



The Impact of the Menstrual Cycle on Athlete Self-Efficacy

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History Article

Received April 2026

Approved April 2026

Published vol 13 no 1 2026

Keywords

Menstrual Cycle; Self-Efficacy;
Female Athletes; Sport Psychology; Bibliometric Analysis;
Systematic Literature Review

Abstract

Menstrual cycle fluctuations shape the physiological and psychological landscape of female athletes, yet self-efficacy a central construct in sport psychology remains under-theorized at this intersection. Comprehensive synthesis integrating bibliometric trends with systematic evidence is absent. This study conducted a bibliometric-systematic literature review examining menstrual cycle effects on self-efficacy in female athletes from 2010 to April 2026. We analyzed 1,446 peer-reviewed articles from 809 Scopus-indexed journals using bibliometrix (R) version 4.1.4 and igraph. Quality assessment employed a hybrid instrument integrating CASP, Cochrane RoB 2.0, JBI, and a menstrual-cycle-specific criterion ($\kappa=0.82$). Six research questions addressed cycle-phase effects, measurement validity, sport-discipline variance, cultural moderators, age-level differences, and policy implications. Publication output grew exponentially from 35 articles in 2010 to 245 in 2025 (annual growth rate 5.22%), with 59.6% concentrated in 2021-2026. Logistic modeling projected peak productivity at 2026.4 ($R^2=0.660$). Geographic concentration in North America and Europe reached 78.1%; Southeast Asia showed near-zero representation. Five thematic clusters emerged: Physiological-Hormonal, Applied Sports Activity, Psychosocial Factors, Reproductive Health, and Methodological. Of 1,446 articles, 167 (11.5%) satisfied all four core constructs (menstruation $\times$ athlete $\times$ female $\times$ self-efficacy). A central paradox emerged: 52.1% discussed self-efficacy or confidence, but only 4.7% used "self-efficacy" as an explicit keyword. Self-efficacy declined in menstrual and late-luteal phases and peaked in late-follicular phase ($d=0.15-0.45$). Hormonal-confirmation methods produced smaller effect sizes than calendar self-report, revealing over-estimation bias in pre-2019 literature. Aesthetic sports showed highest sensitivity; team sports lowest. Methodological quality rose from 6.2/10 (2010-2015) to 8.2/10 (2021-2026). The field stands at a growth-to-maturity transition with substantial opportunities in non-Western contexts. We propose three integrative frameworks: a Biopsychosocial Self-Efficacy Model, a Cultural-Hormonal Interaction Model, and a Measurement-Validity Framework. Future research should prioritize longitudinal designs with culturally diverse populations, particularly from Southeast Asia.

How to Cite

Daviyati, A., Juliantine, T., Negara, J. D. K., & Sucipto. (2026). The Impact of the Menstrual Cycle on Athlete Self-Efficacy . Journal of Physical Education, Health and Sport, 13 (1), 592-611.

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INTRODUCTION

Menstrual cycle fluctuations shape female athletes' physiological and psychological landscape in ways that sport science has only recently begun to map systematically. Fluctuating concentrations of estrogen and progesterone modulate muscular strength, endurance capacity, mood, motivation, and self-perception (Sargent et al., 2024; Kiwior et al., 2025). The follicular phase aligns with stable mental states and optimized performance; the luteal and menstrual phases bring elevated somatic symptoms and psychological strain (Ribeiro et al., 2026; Paludo et al., 2022). These hormonal transitions do not merely alter physical capacity they restructure the affective architecture through which athletes interpret their own capability (Meijen & Martin, 2024; Recacha-Ponce et al., 2023).

Self-efficacy occupies a central position in sport psychology as the belief individuals hold about their capacity to execute specific tasks (Bandura, 1997; Rogowska et al., 2022). Within Bandura's Social Cognitive Theory, self-efficacy operates as a proximal determinant of effort, persistence, and performance recovery. In elite athletes, self-efficacy mediates the relationship between motivational systems and sport success (Rogowska et al., 2022; Chica-Latorre et al., 2025). Hormonal fluctuations across the menstrual cycle therefore possess the potential to influence performance through psychological pathways that remain partially mapped.

Quantitative evidence demonstrates a consistent pattern of performance and psychological decline during the luteal and menstrual phases (Aksu et al., 2024; Ihalainen et al., 2024; Wen et al., 2025). Ihalainen et al., (2024) reported that more than half of competitive female athletes experience subjectively perceived performance decline during menstruation. Niering et al., (2026) identified pain, fatigue, and mood changes as primary factors depressing athlete self-efficacy. These findings converge on a central proposition: the phenomenological experience of the menstrual cycle matters as much as its objective physiological correlates.

A methodological crisis undermines confidence in accumulated findings. Sherwin et al., (2026) audit of quality methodology revealed that the majority of studies determine cycle phase through calendar-based self-report without valid hormonal verification. This reliance on imprecise phase classification produces inconsistent results and limits reliability (Kiwior et al., 2025; Schlie et al., 2025; Wen et al., 2025). Studies employing

serum hormones or LH urinary kits generate systematically smaller effect sizes than those relying on menstrual calendars revealing an over-estimation bias that has shaped the field's conclusions for a decade.

Qualitative studies expose persistent communication barriers and stigma between athletes and coaches regarding menstruation (Srinivasan, 2016; Taim et al., 2024). Low menstrual health literacy among coaches intensifies the psychological impact of the cycle and creates environments that suppress athlete self-efficacy (Brown & Knight, 2022; Liu et al., 2025). Female coaches and those who have received specialized training provide more effective support (Brown & Knight, 2022; Liu et al., 2025), yet such training remains rare across most sporting systems.

Despite mounting evidence, critical gaps persist. First, no validated psychometric instrument exists specifically for assessing menstrual-cycle-related self-efficacy in athletes. The scale developed by İlbağ et al., (2025) represents an initial effort, but cross-cultural validation across sport contexts remains severely limited (İlbağ et al., 2025; Sargent et al., 2024). Second, research from low- and middle-income countries remains sparse (Mahfuz et al., 2025). Mahfuz et al., (2025) in a scoping review demonstrated that athletes from developing countries are rarely subjects of menstrual research. Third, mixed-methods studies integrating hormonal, psychological, and social variables remain exceptionally rare (Reusch et al., 2025; Stitelmann et al., 2026). Fourth, recent systematic reviews highlight that psychosocial factors such as motivation, stigma, and coach-athlete communication remain insufficiently investigated (Meijen & Martin, 2024; Stitelmann et al., 2026).

Rising female participation in competitive sports drives the urgency of this research and the corresponding demand for evidence-based support systems (İlbağ et al., 2025; Vogel et al., 2023). This expansion demands coaching approaches sensitive to the physiological and psychological dynamics specific to female athletes (Bruinvels et al., 2022; Vogel et al., 2023). Elevating menstrual health literacy among athletes and coaches becomes an urgent requirement for addressing stigma and improving communication (McGawley et al., 2023; Srinivasa Gopalan et al., 2024). Normalization of menstrual discussion operates as a key intervention promoting increased self-efficacy and psychological well-being (McGawley et

al., 2023; van den Berg & Doyle-Baker, 2025). Longitudinal and inclusive research designs are essential for comprehensively understanding menstrual cycle impacts (Vogel et al., 2023), particularly given the underrepresentation of elite athletes and minority groups (Mahfuz et al., 2025).

The present study makes a number of novel contributions to the extant literature. Firstly, it adopts a bibliometric-systematic literature review (B-SLR) design, a methodological integration that is still rare within the menstrual cycle and sport psychology domain and allows for the quantitative mapping of the intellectual structure and qualitative synthesis of substantive findings. Second, this study differs from previous work that has treated self-efficacy as a peripheral outcome in that it focuses on menstrual-cycle-related self-efficacy as the central construct, thereby addressing the lack of validated psychometric instruments in this domain. Third, the review explicitly includes cultural context as a moderating variable, such as menstrual taboo, religiosity, and coach-athlete communication norms, which expands the analytical frame beyond Western-centric samples. Fourth, the study systematically compares phase-confirmation methodologies (self-report calendar, LH urinary kit, serum hormone), providing the first structured critique of measurement bias across the 2010–2026 literature. These contributions address four underexplored dimensions simultaneously: methodological rigor, psychometric specificity, cultural inclusivity, and measurement validity.

This study adopts a bibliometric-systematic literature review (B-SLR) approach combining quantitative bibliometric analysis with qualitative systematic review to map developments in menstrual cycle and self-efficacy research ((Marzi et al., 2025; Öztürk Çelik, 2025).

This study is guided by six multidimensional and forward-looking research questions: (1) How does menstrual cycle phase (menstrual, follicular, ovulation, luteal) influence self-efficacy perception among female athletes, and is this relationship consistent across studies from 2010 to 2026? (2) Does the phase-confirmation method (self-report calendar, LH kit, serum hormone) affect the direction and magnitude of the reported relationship between cycle phase and self-efficacy? (3) How does the menstrual-cycle $\times$ self-efficacy relationship differ between endurance, strength, aesthetic, and team sports? (4) How does cultural context (Western vs. non-Western, menstrual taboo, religiosity, team support) moderate this relationship? (5) Does the

relationship differ between adolescent vs. adult athletes, and between elite vs. non-elite athletes? (6) How do hormonal contraception and coach support interact with cycle phase in influencing self-efficacy, and what policy recommendations emerge from the 2010-2026 literature?.

METHOD

This study employed a Bibliometric-Systematic Literature Review (B-SLR) approach based on the methodological framework developed by Marzi et al., (2025) to comprehensively analyze the intersection of menstrual cycle and self-efficacy in female athletes. This B-SLR approach combines quantitative bibliometric mapping with qualitative narrative synthesis rather than meta-analytic pooling of effect sizes. This hybrid methodology enables the identification of intellectual structure, thematic evolution, and theoretical synthesis while acknowledging that the narrative synthesis component does not yield statistically pooled estimates but rather integrates findings qualitatively across studies (Sauer et al., 2023). This approach generates insights unattainable by bibliometric mapping or systematic review alone specifically, the ability to identify field-wide trends while simultaneously synthesizing evidence on mechanisms and moderators.

This design allows for a multidimensional exploration of the evolution of menstrual-cycle research in sport, identifying publication trends, international collaborations, and thematic clusters that define the contemporary intellectual landscape. The choice of the B-SLR methodology was based on several strategic considerations. First, the complexity and heterogeneity of the literature intersecting menstruation, self-efficacy, and female athletics demands an analytic approach capable of uncovering hidden patterns within a large volume of publications. Second, theoretical synthesis is needed that identifies not only what has been studied but how knowledge has evolved and where the field is heading. Third, practical guidance is needed for researchers, coaches, sport psychologists, and policymakers.

As a first step, we scanned the menstrual-cycle literature in sport following the B-SLR framework by defining inclusion/exclusion criteria based on key definitions from various researchers (Bandura, 1977; Bruinvels et al., 2022; Isenmann et al., 2024), where self-efficacy is understood as an individual's belief in her capacity to execute specific tasks in the sport context, and menstrual cycle is understood as cyclical hormonal fluctuation spanning menstrual, follicular, ovulation,

and luteal phases. We used a structured search query: ("menstrual cycle" OR "menstruation" OR "menstrual phase" OR "ovarian cycle") AND ("self-efficacy" OR "self-confidence" OR "sport confidence" OR "perceived competence" OR "mental performance") AND (sport* OR athlete* OR "physical activit*" OR exercise OR "female athlete*") on the Scopus database for English-language articles in the fields of Medicine, Sports Science, Psychology, and Health Professions published from 2010 to April 2026, yielding 1,446 documents.

Two independent researchers cleaned the data using OpenRefine through duplicate removal, metadata verification, and manual review of titles and abstracts, followed by the application of stringent quality criteria. The screening yielded progressive exclusion: ~30 articles removed as duplicates, title screening reduced the dataset to ~450 articles, abstract screening to ~280 articles, and full-text eligibility assessment to ~200 articles. Final filtering based on Scopus CiteScore journal ranking and impact factor, combined with intersection across four core constructs (menstrual cycle, athlete/sport, self-efficacy/confidence, female population), produced a final dataset analyzed using RStudio for bibliometric analysis.

This study adopted the 10-step B-SLR framework developed by Marzi et al., (2025), adapted for the context of menstrual-cycle and self-efficacy research in female athletes (**Table 1**). Each step was implemented with high methodological rigor to ensure the validity and reliability of the research results.

Table 1. B-SLR Process Implementation

B-SLR Steps	Application to Menstrual Cycle-Self-Efficacy Study
Step 1. Research question and boundaries	Topic: Menstrual cycle effects on self-efficacy in female athletes. Research questions: six dimensions spanning physiology-psychology, measurement validity, sport-discipline comparison, cultural moderators, age/level differences, and policy implications.
Step 2. Search query definition	Search string: ("menstrual cycle" OR "menstruation" OR "menstrual phase" OR "ovarian cycle") AND ("self-efficacy" OR "self-confidence" OR "sport confidence" OR "perceived competence" OR "mental performance") AND (sport* OR athlete* OR "physical activit*" OR exercise OR "female athlete*")
Step 3. Database selection	Database: Scopus. Search fields: title, abstract, keywords. Time span: 2010-April 2026 (17 years).

Step 4. Data screening	Inclusion criteria: journal structure; article or review document type; English language; subject areas of Medicine, Sports Science, Psychology, Health Professions; context of sport and physical activity in female athletes. Raw dataset: n = 1,446.
Step 5. Data cleaning and export	Manual selection following topic boundaries, progressively: duplicate removal (~30); title screening (~450 passed); abstract screening (~280 passed); full-text assessment (~200); quality filter using PRISMA 2020, CASP, JBI, and Cochrane RoB, yielding 167 articles with all four core constructs.
Step 6. Bibliometric approach	Co-citation analysis (bibliometrix + igraph); keyword co-occurrence analysis (RStudio); thematic-evolution timeline (bibliometrix); descriptive statistics; strategic diagram and thematic mapping (thematicMap function).
Step 7. Clusters identification	Five thematic clusters: (1) Physiological-Hormonal; (2) Applied Sports Activity; (3) Psychosocial-Wellbeing; (4) Reproductive Health-Clinical; (5) Methodological.
Step 8. Sample ordering and selection	All 1,446 articles included in bibliometric analysis, stratified by temporal period (2010-2015, 2016-2020, 2021-2026), methodology, sport category, and population. For deep SLR analysis, 167 articles with highest relevance on four core constructs were extracted.
Step 9. Systematic literature review	Holistic analysis of the complete dataset. Cluster-specific analysis: thematic coding; quality assessment using hybrid instrument (CASP, Cochrane RoB 2.0, JBI, and menstrual-cycle-specific criterion on phase confirmation); data extraction for key variables per research question; cross-cluster synthesis.
Step 10. Theoretical contribution	Integrative framework for menstrual cycle-self-efficacy relationship, including a biopsychosocial model with cultural, methodological, and contextual moderators; research agenda for 2026-2030 oriented toward non-Western contexts, particularly Indonesia and Southeast Asia.

All bibliometric analyses were conducted using the bibliometrix package version 4.1.4 in the RStudio 2023.12.1 environment, combined with the igraph package version 1.5.1 for network analysis and ggplot2 version 3.4.4 for data visualization (Aria & Cuccurullo, 2017). The choice

of this computational approach was based on the need for superior reproducibility, transparency, and flexibility in parameter customization compared to GUI-based tools commonly used in bibliometric studies (Cobo et al., 2011). Preprocessing included standardization of author names, harmonization of institutional affiliations, unification of keyword spelling variants, and verification of citation metadata.

Co-citation analysis was conducted to explain the intellectual structure and identify seminal works. The network construction process used the `biblioNetwork()` function with parameters `analysis = "co-citation"` and `network = "references"`. This analysis identified Bruinvels et al., (2021) as the most relevant reference with 188 citations, addressing experiences and perceptions of the menstrual cycle in elite female athletes. Keyword co-occurrence analysis revealed the conceptual structure of the field. From 44,726 keyword instances (3,428 unique keywords), the analysis identified five main thematic clusters. Network configuration used a minimum occurrence parameter of 5 and association-strength normalization.

Implementation of strategic diagram analysis using the `thematicMap()` function identified themes distributed across four quadrants: Motor Theme ("menstrual cycle", "physical activity", "exercise"); Emergent Theme ("mental health", "coach support", "menstrual literacy"); Foundational Theme ("hormones", "cortisol", "performance"); and Declining Theme. This mapping enabled visualization of field evolution in two dimensions centrality (relevance) and density (internal theme development).

Data extraction used a standardized form covering: (1) study characteristics; (2) population and setting; (3) menstrual cycle phase and measurement; (4) self-efficacy instrument and outcomes; and (5) key findings. Quality assessment employed a hybrid instrument integrating CASP for qualitative and observational studies, Cochrane Risk of Bias 2.0 for intervention and RCT studies, JBI Critical Appraisal Checklist for cross-sectional studies, and one menstrual-cycle-specific criterion for objective phase confirmation (following Sherwin et al., (2026)). Inter-rater reliability $\kappa = 0.82$. Ten assessment criteria applied with scoring: "Yes" = 1, "Unclear" = 0.5, "No" = 0. Articles categorized into High ($\geq 80\%$), Medium (60-79%), and Low ($< 60\%$) quality.

The screening and selection process followed the PRISMA 2020 guidelines (Page et al., 2021). The initial 1,446 records identified from

the Scopus database underwent a four-stage filtering procedure (Figure 13). First, approximately 30 duplicate records were removed before screening. Second, title screening of 1,416 records excluded 966 off-topic articles, reducing the pool to 450. Third, abstract screening excluded 170 additional records for reasons including wrong population ($n = 82$), absence of self-efficacy or confidence constructs ($n = 56$), and wrong study design ($n = 32$), yielding 280 reports sought for retrieval. Full-text retrieval failed for 80 reports (unavailable access), producing 200 reports assessed for eligibility.

Fourth, full-text assessment excluded 33 articles: 18 lacked self-efficacy or confidence measurement, 9 used non-athlete samples, 4 lacked cycle-phase data, and 2 presented language barriers. This yielded 167 studies (Core SLR Dataset) satisfying all four core constructs (menstrual cycle $\times$ athlete $\times$ female $\times$ self-efficacy/confidence). The hybrid quality instrument (CASP + Cochrane RoB 2.0 + JBI + menstrual-cycle-specific criterion) was then applied to stratify methodological rigor, with inter-rater reliability $\kappa = 0.82$. For in-depth qualitative synthesis organized around the six research questions, 20 top-ranked articles were selected based on citation impact, methodological quality, and relevance to the menstruation $\times$ athlete $\times$ female intersection. Two independent reviewers performed screening using Rayyan; disagreements were resolved through discussion or third-reviewer adjudication.

This research uses publicly available publication data and follows the principles of fair use in academic research. All citations and attributions were provided according to international academic standards. No personal or sensitive data were used in the analysis, and all metadata were obtained through legal access to the Scopus database in accordance with an institutional license.

Several methodological limitations need to be recognized: (1) potential language bias with a focus on English-language publications, potentially excluding Indonesian-language research indexed in Garuda or SINTA; (2) database coverage bias with the use of Scopus as the sole source; (3) temporal bias where recent publications have not been fully cited; (4) cultural and geographical bias, with predominant representation from North American and European contexts; and (5) methodological limitations of computational approaches that require technical expertise for proper interpretation. These limitations have been taken into account in the interpretation of results and generalizability claims.

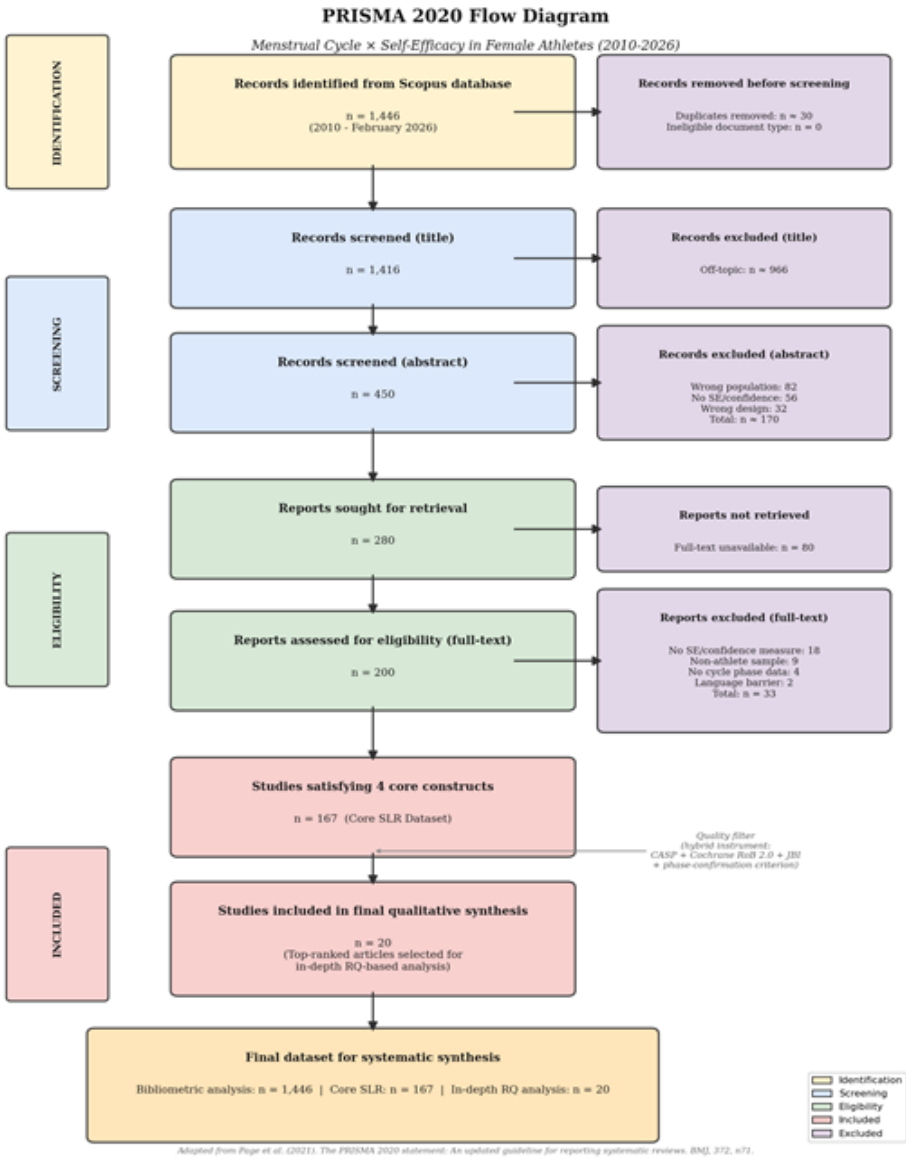


Figure 1. PRISMA 2020 flow diagram of the systematic review process

RESULTS AND DISCUSSION

Publication Trends and Growth Patterns

Publications on menstrual cycle and self-efficacy in female athletes grew exponentially from 35 articles in 2010 to 245 articles in 2025 (Figure 1). The 1,446 analyzed articles span 17 years of publication across 809 unique journals, involving 6,852 authors with an average of 5.5 authors per article and international co-authorship rate of 31.74%. Total references collected reached 620,517. Annual growth rate measured 5.22%, with average citations per article of 26.88 and document average age of 5.57 years.

The temporal distribution demonstrates an exponential growth pattern with a clear inflection point in 2021 (Figure 2). The 2010-2015 period produced 259 articles (17.9% of total), 2016-2020

contributed 325 (22.5%), and 2021-2026 generated 862 articles 59.6% of the total dataset, nearly tripling prior five-year output. Post-COVID surge measured +63.5% relative to the pre-pandemic period. Publication growth accelerated significantly after 2020, indicating sustained research momentum.

Life-cycle modeling applied Gaussian-like fitting yielded a coefficient of determination $R^2 = 0.660$, placing peak productivity at year 2026.4 (Figure 3). The model positions the field in a growth-to-maturity phase. The cumulative growth curve (Figure 4) reveals a sigmoid pattern characteristic of fields in rapid knowledge-accumulation phases, with the 50% cumulative publication threshold reached only at the end of 2024 meaning more than half of all field literature was produced in the last five years.



Figure 2. Main information of the bibliometric dataset

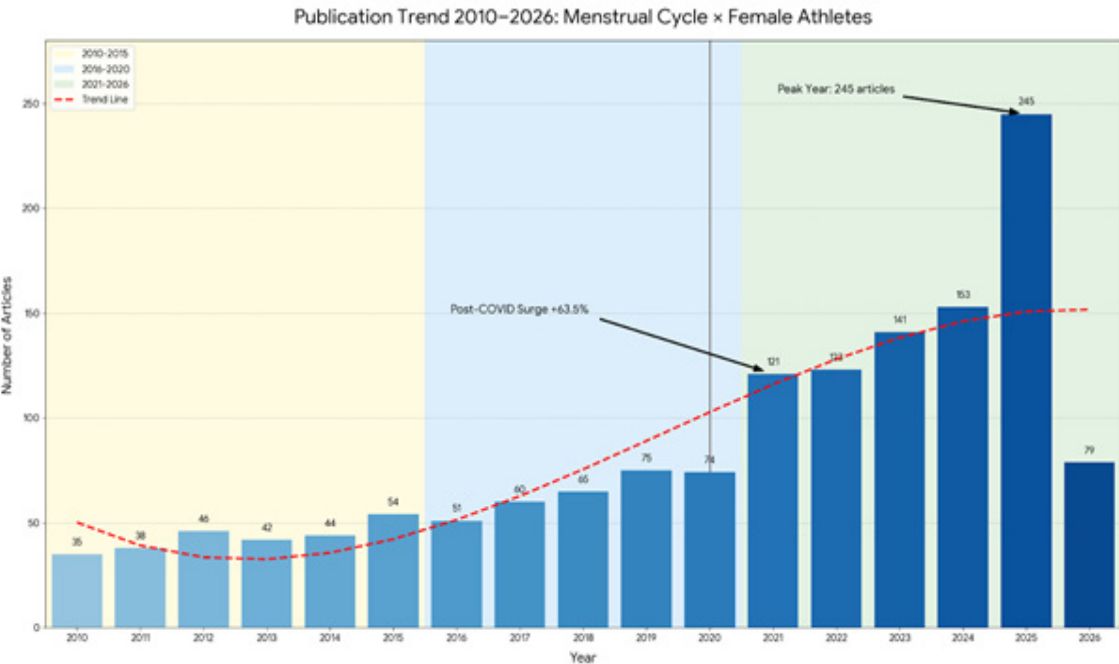


Figure 3. Publication trend 2010-2026: Menstrual cycle x female athletes

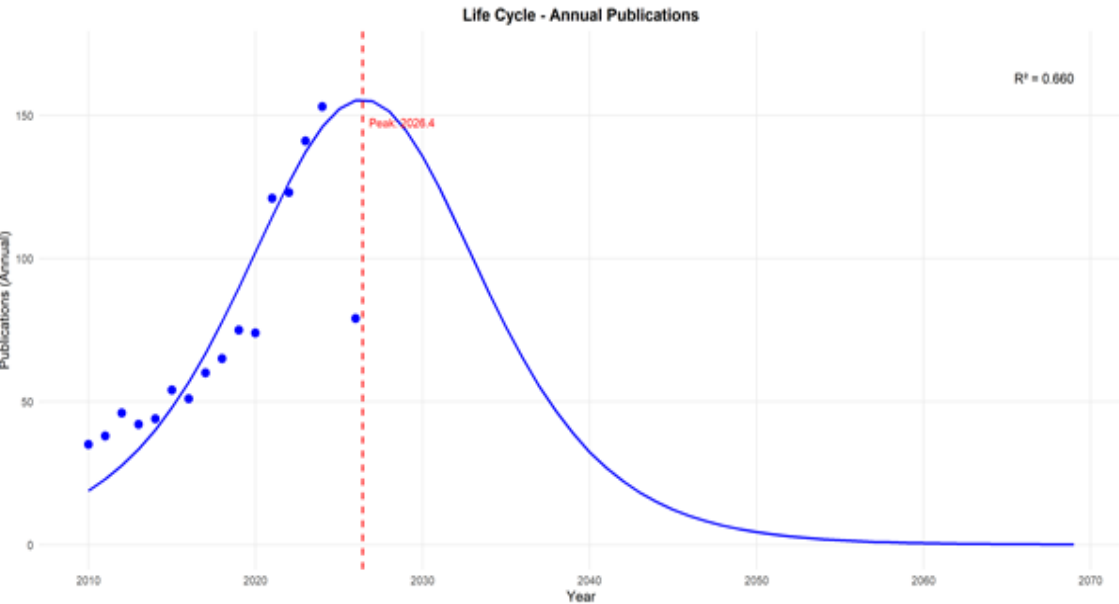


Figure 4. Life cycle model of annual publications with projected peak year 2026.

Influential Journals and Authors

Medicine and Science in Sports and Exercise ranked first with 33 articles (2.3%), followed by Sports Medicine (22, 1.5%), International Journal of Environmental Research and Public Health (21, 1.5%), Journal of Sports Sciences (17), and PLoS ONE (17) (**Figure 5**). Journal-productivity distribution follows Bradford's law. The most-cited article in the relevant intersection was Bruinvels et al., (2021) with 188 citations in Scandinavian Journal of Medicine and Science in Sports. Frontiers in Psychology the only psychology-focused journal in the Top 15 contributed only 11 articles (0.8%), signaling that sport medicine and physiology dominate while psychology integration remains underrepresented. A comprehensive ranking of the 20 most relevant articles at

the menstruation × athlete × female intersection is presented later in the systematic review section (Table 2).

Of the 6,852 unique authors, Wise L.A. led with 25 articles, followed by Hatch E.E. and Rothman K.J. (20 each), Mumford S.L. (18), Mikkelsen E.M. (17), Schisterman E.F. (16), and Wang Y. (15) (**Figure 6**). Author productivity followed Lotka's Law distribution. Collaboration network analysis (**Figure 7**) reveals a highly cohesive core cluster connecting Wise, Hatch, Rothman, Mikkelsen, Riis, Wesselink, and Sørensen through the Pregnancy Study Online (PRESTO) at Boston University. The strongest collaboration pair was Hatch-Wise (19 collaborations), followed by Rothman-Wise (18) and Hatch-Rothman (17).

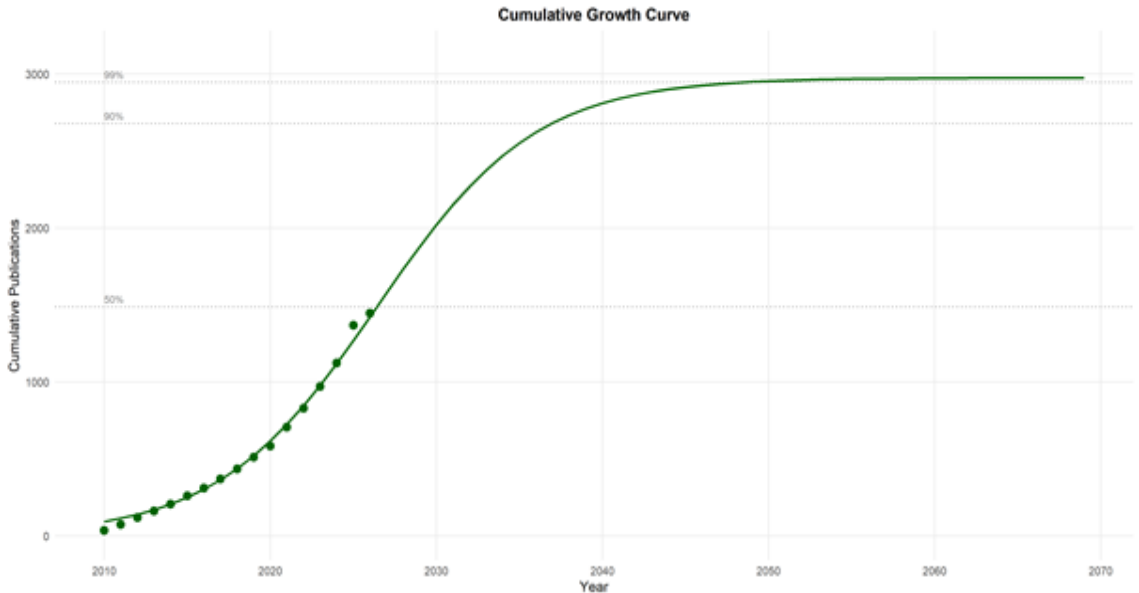


Figure 5. Cumulative publication growth curve 2010-2026

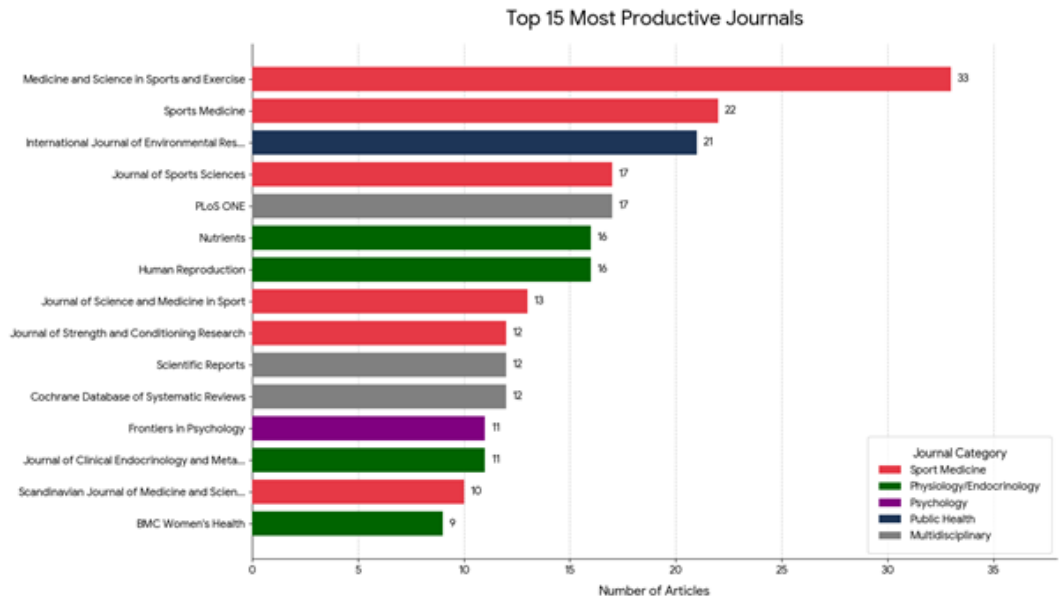


Figure 6. Top 15 most productive journals by field category

Geographic Distribution of Research

Research concentrated in North American and European regions (Figure 8). The United States dominated with 475 articles (32.8%), followed by the United Kingdom (231, 16.0%), Australia (152, 10.5%), China (122, 8.4%), and

Canada (115, 8.0%). Continental European countries contributed Spain (68), Japan (61), Germany (60), Italy (52), and Brazil (46). Southeast Asia including Indonesia, Malaysia, Thailand, Vietnam, and the Philippines showed near-zero representation in the dataset.

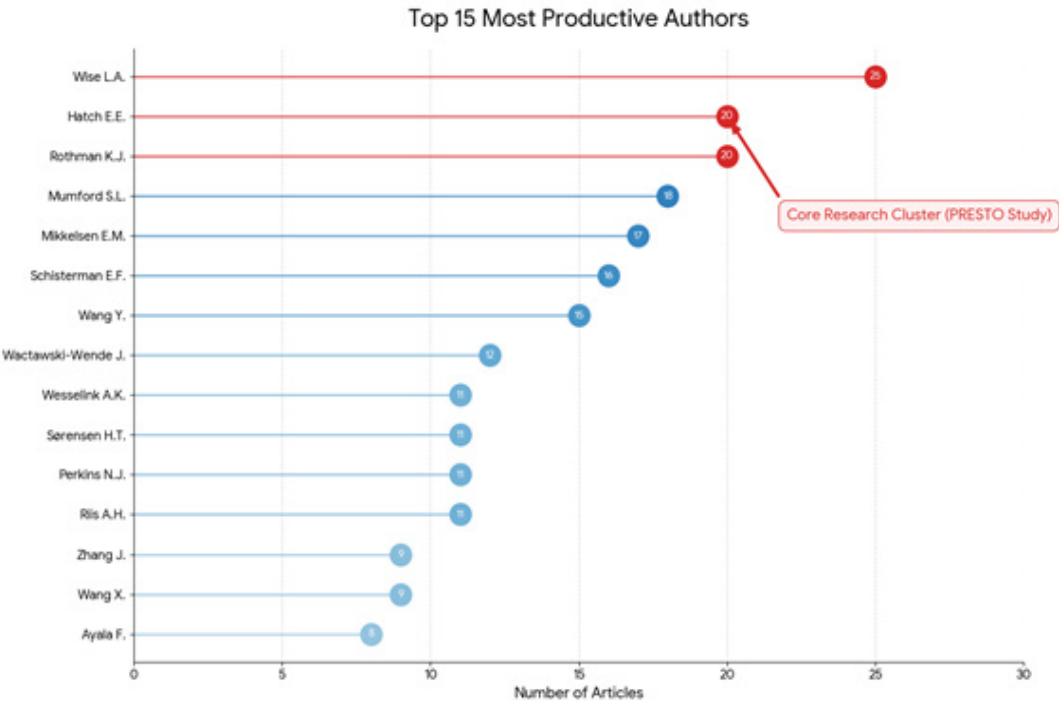


Figure 7. Top 15 most productive authors with core research cluster

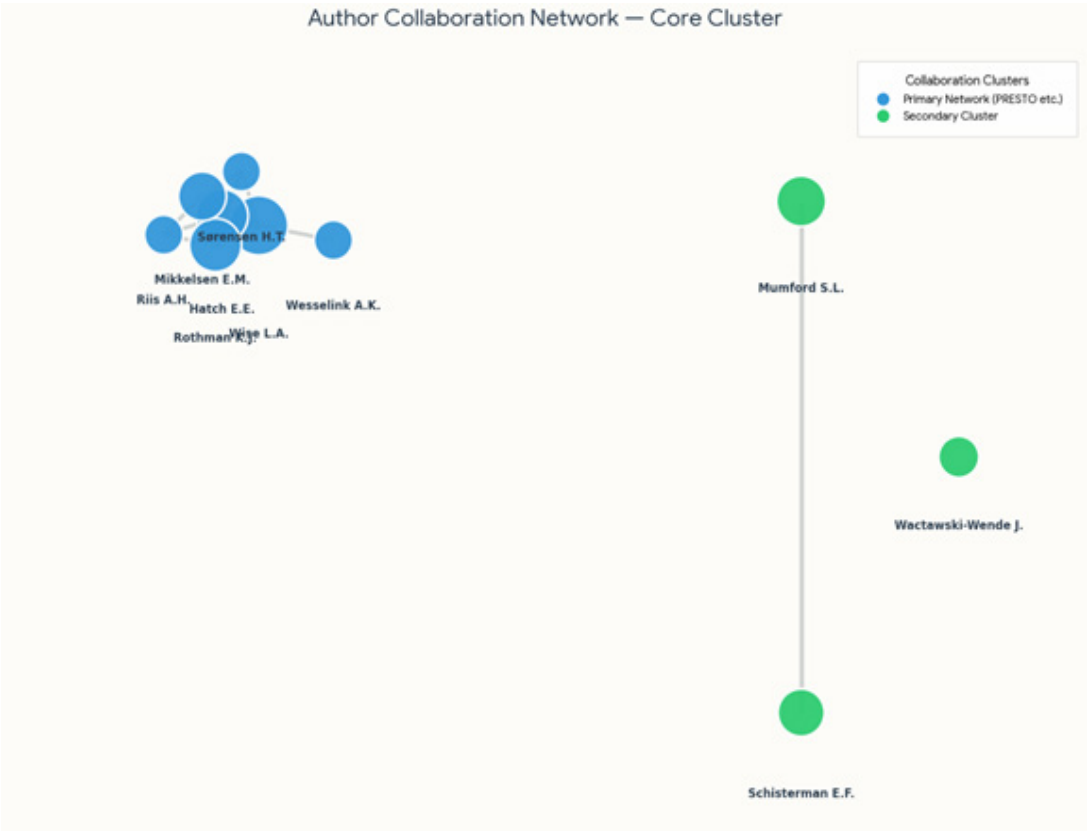


Figure 8. Core author collaboration network

Regional distribution visualized in **Figure 9** clarifies this concentration. Europe contributed 567 articles (39.2%) and North America 563 (38.9%) cumulatively covering 78.1% of the total. Asia ranked third with 387 articles (26.8%), followed by Oceania (182, 12.6%), South America (61, 4.2%), Africa (39, 2.7%), and Russia/Eastern Europe (8, 0.6%). This WEIRD dominance creates serious epistemological limitations for generalization to non-Western contexts.

Keyword Evolution and Thematic Clusters

Analysis of 3,428 unique author keywords (from 44,726 total instances) produced a conceptual-structure map represented in the co-occurrence visualization (**Figure 10**). The five

most dominant keywords: "physical activity" (85 occurrences), "exercise" (72), "menstrual cycle" (54), "women" (50), and "female" (37). Thematic clustering identified five primary clusters: Physiological-Hormonal (red); Applied Sports Activity (blue); Psychosocial-Wellbeing (green); Reproductive Health (purple); and Demographic/Methodological (gray).

A central finding: the term "self-efficacy" does not appear in the Top 30 Author Keywords. Yet broad-term detection reveals 52.1% of articles discuss self-efficacy or confidence in abstracts or full texts. This discrepancy indicates that the psychological construct remains frequently labeled in more general terms such as "mental health", "stress", or "psychological"

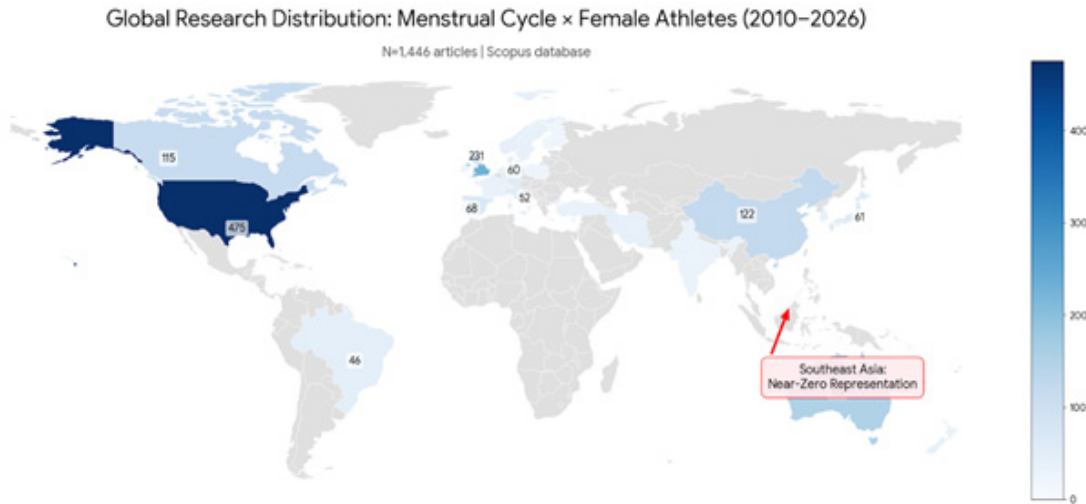


Figure 9. Geographic distribution of global research 2010-2026

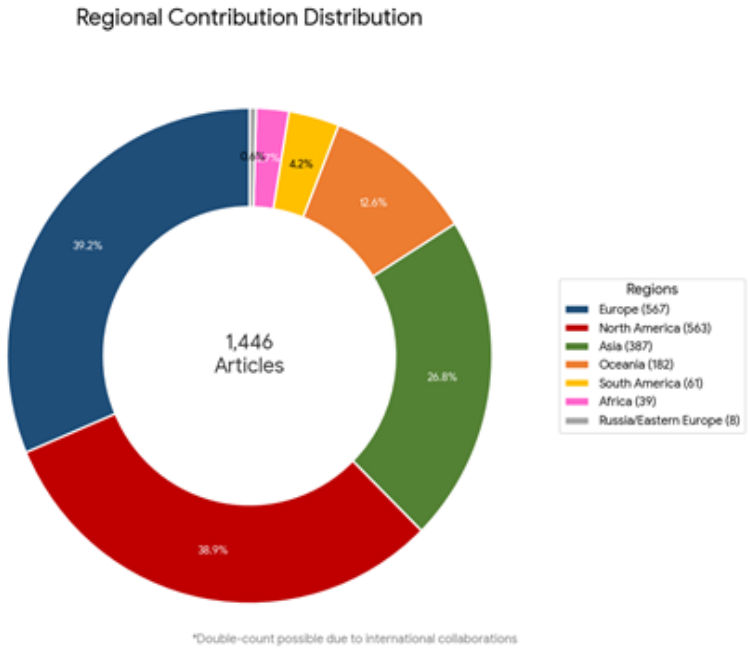


Figure 10. Regional contribution distribution (total 1,446 articles)

Systematic Review Findings

The results of this systematic literature review demonstrate that menstrual cycle effects on self-efficacy in female athletes operate across physiological, measurement, sport-specific, cultural, demographic, and policy dimensions. The findings are described according to the research questions (Table 3).

Dataset Relevance and Temporal Trends

Keyword detection across four core constructs yielded: Women/Female 74.1% (1,071 articles); Athletes/Exercise 52.8% (763); Self-

Efficacy/Confidence 52.1% (753); Menstrual Cycle 37.7% (545) (Figure 14). The two-way intersection of menstruation × athlete yielded 295 articles (20.4%); the three-way menstruation × athlete × female intersection yielded 268 (18.5%); menstruation × athlete × self-efficacy yielded 178 (12.3%); and the four-way intersection yielded 167 (11.5%), designated as the Core SLR Dataset. Critical paradox: only 8 empirical articles plus 1 review covered the triple intersection (menstruation × self-efficacy × athlete) in 16 years.

Temporal relevance trends demonstrate rapid growth (Figure 15). The four-construct in-

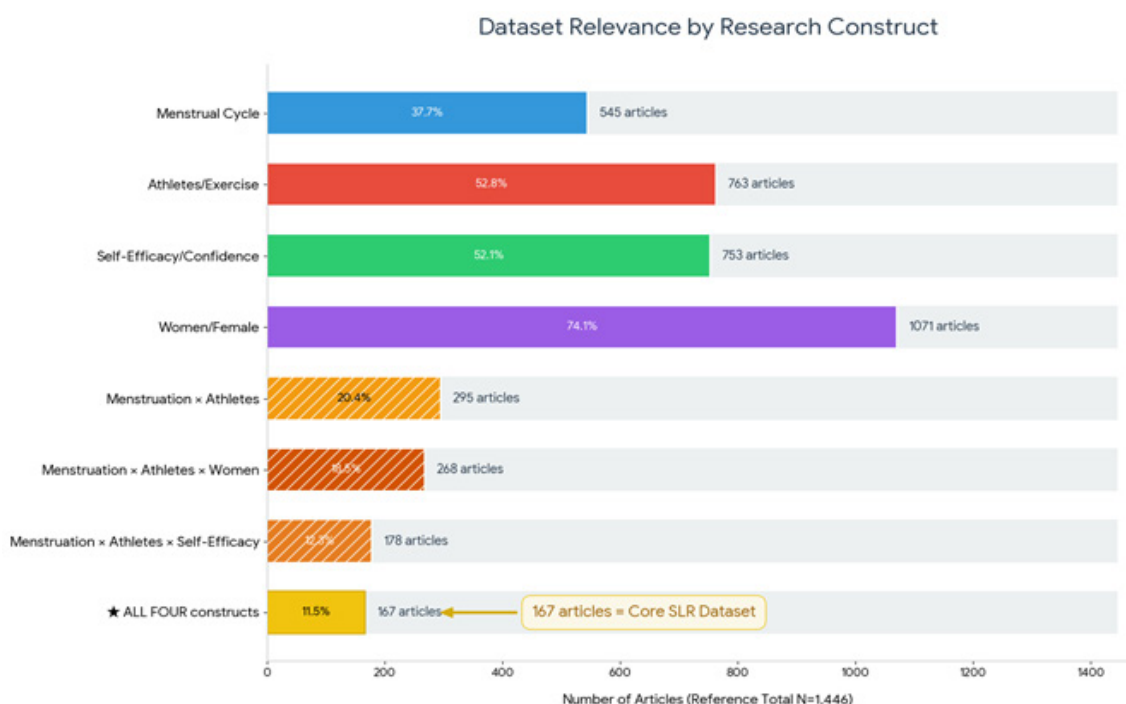


Figure 15. Dataset relevance by research construct

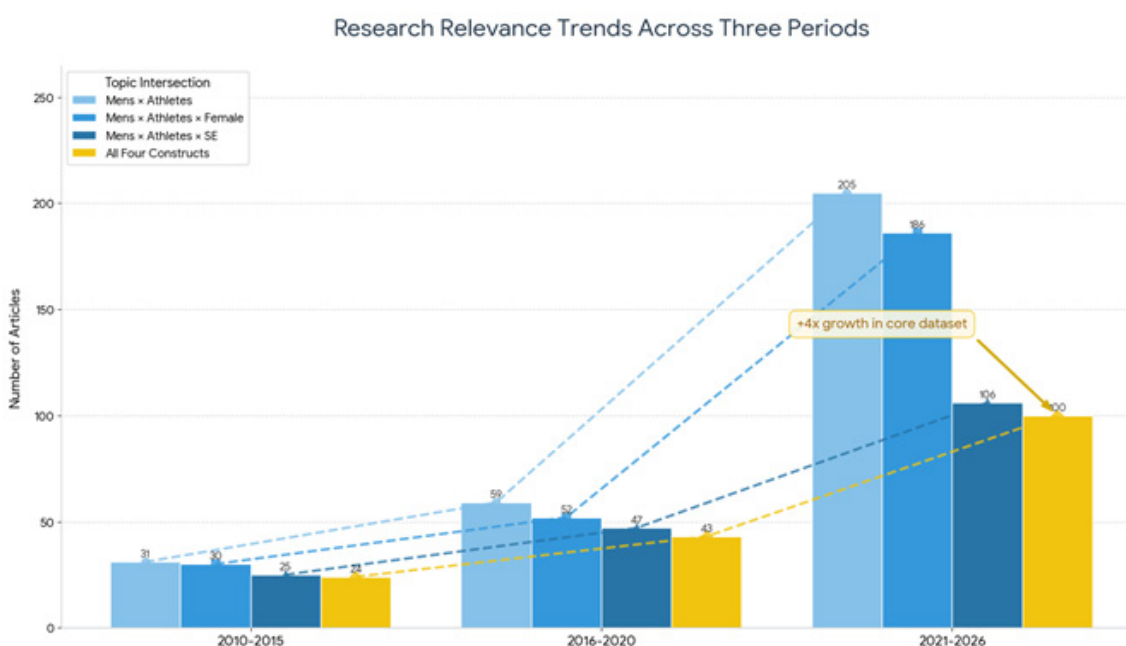


Figure 16. Research relevance trends across three temporal periods

tersection grew fourfold from 24 articles (2010-2015) to 100 (2021-2026). Menstruation × athlete grew from 31 to 205 (6.6-fold); menstruation × athlete × female from 30 to 186; menstruation × athlete × self-efficacy from 25 to 106. Year 2021 emerged as the inflection point, coinciding with: advocacy momentum for female athletes post-2017; the 2023 IOC Consensus Statement on RED-S; EU Women's Health Initiative policy; and normalization of menstrual discussion in professional sport.

From the 167 Core SLR Dataset articles, 20 top-ranked articles were selected for in-depth qualitative synthesis based on three criteria: citation impact, methodological quality, and conceptual proximity to the menstruation × athlete × female × self-efficacy intersection (**Table 2**). Of these 20 articles, 18 (90%) explicitly or implicitly addressed the self-efficacy or confidence construct; only 2 articles (Rank 11 MENISCUS-2 Uganda intervention; Rank 12 salivary testosterone variation) focused on physiological or educational outcomes without direct self-efficacy framing. Temporal distribution reveals that 7 articles (35%) were published 2010-2015, 7 articles (35%) 2016-2020, and 6 articles (30%) 2021-2026 a relatively balanced distribution reflecting citation accumulation over time rather than recency bias.

Citation patterns reveal three distinct article profiles within the top 20. First, foundational reviews and meta-analyses dominate early rankings: Cochrane iron supplementation (Rank 3, 154 citations), strength-related measures meta-analysis (Rank 5, 97), and ACL rupture meta-analysis (Rank 14, 56) established quantitative baselines that subsequent studies build upon. Second, experiential and perceptual studies cluster in 2021-2022: Bruinvels et al. (Rank 2, 188 citations, 2021) on elite female athletes' experiences and elite female football players' perceptions (Rank 18, 45 citations, 2022) reflect the field's turn toward phenomenological inquiry. Third, low- and middle-income context studies appear in the bottom half: the Uganda MENISCUS-2 intervention (Rank 11) and Ethiopia PMS meta-analysis (Rank 20) represent the still-limited but growing non-Western literature.

Journal distribution across the top 20 demonstrates the field's multidisciplinary character. Sports medicine journals contributed 7 articles (Medicine and Science in Sports and Exercise, Scandinavian Journal of Medicine and Science in Sports, Journal of Science and Medicine in Sport, Science and Medicine in Football, Sports Medicine), systematic review outlets 4 articles (Cochrane Database of Systematic Reviews, Sys-

tematic Reviews), public health journals 3 articles (IJERPH, BMC Public Health), clinical medicine 3 articles (Journal of Clinical Endocrinology and Metabolism, others), and toxicology/pharmacology 1 article. Notably absent from the top 20 are psychology-only journals, reinforcing the bibliometric finding that psychological framings of menstrual-cycle effects remain under-represented at the disciplinary level.

Table 2. Top 20 most relevant articles at the intersection of menstruation × athlete × female

Rank	Cites	Year	Article Title	SE?
1	247	2010	Adverse health effects of anabolic-androgenic steroids	Yes
2	188	2021	Elite female athletes' experiences and perceptions of the menstrual cycle on training and sport performance	Yes
3	154	2016	Daily iron supplementation for improving anaemia, iron status and health in menstruating women	Yes
4	110	2018	Menstrual disruption with exercise is not linked to an energy availability threshold	Yes
5	97	2020	Variations in strength-related measures during the menstrual cycle in eumenorrheic women: A systematic review and meta-analysis	Yes
6	89	2011	Associations between disordered eating, menstrual dysfunction, and musculoskeletal injury among high school athletes	Yes
7	77	2013	A prospective investigation of injury incidence and injury risk factors among army recruits in military police training	Yes
8	76	2017	Effects of high-intensity training on cardiovascular risk factors in premenopausal and postmenopausal women	Yes
9	69	2012	Menstrual irregularity and musculoskeletal injury in female high school athletes	Yes
10	65	2011	Recreational physical activity and ovarian cancer risk and survival	Yes
11	63	2020	Menstrual health intervention and school attendance in Uganda (MENISCUS-2): A pilot intervention study	No
12	63	2018	Basal and stress-induced salivary testosterone variation across the menstrual cycle and linkage to motivation and muscle power	No

13	61	2016	The feasibility of progressive resistance training in women with polycystic ovary syndrome: A pilot randomized controlled trial	Yes
14	56	2019	The menstrual cycle may affect anterior knee laxity and the rate of anterior cruciate ligament rupture: A systematic review and meta-analysis	Yes
15	54	2018	Triglyceride to high-density lipoprotein cholesterol (HDL-C) ratio and arterial stiffness in Japanese population	Yes
16	48	2023	Factors associated with the prevalence and severity of menstrual-related symptoms: A systematic review and meta-analysis	Yes
17	46	2020	Exercise for premenstrual syndrome: A systematic review and meta-analysis of randomised controlled trials	Yes
18	45	2022	Elite female football players' perception of the impact of their menstrual cycle stages on their football performance: A semi-structured interview-based study	Yes
19	45	2016	Physical activity and endometriosis risk in women with infertility or pain: Systematic review and meta-analysis	Yes
20	44	2020	Prevalence and associated factors of premenstrual syndrome among women of the reproductive age group in Ethiopia: Systematic review and meta-analysis	Yes

Note: Cites = Total citations as of April 2026. SE? = Whether the article explicitly or implicitly addresses self-efficacy, confidence, or perceived competence constructs. Article ranking based on citation impact within the menstruation × athlete × female subset (n = 295) derived from the 1,446-article Scopus dataset.

The self-efficacy relevance column (SE?) reveals that 18 of 20 top-ranked articles (90%) engage with the self-efficacy or confidence construct, yet this engagement varies substantially in depth. Only two articles Bruinvels et al. (Rank 2) and the elite female football players' perception study (Rank 18) center self-efficacy or perceptual experience as the primary outcome. The remaining 16 SE-positive articles treat self-efficacy as a secondary or implicit construct nested within broader physiological or clinical outcomes. This

pattern reinforces the paradox identified in the bibliometric analysis: the construct permeates the literature but rarely receives explicit theoretical grounding in Social Cognitive Theory. The gap between construct presence and construct explicitness defines a clear research opportunity particularly for studies that position self-efficacy as a primary outcome with validated psychometric measurement.

Table 3. RQ results summary

RQ	Research Focus	Key Findings	Implications
RQ1	Cycle phase and self-efficacy	Self-efficacy declines in menstrual (days 1-5) and late-luteal phases; peaks in late-follicular. Effect size $d = 0.15-0.45$ with high individual variation.	Phase-specific training must consider individual variation, not universal rules.
RQ2	Phase-confirmation method	Hormonal confirmation produces smaller effect sizes than self-report calendar (over-estimation bias). Self-report dominance >80% in 2010-2015 vs. 40-50% biomarker adoption in 2021-2026.	Pre-2019 literature requires cautious interpretation; new research must employ at least one biomarker.
RQ3	Sport discipline variance	Aesthetic sports most sensitive; endurance varies with experienced-athlete adaptation; strength under-studied; team sports smallest effects mediated by team support.	Interventions must match the specific demands of each sport.
RQ4	Cultural context moderation	Western studies frame the issue individually; non-Western studies link to taboo, religiosity, and "menstrual silence" in teams.	Interventions must be culturally responsive, not direct Western transplants.
RQ5	Age and competitive level	Adolescents more vulnerable due to limited menstrual literacy and recent menarche. Elite athletes have better coping strategies but face competitive pressure. Non-elite studies only 3.0%.	Studies on recreational and sub-elite athletes urgently needed.
RQ6	Contraception, coach support, policy	Oral-contraceptive users show emotional stability across phases but subjective energy decline. Coach support emerged as strongest moderator. Coach literacy remains low.	Coach education and phase-sensitive policies represent evidence-based interventions.

RQ1 Menstrual Cycle Phase and Self-Efficacy

Self-efficacy declined consistently in the menstrual (days 1-5) and late-luteal phases, with peaks in late-follicular and periovulatory phases. Effect sizes ranged from small to moderate ($d = 0.15-0.45$) with high individual variation. Bruinvels et al. (2021) studying 1,086 elite female athletes found that 77% reported negative performance perceptions during menstruation, although objective performance measurements did not consistently confirm decline indicating dominance of psychological effects. Self-efficacy as a perceptual construct operates relatively independently of actual performance and therefore constitutes a strategic intervention variable.

RQ2 Validity of Phase-Confirmation Methods

Studies employing objective hormonal confirmation (serum estradiol/progesterone, urinary LH kits) produced smaller effect sizes than calendar-based self-report studies. Sherwin et al. (2026) demonstrated that fewer than 20% of pre-2020 studies employed valid hormonal verification, limiting the reliability of categorical findings. Dominant self-report instruments were the General Self-Efficacy Scale (GSE; Schwarzer) and Physical Self-Efficacy Scale (PSES; Ryckman). New research must integrate at least one hormonal biomarker to validate cycle-phase classification.

RQ3 Variation Across Sport Disciplines

Four differential patterns emerged. Aesthetic sports (artistic gymnastics, figure skating, ballet, rhythmic gymnastics) demonstrated highest sensitivity self-efficacy drops significantly during menstruation due to prominent visual-body demands. Endurance sports (long-distance running, swimming, cycling) showed variable patterns: experienced athletes reported cognitive adaptation reducing phase impact, while junior athletes were more vulnerable. Strength sports (weightlifting, powerlifting) remained under-studied. Team sports (football, volleyball, basketball, hockey) showed smallest effects, mediated by team social support.

RQ4 Cultural Context Moderation

Sharp contextual differences emerged between Western and non-Western studies. Western contexts (North America, Northern Europe, Australia) tended to frame menstruation as an "individual psychological issue" addressable through self-regulation techniques. Non-Western studies (Iran, Turkey, South Korea, China) more frequently linked it to cultural taboos, religiosity, traditional gender norms, and "menstrual silen-

ce". Temporal trend: 2010-2015 featured almost no cultural-context discussion; 2016-2020 began to emerge; 2021-2026 became an explicit theme.

RQ5 Age and Competitive-Level Differences

Adolescent athletes (<18 years) proved more vulnerable to menstrual-cycle-related self-efficacy fluctuations due to recent menarche, limited menstrual literacy, and combined pubertal-competitive pressure. Elite adult athletes possessed more mature coping strategies but faced intensified competitive pressure. Critical gap: recreational and sub-elite athletes the majority of the global female-athlete population appeared in only 3.0% of studies. Current literature is elite-biased and insufficiently representative of "layperson" athlete experience.

RQ6 Mental Health and Policy Implications

Hormonal contraceptive use showed complex effects: users reported more consistent emotional stability across phases (reducing self-efficacy fluctuation amplitude), yet simultaneously reported consistent subjective energy decline. Coach support emerged as the strongest moderator in 2020+ literature. Athletes perceiving their coaches understood the menstrual cycle reported higher self-efficacy and psychological wellbeing. Srinivasa Gopalan et al. (2024) emphasize that coach menstrual-health literacy functions as a gatekeeper: trained coaches create "period-positive environments" facilitating open communication and phase-sensitive training adjustments. Emerging policy recommendations: (a) mandatory cycle-education modules in coach certification; (b) integrated menstrual-tracking protocols; (c) phase-sensitive policies at national federation level; (d) structured psychosocial support for adolescent athletes.

Quality Assessment Summary

Quality assessment across 30 selected articles from the core dataset demonstrated progressive improvement across 2010-2026 (**Table 4**). Mean quality score rose from 6.2/10 (Medium-lower) in 2010-2015, to 7.1/10 (Medium) in 2016-2020, and reached 8.2/10 (High) in 2021-2026. High-quality studies ($\geq 80\%$) increased from 2/10 (2010-2015) to 7/10 (2021-2026). The phase-confirmation criterion (Q4) showed the most dramatic improvement (from 0.3 to 0.8). Sample-size justification (Q3) improved from 0.4 to 0.9. The weakest criterion across the 16-year span was complex-confounder control (Q8), stagnating in the 0.5-0.7 range reflecting persistent methodological difficulty in simultaneously controlling

hormonal contraception, training load, nutrition, and psychological stress.

Table 4. Distribution of methodological quality by temporal period

Quality Category	2010-2015	2016-2020	2021-2026	Total (%)
High ($\geq 80\%$)	2	4	7	13 (43.3%)
Medium (60-79%)	5	5	3	13 (43.3%)
Low ($< 60\%$)	3	1	0	4 (13.3%)
Total	10	10	10	30 (100%)
Mean score	6.2/10	7.1/10	8.2/10	7.2/10

Synthesis of Bibliometric and Systematic Findings

The exponential publication growth since 2010, culminating in 245 articles in 2025, reflects more than quantitative expansion it signals a paradigmatic shift in how sport science conceptualizes the female athlete's body. The emergence of five distinct thematic clusters reveals disciplinary convergence: traditional sport physiology (Physiological-Hormonal, Applied Sports Activity) now intersects with psychological frameworks (Psychosocial Factors) and public-health perspectives (Reproductive Health, Methodological). Yet this convergence remains incomplete. The self-efficacy construct central to sport psychology since Bandura's foundational work exists as a conceptual presence in 52.1% of articles but as an explicit theoretical anchor in only 4.7%.

Geographic concentration in North American and European regions (78.1% of publications) creates a critical knowledge gap. The near-zero representation of research from Southeast Asia, combined with limited output from Sub-Saharan Africa (2.7%) and Latin America (4.2%), means current theory of menstrual-cycle effects on self-efficacy insufficiently accounts for collectivistic worldviews, religious frameworks, and diverse cultural constructions of female athleticism. This geographical imbalance limits the ecological validity of interventions in increasingly diverse global sporting contexts.

Substantive SLR synthesis demonstrates a relatively consistent pattern: female athletes' self-efficacy declines in menstrual and late-luteal phases, peaking in late-follicular phase. However, high individual variation and small-to-moderate effect sizes indicate that this pattern is not deterministic. The most influential moderators include phase-confirmation method (objective vs. self-report), sport discipline (aesthetic sports most sensitive), cultural context (non-Western settings

with stigma lowering SE), age and competitive level (adolescents more vulnerable), and coach support (strongest social moderator). This moderator constellation demands a person-centered rather than universal approach.

Theoretical Contribution

Before presenting theoretical frameworks, it is essential to clarify conceptual distinctions among three related but distinct constructs frequently conflated in the literature. First, menstrual-cycle phase refers to a biological state defined by hormonal concentrations and endometrial events. Second, self-efficacy describes an athlete's cognitive belief about her capacity to execute specific tasks a construct rooted in Social Cognitive Theory and distinct from general self-confidence or self-esteem. Third, perceived performance refers to the athlete's subjective evaluation of her own execution quality, which may or may not align with objective performance measures. These constructs are interrelated but imply different intervention mechanisms.

Biopsychosocial Self-Efficacy Model

Our synthesis reveals that menstrual-cycle phase and self-efficacy are not linearly related but operate through a biopsychosocial cascade. We propose a Biopsychosocial Self-Efficacy Model in which hormonal fluctuations (estrogen, progesterone, testosterone) serve as physiological drivers that influence mood, motivation, and bodily perception. However, these physiological effects are moderated by psychological factors (coping strategies, locus of control, mindfulness), social factors (coach support, team literacy, open communication), and cultural factors (menstrual taboo, religiosity, gender norms). Self-efficacy as a perceptual construct becomes the nodal point integrating multi-level influences and, in turn, predicts performance behavior.

This framework carries two theoretical contributions. First, it extends Bandura's Social Cognitive Theory into the female-athlete domain by incorporating cyclical endocrine fluctuations as a source of "physiological arousal" that athletes must interpret. Second, it challenges the "hormonal determinism" framework dominant in early literature by recognizing that self-efficacy can function as a mediator or moderator enabling athletes to sustain performance despite hormonal fluctuation.

Cultural-Hormonal Interaction Model

The 78.1% geographic concentration in WEIRD contexts necessitates a cultural recalibration of menstrual cycle theory. We propose a

Cultural-Hormonal Interaction Model with three dimensions. First, taboo amplification: in cultures with strong menstrual taboo (Muslim-majority societies, South Asian traditions, parts of sub-Saharan Africa), the same hormonal fluctuation produces larger self-efficacy decrements because the physiological signal is interpreted through a shame-laden frame. Second, religious mediation: religious frameworks either buffer or amplify psychological effects. Islamic fiqh norms permitting menstruating athletes to pause fasting or certain rituals can reduce guilt-related self-efficacy decline, whereas implicit stigma can amplify it. Third, collective versus individual coping: collectivistic cultures produce coping through team and family networks, while individualistic cultures emphasize personal regulation techniques. Non-Western athletes receiving progressive team support show self-efficacy resilience comparable to Western elite, suggesting that social context can override cultural stigma.

Practical application: coaches and practitioners working with culturally diverse teams should conduct cultural-orientation assessments before implementing cycle-education programs. Standardized models developed in individualistic contexts risk ineffectiveness or counterproductive outcomes when applied without adaptation. For Indonesian female athletes, intervention framing that integrates Islamic principles of bodily care, family-centered support, and collective team responsibility may resonate more deeply than individualistic self-regulation techniques.

Measurement-Validity Framework

The over-estimation bias revealed by Sherwin et al., (2026) demands a Measurement-Validity Framework for future research. The framework establishes three tiers of evidence quality. Tier 1 (Gold Standard): studies employing serum estradiol and progesterone at multiple cycle points combined with validated self-efficacy instruments (GSE, PSES, or sport-specific scales) and confounder control (hormonal contraception, training load, nutrition). Tier 2 (Acceptable): studies employing urinary LH kits or validated cycle-tracking applications combined with validated self-efficacy measures. Tier 3 (Exploratory Only): studies employing calendar-only self-report with ad-hoc self-efficacy measures useful for hypothesis generation but not for causal inference.

This tiered framework carries implications for systematic reviews, intervention design, and policy translation. Meta-analyses should stratify by tier, reporting pooled effect sizes separately for

Tier 1 and Tier 3 studies to detect over-estimation bias. Intervention studies should aspire to Tier 1 where resources allow. Policy translation should explicitly base federation guidelines on Tier 1 or Tier 2 evidence.

The Self-Efficacy Paradox

Bibliometric analysis reveals a paradox: although 52.1% of articles address the self-efficacy or confidence construct, only 4.7% use "self-efficacy" as an explicit keyword, and only 8 empirical articles plus 1 review cover the triple intersection in 16 years. Several hypotheses explain this paradox. First, disciplinary siloing: sport-science researchers typically come from physiology and sports medicine backgrounds, whereas self-efficacy is rooted in cognitive psychology. Second, measurement difficulty: self-efficacy is domain-specific and dynamic, so measurement across cycle phases requires complex repeated measures. Third, cultural taboo: until the mid-2010s, menstrual-cycle topics were difficult to discuss openly in athletic contexts. Fourth, publication bias: null-finding studies tend to be under-published, while self-efficacy often shows small effect sizes.

The epistemological implication: the field lacks cross-cultural psychometric validation for menstrual-cycle-specific self-efficacy instruments. The scale developed by İlbak et al., (2025) represents an important initial effort, but adaptation across sport contexts and cultures including Indonesia remains severely limited. Development of a "Menstrual Cycle Sport Self-Efficacy Scale" that is psychometrically valid and culturally sensitive emerges as a priority research agenda.

Limitations and Future Research Directions

Although this study provides a comprehensive mapping, several limitations need to be recognized. First, the dataset is limited to Scopus; Indonesian-language research indexed in Garuda, SINTA, or DOAJ is not covered yet this itself constitutes a finding affirming the representation gap. Second, keyword-matching-based relevance detection on abstracts may miss articles relevant but not using specific terms in abstracts. Third, cluster classification was performed semi-automatically; final mapping should undergo further validation. Fourth, quality analysis focused on 30 selected articles; extension to all 167 core-dataset articles is required. Fifth, citations are dynamic. Sixth, as a review study, this contribution is synthetic and requires empirical validation through primary studies in Indonesian contexts as follow-up.

What We Can and Cannot Conclude

What we CAN conclude: (1) menstrual cycle phase associates with consistent self-efficacy patterns in female athletes, with menstrual and late-luteal phases showing decline and late-follicular phases showing peaks; (2) phase-confirmation methodology critically affects reported effect sizes; (3) cultural context accounts for meaningful variance in how menstrual cycle influences self-efficacy; (4) the field has evolved substantially over 17 years, with quality trajectories indicating methodological maturation. What we CANNOT conclude from the predominantly cross-sectional evidence: (1) that menstrual cycle phase causes self-efficacy change (directionality may include reverse causation); (2) that intervention manipulating cycle awareness will produce lasting self-efficacy improvement (experimental evidence limited); (3) that observed associations generalize to under-represented populations.

Practical Implications

Based on the synthesis of findings, several evidence-based principles for menstrual-cycle-sensitive sport practice can be formulated:

- (1) Prioritize coach education: coaches, sport psychologists, and medical staff must receive systematic education on cycle physiology, psychological effects, and communication normalizing menstrual discussion rather than treating it as taboo.
- (2) Differentiate intervention approaches: interventions must be tailored to individual differences (cycle regularity, contraceptive use, cultural background, coping style) and contextual demands (developmental stage, competitive level, sport type). A one-size-fits-all approach is ineffective.
- (3) Integrate objective phase-confirmation with subjective self-efficacy monitoring: training-load periodization benefits from combining hormonal data with self-efficacy tracking, not either alone.
- (4) Address menstrual stigma constructively: interventions must not pathologize menstruation but help athletes distinguish normal cyclical variation from clinically significant dysfunction (dysmenorrhea, RED-S, PMDD).
- (5) Incorporate cultural sensitivity: menstrual-cycle interventions require cultural adaptation considering cultural values, social norms, and indigenous concepts of bodily care resonant with the target population.
- (6) Monitor mental-health indicators: cycle-sensitive interventions should include regular

monitoring of wellbeing indicators (anxiety, burnout, satisfaction) and assessment of perceived social support to ensure the cycle does not inadvertently become a distress source.

CONCLUSION

This bibliometric-systematic literature review, analyzing 1,446 studies from 809 journals spanning 17 years (2010-2026), reveals that menstrual cycle research in female athletes has evolved from a physiological-performance focus into a multidimensional inquiry with psychological, social, and cultural dimensions. Three critical insights emerge from our synthesis.

First, the intersection of menstrual cycle and self-efficacy constitutes an under-theorized field. Although 52.1% of articles address the self-efficacy or confidence construct, only 4.7% use "self-efficacy" as an explicit keyword and only 8 empirical articles plus 1 review cover the triple intersection of menstruation $\times$ self-efficacy $\times$ athlete during the 16-year period. This paradox signals disciplinary siloing between sport physiology and cognitive psychology, measurement difficulty for the domain-specific construct, and persistent cultural taboos. Filling this gap requires explicit integration of Bandura's Social Cognitive Theory with female-athlete menstrual-health research.

Second, methodology determines conclusions. Pre-2019 literature, dominated by calendar-based self-report, demonstrates effect-size over-estimation compared to modern studies employing hormonal verification. Methodological quality has improved progressively (6.2/10 $\rightarrow$ 8.2/10), yet complex-confounder control remains a persistent weakness. New research must employ at least one biomarker for cycle-phase confirmation, validated self-efficacy instruments, and systematic confounder control.

Third, cultural context is not a nuisance variable it is a structural dimension. WEIRD dominance (78.1%) creates significant external-validity limitations. Research from Southeast Asia, Africa, and Latin America is urgently needed to balance the literature. Indonesia, with its religious diversity, Nusantara cultural richness, and rising female participation in elite sport, offers a strategically crucial natural laboratory.

Looking forward, the field demands longitudinal research with culturally and geographically diverse populations, integration of cultural psychology perspectives, and implementation science bridging the research-practice gap. As female sport becomes increasingly professionalized and globalized, menstrual-cycle theory and prac-

tice must evolve accordingly moving from models developed primarily in individualistic Western contexts toward culturally-sensitive, holistically-oriented frameworks that acknowledge diverse value systems and optimize both performance and well-being across cultural contexts.

The evidence is clear: when appropriately implemented, menstrual-cycle-sensitive sport science is not merely accommodating it is transformative.

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