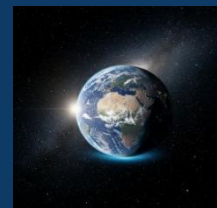




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The Interplay Between Endometriosis, Athletic Performance, and Physical Activity: A Narrative Review on Symptom Management and Training Adaptations in Active Women

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Abstract

Background: Endometriosis is a chronic, systemic inflammatory condition affecting 10% of women, characterized by chronic pelvic pain, "endo-fatigue" and myofascial hypertonia. In athletes, these symptoms compromise exercise tolerance and neuromuscular function, yet performance-limiting impacts remain under-researched. A critical gap exists regarding training adaptations in active women, as studies traditionally focus on sedentary cohorts.

Aim: This review evaluates the bi-directional relationship between endometriosis and athletic performance, synthesizing evidence-based strategies for tailored exercise and training load periodization.

Material and methods: PubMed and Scopus were searched using integrated clinical and exercise science terminology. Eligibility focused on peer-reviewed studies of active populations and physical activity interventions, using thematic narrative synthesis to integrate pathophysiology with performance metrics.

Results: Endometriosis induces objective neuromuscular deconditioning, specifically reduced isometric strength and compromised lumbopelvic control. Structured physical activity and pelvic floor rehabilitation act as anti-inflammatory modulators, reducing pain perception and fatigue while improving cardiorespiratory tolerance. Cycle-adjusted periodization, intensifying loads during peak estrogen phases and utilizing symptom-triggered modifications, maintains training adaptations without provoking flare-ups.

Conclusions: Endometriosis is a systemic performance constraint requiring interdisciplinary sports medicine care and proactive screening. Success requires flexible, symptom-aligned periodization and normalizing menstrual health in competitive sports. Individualized interventions are essential for the well-being and performance longevity of active women.

Key words: endometriosis, athletic performance, physical activity, menstrual cycle, chronic pelvic pain, training load

1. Introduction

Endometriosis is an estrogen-dependent, chronic inflammatory condition affecting approximately 6-15% of women of reproductive age globally (Sachs et al., 2023; Medeiros da Luz et al., 2025; Boroncsok et al., 2026). While traditionally viewed as a pelvic disorder, modern clinical perspectives define it as a systemic disease involving the gastrointestinal, urinary, and musculoskeletal systems (Taylor et al., 2021; Xie et al., 2025; Silva et al., 2024). Among athletic populations, the prevalence of dysmenorrhea, a cardinal symptom of endometriosis, is reported to be as high as 74-83%, yet clinical diagnosis is frequently hindered by normalization of pain within sports cultures and diagnostic delays ranging from 5 to 12 years (Nose-Ogura et al., 2026; Jones et al., 2024; Larsson et al., 2026). Despite the substantial physiological demands of competitive sport, the influence of the endometriosis-

related inflammatory milieu on high-level athletic adaptations remains a critically under-researched domain (Ekenros et al., 2022; Tourny et al., 2023).

The symptom burden of endometriosis, encompassing chronic pelvic pain (CPP), "endo-fatigue" and dyspareunia, profoundly compromises exercise tolerance and recovery kinetics (Salinas-Asensio et al., 2025; Tennfjord et al., 2024). Symptomatic women exhibit objective physical deconditioning, including reduced isometric back strength, impaired lumbar flexibility, and diminished functional capacity in standardized tests compared to age-matched healthy controls (Álvarez-Salvago et al., 2020; Silva et al., 2024). These deficits are often exacerbated by central sensitization and myofascial hypertonia, where chronic nociceptive input triggers a "vicious cycle" of pain-derived physical inactivity and subsequent atrophy of deep stabilizing musculature (Artacho-Cordón et al., 2023; Salinas-Asensio et al., 2022; Raimondo et al., 2023). Furthermore, the psychological impact, including fear-avoidance behaviors and reduced autonomous motivation, creates significant barriers to training consistency and adherence in active populations (Medeiros da Luz et al., 2025; Larsson et al., 2026).

A critical gap exists in current literature regarding the management of active women and athletes with endometriosis. To date, exercise research has predominantly focused on low-intensity therapeutic modalities for sedentary women or those unresponsive to medical management, primarily utilizing Hatha yoga, Pilates, or general stretching (Gonçalves et al., 2017; Mena-González et al., 2026; Song and Kim, 2023). There is a systematic lack of evidence concerning high-intensity training adaptations, the efficacy of specialized pelvic floor rehabilitation for athletes, and the application of training load periodization to accommodate cyclical symptom fluctuations (Ekenros et al., 2024; Schatz et al., 2026). Addressing how to adapt training regimens for symptomatic active women is essential for optimizing performance while preventing symptom exacerbation and athletic burnout (Ryman Augustsson and Findhé-Malenica, 2025; Tennfjord et al., 2021).

Research Objective: The primary aim of this narrative review is to evaluate the bi-directional relationship between endometriosis symptomatology and athletic performance, while synthesizing current evidence-based strategies for tailored exercise interventions and training load periodization specifically for active women.

Research Problems: The review seeks to address several fundamental questions within the current literature, including to what extent do endometriosis-specific symptoms, such as

chronic pelvic pain and systemic inflammation, impair objective athletic performance and recovery outcomes in active populations. Furthermore, it examines what is the clinical efficacy of targeted physical activity and pelvic floor muscle strategies in mitigating symptom burden for women engaging in high-intensity training. Finally, it investigates how training loads can be effectively adapted or periodized to account for cyclical fluctuations in symptom severity and hormonal status in athletes living with endometriosis.

Research Hypotheses: The following academic hypotheses are proposed based on the available evidence: chronic pain and systemic inflammation associated with endometriosis significantly reduce peak athletic performance and exercise tolerance via mechanisms of central sensitization and "endo-fatigue." Additionally, it is hypothesized that tailored therapeutic exercise programs and specialized pelvic floor rehabilitation will significantly reduce symptom burden and improve health-related quality of life in active populations. Finally, the review postulations that menstrual cycle-adjusted training periodization allows for the maintenance of critical physiological adaptations while preventing acute flare-ups of endometriosis-related symptoms.

2. Research Materials and Methods

The literature search for this narrative review was executed through a comprehensive multi-database strategy to capture the intersection of clinical gynaecology and exercise physiology. Bibliographic searches were conducted across major biomedical and sports science databases, specifically PubMed and Scopus. The search logic integrated clinical gynaecological descriptors with formal exercise science terminology using Boolean operators to ensure a rigorous selection of relevant studies. Primary search strings included terms for pathological conditions such as endometriosis, chronic pelvic pain, dysmenorrhea, and central sensitization, which were cross-referenced with performance-oriented keywords including athletic performance, exercise tolerance, female athletes, active women, training load, periodization, and pelvic floor rehabilitation. This dual-disciplinary approach allowed for the identification of literature spanning from cellular inflammatory mechanisms to applied field-based athletic monitoring.

Eligibility for inclusion was determined through a structured screening process focused on the lived physiological and training realities of active populations. Peer-reviewed primary clinical trials, randomized controlled trials, observational cohort analyses, and international sports

medicine guidelines were prioritized. Specifically, studies were included if they examined active women or competitive athletes, evaluated physical activity interventions, or assessed training-related adaptations in the presence of endometriosis or cyclical pelvic pain. Exclusion criteria were strictly applied to studies limited to strictly sedentary or general populations without reported physical activity outcomes, as well as research lacking objective physical performance metrics. This ensured the review maintained a specific focus on the unique demands of high-intensity training and the management of athletic careers within a symptomatic framework.

The data synthesis followed a narrative thematic approach designed to integrate diverse clinical and physiological findings into a cohesive framework for training optimization. Thematic analysis was utilized to categorize evidence into three primary domains: the pathophysiological mechanisms of the disease including systemic inflammation and myofascial hypertonia, the objective impacts on athletic performance metrics such as strength and aerobic capacity, and the clinical efficacy of specific exercise prescription strategies. This synthesis facilitated a cross-analysis of training load periodization, specialized lumbopelvic stabilization, and pelvic floor rehabilitation techniques. By clustering the evidence around these core themes, the review directly addresses the identified research objectives and evaluates the proposed hypotheses regarding symptom mitigation and training adaptations in active women.

AI was utilized for two specific purposes in this research. Text analysis of clinical reasoning narratives to identify linguistic patterns associated with specific logical fallacies. Assistance in refining the academic English language of the manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. AI were used for additional linguistic refinement of the research manuscript, ensuring proper English grammar, style, and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final interpretation of results, classification of errors, and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition, and linguistic refinement, rather than replacing human judgment in the analytical process.

3. Research Results

3.1 Pathophysiological Symptom Burden and Neuromuscular Impact

The chronic inflammatory environment of endometriosis, characterized by a localized peritoneal reaction and cyclic bleeding of ectopic implants, induces significant nociceptive hypersensitivity and central sensitization (Awad et al., 2017; Raimondo et al., 2023; Evans et al., 2021). This systemic milieu facilitates a "vicious cycle" in which chronic pelvic pain (CPP) and dysmenorrhea lead to pain-derived physical inactivity, resulting in objective neuromuscular deconditioning (Salinas-Asensio et al., 2022; Artacho-Cordón et al., 2023). Empirical evidence demonstrates that women with endometriosis exhibit significantly lower isometric back strength compared to healthy controls, alongside diminished handgrip strength and reduced lower-limb torque as measured via the chair stands test (Álvarez-Salvago et al., 2020; Silva et al., 2024; Silva et al., 2024). These deficits are often accompanied by trophic changes in soft tissues, specifically a reduction in the thickness and recruitment of deep stabilizing musculature such as the transversus abdominis and lumbar multifidus, which are critical for lumbopelvic stability and motor control (Salinas-Asensio et al., 2022; Salinas-Asensio et al., 2025; Lara-Ramos et al., 2021). Furthermore, the persistence of myofascial hypertonia and pelvic floor muscle dysfunction contributes to postural abnormalities, including increased thoracic kyphosis angles, which potentially jeopardize movement mechanics and isokinetic peak torque in active populations (Awad et al., 2017; Del Forno et al., 2021; Salinas-Asensio et al., 2025). The prevalence of widespread pain hypersensitivity and fatigue-related disability in elite athletes underscores the necessity of clinical screening for these neuromuscular impairments to prevent long-term functional decline (Evans et al., 2021; Jones et al., 2024; Silva et al., 2024).

3.2 Endo-Fatigue, Systemic Inflammation, and Cardiorespiratory Impairment

Endometriosis is a systemic inflammatory condition involving elevated levels of proinflammatory cytokines, including TNF- α , IL-6, and IL-1 β , which act as primary drivers for „endo-fatigue”, a symptom affecting over 50% of symptomatic women (Boronsok et al., 2026; Ramin-Wright et al., 2018; Álvarez-Salvago et al., 2020). This inflammatory state, combined with central sensitization, profoundly impairs cardiorespiratory fitness and exercise tolerance (Salinas-Asensio et al., 2025; Silva et al., 2024). Cross-sectional analyses reveal that women with endometriosis cover significantly shorter distances in the 6-minute walk test

(6MWT) and exhibit lower gait speeds than age-matched healthy peers (Silva et al., 2024; Álvarez-Salvago et al., 2020). This deconditioning is often exacerbated by debilitating gastrointestinal (GI) symptoms - such as bloating, which affects 52% of elite female track and field athletes, as well as dyschezia and tenesmus (Jones et al., 2024; Medeiros da Luz et al., 2025; Ruszała et al., 2022). The metabolic cost of managing chronic inflammation may alter lactate thresholds and prolong recovery periods; athletes frequently report that symptom severity peaks during menstruation, correlating with perceived declines in performance and longer recovery requirements (Jeppesen et al., 2024; Ferrer et al., 2025; Jones et al., 2024). Additionally, the presence of an atherogenic lipid profile and increased atherosclerosis risk in endometriosis cohorts reinforces the urgency of maintaining high cardiorespiratory fitness to mitigate long-term cardiovascular consequences (Sachs et al., 2023; Boroncsok et al., 2026).

3.3 Physical Activity and Exercise- Induced Symptom Modulation

Structured physical activity and therapeutic exercise exert potent anti-inflammatory and analgesic effects through the modulation of neuro-hormonal pathways and the release of skeletal muscle-derived myokines (Boroncsok et al., 2026; Tourny et al., 2023). Regular exercise increases systemic levels of anti-inflammatory mediators (e.g., IL-10) and elevates sex hormone-binding globulin (SHBG) levels, which reduces the bioavailability of estrogen and may impede the progression of estrogen-dependent lesions (Tourny et al., 2023; Sachs et al., 2023; Boroncsok et al., 2026). Clinical trials, including the "Physio-EndEA" study, demonstrate that 8 to 12 weeks of supervised multimodal training, incorporating aerobic, resistance, and stretching exercises, significantly improves fatigue scores, lumbar strength, and overall health-related quality of life (HRQoL) (Salinas-Asensio et al., 2025; Artacho-Cordón et al., 2023). Body awareness practices, such as Hatha yoga and progressive muscle relaxation (PMR), have been shown to reduce pain perception (VAS scores) and stress by activating the hypothalamic-pituitary-adrenal (HPA) axis and stimulating the release of endomorphins, serotonin, and endocannabinoids (Mena-González et al., 2026; Gonçalves et al., 2017; Boroncsok et al., 2026). Furthermore, specialized pelvic floor muscle training (PFMT) serves as a critical empowering tool, effectively reducing myofascial hypertonia and alleviating symptoms of dyspareunia and pelvic floor dysfunction (Tennfjord et al., 2024; Del Forno et al., 2023; Xie et al., 2025). Observational data support these findings, indicating that women who engage in regular exercise at least three times per week experience lower pain levels on subsequent days, provided training intensity is adapted to individual tolerance thresholds (Ensari et al., 2022; Boroncsok et al., 2026).

3.4 Cycle-Adjusted Periodization and Training Adaptations

Optimizing performance in active women with endometriosis necessitates training load periodization that accounts for the intersection of hormonal fluctuations and cyclical symptom flare-ups (Ekenros et al., 2024; Schatz et al., 2026). While recent evidence suggests no inherent anabolic advantage to specific menstrual cycle phases for muscle protein synthesis (MPS) or myofibrillar protein breakdown (MPB), the subjective impact of endometriosis symptoms often dictates phase-aligned adjustments (Colenso-Semple et al., 2023; Nolan et al., 2024). Athletes frequently report peak performance, motivation, and perceived energy during the late follicular phase and around ovulation, corresponding with peaking estrogen levels (Jones et al., 2024; Kneffel et al., 2026; Ryman Augustsson and Findhé-Malenica, 2025). Conversely, impairments are greatest during the early follicular (menstrual) and late luteal phases, when dysmenorrhea and "endo-fatigue" are most severe (Jones et al., 2024; Kneffel et al., 2026; Ekenros et al., 2022). Proposed periodization models, such as those in the IMPACT study, suggest intensifying training loads during the late follicular phase while reducing volume or extending recovery during symptomatic periods (Ekenros et al., 2024; Schatz et al., 2026). Symptom-triggered periodization, supported by real-time monitoring via wearable technologies (e.g., Oura smart rings) and standardized tracking tools like the MEDI-Q, allows for the maintenance of physiological adaptations while preventing acute exacerbations of pelvic pain (Ekenros et al., 2024; Kneffel et al., 2026). Moreover, addressing psychological determinants such as autonomous motivation and self-determination is essential, as women with thwarted basic psychological needs are significantly less likely to adhere to consistent training regimens (Medeiros da Luz et al., 2025).

Clinical / Physiological Domain	Key Symptom / Challenge	Impact on Physical Performance & Recovery	Recommended Exercise / Training Strategy
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Neuromuscular Core Function	&	Chronic pelvic pain, myofascial hypertonia, and atrophy of deep stabilizing musculature.	Reduced isometric back strength, impaired balance, and diminished lower-limb peak torque.	Targeted lumbopelvic stabilization, stretching, and specialized pelvic floor rehabilitation.
Cardiorespiratory Energy Systems	&	Debilitating "endo-fatigue" and elevated systemic proinflammatory cytokines.	Diminished functional capacity, impaired exercise tolerance, and prolonged recovery kinetics.	Supervised multimodal training incorporating aerobic and moderate-intensity conditioning.
Gastrointestinal Fueling Issues	&	Cyclical bloating (endo-belly), dyschezia, and associated gastrointestinal distress.	Perceived performance impairments and increased psychological barriers to training consistency.	Integration of anti-inflammatory dietary patterns with structured physical activity.
Training Adaptation & Load Management		Hormonal cycle fluctuations and acute flare-ups of dysmenorrhea.	Performance drops in follicular/luteal phases and increased risk of training absenteeism.	Cycle-phase adjusted periodization and symptom-triggered training load modifications.

4. Discussion

The synthesized findings of this review demonstrate that the systemic inflammatory nature of endometriosis creates physiological barriers to peak performance that necessitate a paradigm shift from traditional gynecological care to specialized sports medicine management. While historical research predominantly utilized exercise as a low-intensity therapeutic adjunct for sedentary populations, current evidence confirms that for active women and elite athletes, endometriosis-related symptoms- specifically chronic pelvic pain, "endo-fatigue" and myofascial hypertonia- function as primary performance-limiting factors (Sachs et al., 2023;

Salinas-Asensio et al., 2025). The resolution of the initial research gap suggests a bi-directional relationship: the disease's inflammatory milieu significantly impairs exercise tolerance and recovery kinetics, yet tailored physical activity remains a potent modulator capable of altering systemic cytokine activity and mitigating lesion progression. This transition highlights that for the athletic population, endometriosis is not merely a comorbid condition but a systemic state requiring sophisticated training load modifications.

The neurobiological and biomechanical mechanisms identified provide a rigorous explanation for the objective declines in neuromuscular performance and aerobic capacity. The presence of elevated systemic proinflammatory cytokines, such as TNF- α and IL-6, serves as the primary driver of "endo-fatigue", which profoundly compromises cardiorespiratory tolerance and exercise endurance (Boronsok et al., 2026; Ramin-Wright et al., 2018). These inflammatory markers facilitate central sensitization, whereby persistent nociceptive input from ectopic implants leads to widespread pain hypersensitivity and reduced pain thresholds (Evans et al., 2021; Raimondo et al., 2023). Biomechanically, chronic pelvic pain triggers a "vicious cycle" of protective guarding and physical inactivity, resulting in trophic changes such as the deconditioning of deep stabilizing musculature like the transversus abdominis (Salinas-Asensio et al., 2022). Myofascial hypertonia and pelvic floor muscle dysfunction further disrupt lumbopelvic motor control, potentially increasing the risk of secondary injuries during high-intensity training phases when joint laxity and neuromuscular fatigue are already accentuated (Jones et al., 2024; Ferrer et al., 2025).

Evaluating training paradigms reveals that flexible, symptom-triggered exercise prescriptions are superior to rigid, static periodization models for maintaining athletic adaptations. Protocols such as those established in the IMPACT study suggest that intensifying training volume during the late follicular phase to capitalize on peak estrogen levels, while reducing loads during symptomatic menstrual phases allows athletes to sustain physiological progress without provoking acute flare-ups (Ekenros et al., 2024; Schatz et al., 2026). This nuanced load management, supported by real-time physiological monitoring and standardized symptom tracking via tools like the MEDI-Q, enables the maintenance of "proximal stability" and lumbopelvic integrity (Kneffel et al., 2026; Salinas-Asensio et al., 2022). Furthermore, addressing the psychological determinants of adherence is critical, as women with thwarted basic psychological needs are significantly less likely to maintain training consistency due to fear-avoidance behaviors and a mistrust of their physical capacity (Medeiros da Luz et al., 2025).

Despite these clinical advancements, significant methodological limitations persist, including diagnostic heterogeneity and small sample sizes that often restrict the generalizability of findings to broader athletic cohorts (Schatz et al., 2026; Sachs et al., 2023). There remains a critical scarcity of high-intensity intervention trials, as most existing research utilizes low-to-moderate intensity modalities like yoga or Pilates, leaving the effects of maximal strength or aerobic training on systemic inflammation largely speculative (Mena-González et al., 2026; Tennfjord et al., 2021). Future directions for sports medicine must prioritize the development of interdisciplinary care models that integrate gynaecology, physiotherapy, and strength and conditioning. Moving beyond the "normalization of pain" in women's sports and adopting proactive, individualized screening protocols is essential for supporting the long-term health and performance longevity of active women living with endometriosis (Nose-Ogura et al., 2026; Jones et al., 2024).

5. Conclusions

This review establishes a fundamental paradigm shift in the management of active women, reframing endometriosis not merely as a localized gynecological concern but as a complex, systemic inflammatory condition that directly constrains athletic capacity. The synthesized evidence demonstrates that the disease's unique inflammatory milieu, characterized by central sensitization and "endo-fatigue" induces measurable neuromuscular deconditioning and cardiorespiratory impairment that standard athletic models often fail to account for. Crucially, the findings highlight that structured, tailored physical activity and specialized pelvic floor muscle rehabilitation represent vital non-pharmacological tools. Rather than being viewed as a risk to be avoided, individualized exercise serves as a potent anti-inflammatory modulator capable of reducing myofascial hypertonia, improving pain perception, and restoring the functional stability necessary for high-performance training.

The practical implications for coaches, sports medicine clinicians, and athletes necessitate a transition from rigid, static training models to flexible, cycle-adjusted periodization frameworks. Success in managing the training athlete depends upon the implementation of symptom-triggered training load modifications that prioritize individual physiological readiness and recovery kinetics over traditional phase-based assumptions. This requires an interdisciplinary care vision where gynecological expertise is integrated with sports medicine and strength and conditioning to provide a cohesive support system. By utilizing real-time subjective tracking and physiological monitoring, practitioners can ensure that training

volume is dynamically adapted to accommodate cyclical flare-ups, thereby maintaining athletic progress while mitigating the systemic symptom burden.

Ultimately, the future of female sports science depends upon the normalization of menstrual health and the proactive management of chronic pelvic pain within both elite and recreational environments. By dismantling the persistent taboos and the culture of pain normalization that frequently lead to significant diagnostic delays, the athletic community can foster an environment that supports the long-term well-being and performance longevity of women. This review underscores that while endometriosis remains a challenging clinical reality, it should no longer function as an insurmountable barrier to athletic success. Moving forward, the integration of menstrual literacy and evidence-based management strategies will be vital in ensuring that active women can sustain their training adaptations and achieve their peak potential despite the presence of chronic illness.

Disclosure

Supplementary Materials

Not applicable.

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Conflicts of Interest

The authors deny any conflict of interest.

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