evaluate their effectiveness—track performance metrics and wellness indicators across multiple cycles to identify patterns or improvements. If certain interventions are not yielding the expected benefits, they should be revisited and tailored accordingly. Over successive menstrual cycles, this iterative process of feedback and refinement will help optimise the training regimen for the individual.

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Annexe 1: Contributors to evidence-based recomendations development

Recomendations Development Group

The Recomendations Development Group was composed by experts in the areas of mental health, physical activity and exercise, psychology and public health from the WFC consortium. The members of the Recomendations Development Group included:

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