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# Stress urinary incontinence in physically active women – current evidence, risk factors and clinical relevance

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## Abstract

**Background:** Stress urinary incontinence (SUI) affects a significant proportion of women throughout life. Although traditionally associated with childbirth, menopause, and obesity, recent evidence shows that physically active women and female athletes also experience SUI, including those who are young, nulliparous, and without classical risk factors.

**Objective:** To summarize current literature on the epidemiology, pathophysiology, risk factors, diagnostic approach, and therapeutic strategies for stress urinary incontinence in physically active women.

**Methods:** A narrative literature review was conducted using PubMed, Scopus, and Google Scholar databases, focusing primarily on publications from 2000–2024. Search terms included "stress urinary incontinence," "female athletes," "physical activity," "pelvic floor," and related MeSH terms. Eligible sources included observational studies, experimental research, systematic reviews, meta-analyses, and relevant clinical guidelines.
**Results:** Available data indicate a higher prevalence of SUI in physically active women compared to the general female population, with reported rates exceeding 50–60% in some high-impact sports. Pathophysiology involves combined mechanical overload, altered neuromuscular control, increased intra-abdominal pressure, and in some cases unfavorable hormonal or energy-availability profiles. Clinical assessment follows standard diagnostic protocols, with emphasis on detailed physical activity history and pelvic floor evaluation. First-line management consists of pelvic floor muscle training integrated with motor control and breathing pattern re-education, while surgical treatment is reserved for refractory cases.
**Conclusions:** Stress urinary incontinence is relatively common among physically active women but remains underrecognized and underreported. Early identification, structured diagnostic assessment, and individualized conservative treatment are essential. Further research is needed to clarify sport-specific mechanisms, refine preventive strategies, and evaluate long-term treatment outcomes in female athletes.

**Keywords:** Urinary Incontinence, Stress; Pelvic Floor; Pelvic Floor Disorders; Female Athletes; Exercise; Physical Exertion; Athletic Injuries; Biomechanical Phenomena; Risk Factors; Pelvic Floor Muscle Training; Urodynamics; Quality of Life.

## 1. Introduction

Urinary incontinence is a condition that affects a considerable proportion of women during their lifetime, regardless of age or hormonal status [1,2]. Traditionally, vaginal delivery, postmenopausal status and obesity have been highlighted as the main factors contributing to impaired continence mechanisms [3–5]. However, with the growing number of women involved in competitive sports and the increasing popularity of high-intensity recreational activity, the question arises to what extent physical exertion itself may contribute to the development of stress urinary incontinence (SUI).

According to the International Continence Society (ICS), SUI is defined as involuntary urine leakage occurring during an increase in intra-abdominal pressure without simultaneous detrusor contraction, and it represents the most common type of incontinence among women [2,3]. In clinical practice, this refers to leakage triggered by coughing, sneezing, laughing, brisk walking or lifting. In physically active women, episodes of leakage occurring during running, jumping or strength-training activities may be particularly relevant, as they can lead to modifications in training plans or even temporary withdrawal from selected forms of exercise [7,9].

Epidemiological studies have demonstrated that the prevalence of SUI is higher among female athletes compared with non-athletic peers [10,17,24]. Notably, this issue also affects young, slim, nulliparous women, in whom traditional risk factors are largely absent [17,18]. This observation prompts further exploration of pathophysiological mechanisms and risk factors specific to this population.

The purpose of this paper is to summarise current knowledge on SUI in physically active women, with particular emphasis on epidemiology, pathophysiology, key risk factors, diagnostic approach and therapeutic options, as well as to identify the most relevant research gaps.

## 2. Material and Methods

This article is a narrative review. In the initial stage of the search process, relevant literature was analysed using PubMed, Scopus and Google Scholar databases, with the following keyword combinations: urinary incontinence, stress urinary incontinence, female athletes, physical activity, exercise, pelvic floor, RED-S, women, sports. Publications from 2000 to 2024 were primarily included; however, in the case of key papers on epidemiology and pathophysiology, earlier studies were also reviewed [3–5].

The analysis included observational studies, experimental research, systematic reviews, meta-analyses and current clinical guidelines issued by scientific societies (ICS, IUGA, EAU) [2,13]. Due to the narrative character of this review, no formal risk-of-bias assessment or quantitative meta-analysis was performed. The intention of the authors was to provide a structured and concise summary of the most relevant findings, with particular emphasis on their practical applicability in clinical and physiotherapeutic settings.

## 3. Epidemiology of Stress Urinary Incontinence in Physically Active Women

Estimating the prevalence of SUI among physically active women is challenging due to differences in definitions, diagnostic tools and characteristics of study populations. Available data, however, suggest that SUI occurs more frequently in this group compared with the general female population [7,10,17].

Population-based studies indicate that urinary incontinence (of any type) affects approximately 25–45% of women, with the stress subtype accounting for a substantial proportion of these cases [5,15]. In contrast, reported prevalence rates among female athletes are often considerably higher. As early as the 1990s, Nygaard described SUI symptoms in 28% of young competitive athletes [7]. More recent studies involving gymnasts, track-and-field athletes and volleyball players report prevalence rates ranging from 30% to 60%, with even higher values observed in selected sports disciplines [17,18,24–26].

Notably, this issue is not limited to elite athletes. SUI episodes have also been reported among women engaged in recreational long-distance running, fitness training and high-impact aerobic exercise [20,23]. The likelihood of experiencing symptoms appears to increase alongside training intensity and cumulative exposure [21,24].

A recurrent observation in the literature is the discrepancy between symptom prevalence and help-seeking behaviour. In several studies, more than half of symptomatic athletes had never consulted a healthcare professional, often attributing the problem to embarrassment, the belief that “it is normal in sport”, or concerns about potential consequences for their athletic career [19,24,26]. This suggests that the true scale of the problem may be underestimated, particularly when based solely on self-reporting.

## 4. Pathophysiology of Stress Urinary Incontinence in Physically Active Women

The underlying mechanisms of **SUI** in female athletes are based on the same principles as in the general female population, but they occur under substantially higher and more repetitive mechanical loads [3,4]. Continence requires coordinated function of the pelvic floor muscles (PFM), fascial and ligamentous supports, urethral sphincter complex, and adequate intra-abdominal pressure regulation [3,12].

The PFM act as a dynamic diaphragm that, under physiological conditions, contracts reflexively in response to a sudden rise in intra-abdominal pressure. This protective response, commonly referred to as the **"Knack"**, involves a rapid, automatic PFM contraction and plays a key role in preventing leakage during activities such as coughing, jumping, or lifting [5]. In some physically active women, studies have demonstrated delayed or insufficient PFM activation relative to the load-generating event, which results in inadequate support of the bladder neck at the critical moment [27,28].

At the same time, repetitive overload may affect the passive stabilising structures of the continence mechanism. The pubourethral ligament, vesicovaginal fascia, and other connective tissue elements may gradually stretch or develop microtrauma under repeated jumping, landing, rapid direction changes, or heavy resistance training [4]. Imaging studies have confirmed that women with SUI more frequently present with excessive urethral mobility and increased bladder-neck rotation during Valsalva manoeuvre [8,22].

In certain athletes, hormonal and energy-availability disturbances may additionally contribute to continence impairment. **Relative Energy Deficiency in Sport (RED-S)**, menstrual irregularities, and chronic low caloric intake may cause relative hypoestrogenism, negatively affecting urethral mucosal trophism and periurethral vascularisation [11]. Combined with mechanical overload, this may lower urethral closing pressure and further increase leakage risk.

Another important component of continence control is trunk and core stability. Studies indicate close functional interdependence between the transverse abdominal muscle, diaphragm, and PFM [12]. In some high-intensity athletes, this mechanism appears altered - frequent use of Valsalva manoeuvre, dominance of superficial abdominal muscles, and insufficient synchronisation with the pelvic floor have been observed [28]. Such patterns can induce abrupt increases in intra-abdominal pressure that are not adequately balanced by the pelvic floor, which may precipitate leakage episodes.

## 5. Risk Factors

From a clinical perspective, early recognition of risk characteristics in physically active women is essential. The most frequently cited factors include: the type of sport performed, cumulative exposure to high-impact physical activity, obstetric history, body composition, hormonal background, and the quality of core and pelvic stabilisation [15,17,20].

The highest risk has been reported in sports involving repetitive jumping or running loads, where ground-reaction forces transmitted to the pelvis are considerable. This applies particularly to artistic and competitive gymnastics, volleyball, track-and-field disciplines, and high-intensity functional training (e.g. CrossFit) [17,24–26]. In studies including women training on trampolines or participating in high-jump events, the proportion of those reporting SUI episodes exceeded 60% [25].

Traditional risk factors - such as vaginal childbirth, high birthweight, or obesity - remain clinically relevant, but many athletes, particularly young nulliparous women, do not present with these characteristics [5,15,18]. In this population, attention shifts towards mechanisms related to training overload, energy and hormonal disturbances, and impaired motor control. Evidence suggests that women with SUI more frequently demonstrate reduced pelvic floor muscle strength, limited muscular endurance, and altered breathing patterns [21,23,27]. There are also reports indicating that similar impairments may be present in some physically active women, although high-quality studies specifically validating these findings in athletic cohorts remain limited.

| **Sport discipline** | **Type of participation** | Estimated SUI prevalence | **Reference** |
|---|---|---|---|
| Artistic & rhythmic gymnastics | Professional / competitive | 50-60% | [24-26] |
| Athletics (jumps, sprints) | Professional | 30-50% | [17,18,26] |
| Volleyball | Professional | 30-40% | [24] |
| Long-distance running | Recreational | 20-40% | [20,23] |
| High-impact fitness / aerobic | Recreational | 25-40% | [20,23] |

**Table 1**. Estimated prevalence of stress urinary incontinence among physically active women based on published data.

**6. Diagnostics**

The diagnostic approach to **stress urinary incontinence (SUI)** in physically active women follows the same general principles as in the wider female population; however, in this group a detailed history focused on the type, frequency, and intensity of physical activity is essential [2,13]. It is important to determine whether leakage occurs exclusively during exertion or also in everyday situations, and whether symptoms are accompanied by urgency episodes.

Validated questionnaires, such as the **International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form (ICIQ-UI SF)**, are recommended and should be supplemented with questions regarding the impact of symptoms on training continuation and competition participation [15]. Physical examination should include assessment of posture, breathing pattern, and deep stabilising muscle function, followed by a vaginal examination evaluating pelvic floor muscle (PFM) strength, resting tone, and the presence of episiotomy or perineal scars [3,5,13].

Imaging studies, particularly pelvic floor ultrasound, may be used to assess bladder neck mobility, urethral position, and the functional response of the PFM during exertional manoeuvres [8,22]. **Urodynamic testing** is reserved for diagnostically unclear cases, suspected mixed incontinence, or when surgical management is being considered [2,13,30].

## 7. Therapeutic Management

According to current recommendations, the first-line treatment for **stress urinary incontinence (SUI)** in women is conservative management, with **pelvic floor muscle training (PFMT)** as the primary intervention [1,6,21]. The effectiveness of PFMT has been confirmed in multiple randomized trials, showing outcomes comparable to surgical treatment in many patients, while offering a significantly lower risk of complications [6].

In physically active women, therapy should additionally include **movement pattern retraining and respiratory control techniques**. Teaching patients to activate the pelvic floor muscles reflexively and in advance of activities that substantially increase intra-abdominal pressure is a key therapeutic goal. Equally important is coordinated engagement of the pelvic floor with deep abdominal stabilisers and pelvic girdle control [12,21,27].

In some athletes, **temporary reduction or modification of high-impact training** may be beneficial, with the introduction of alternative forms of activity such as swimming or cycling until symptom improvement is achieved [24,26]. In selected cases, **intravaginal pessaries or support devices** may be considered to improve urethral support during exercise, particularly when leakage occurs only under athletic conditions [30].

Surgical treatment should be reserved for women who continue to experience significant symptoms despite properly conducted conservative therapy. **Mid-urethral sling (MUS)** procedures remain the gold standard, with reported success rates ranging from 80% to 90% [13,14,30]. In athletes, the decision regarding surgery should take into account the nature of the specific sport, expected career duration, and the feasibility of reducing or modifying training loads postoperatively.

| Intervention category | Description / key elements | Clinical notes | References |
|---|---|---|---|
| Pelvic floor muscle training (PFMT) | Targeted strengthening and endurance training of pelvic floor muscles; supervised programs preferred | Consider integration with sport-specific tasks and load progression; minimum 3 months duration | [1,6,21] |
| Motor control & breathing retraining | Teaching anticipatory pelvic floor activation, coordination with diaphragm and deep core muscles | Correct excessive Valsalva use; emphasize timing rather than maximal contraction | [12,21,27,28] |
| Training load modification | Temporary reduction of high-impact sessions; inclusion of low-impact modalities (cycling, swimming) | Short-term strategy to allow tissue recovery; gradual return based on symptoms | [24,26] |
| Pessary / vaginal support devices | Use of supportive intravaginal devices during training to improve urethral support | Helpful especially when leakage occurs exclusively during sport activities | [30] |

| | | | |
|---|---|---|---|
| Lifestyle & hormonal considerations | Screening for RED-S, menstrual disturbances, energy deficit; nutrition and recovery optimization | May reverse hypoestrogenic state and improve tissue integrity in selected athletes | [11] |
| Surgical treatment | Mid-urethral sling (MUS) reserved for persistent, function-limiting symptoms | Requires discussion regarding sport type, prognosis and postoperative load modification | [13,14,30] |

**Table 2.** Overview of recommended therapeutic interventions for physically active women with stress urinary incontinence (SUI)

## 8. Discussion

The available literature indicates that **stress urinary incontinence (SUI)** in physically active women is relatively common, yet it remains insufficiently addressed in both medical and athletic environments [7,17,24].

It is notable that this issue predominantly affects women who are generally regarded as *healthy, fit, and resilient*, and therefore perceived as unlikely to develop conditions associated with pelvic floor dysfunction.

Furthermore, training loads that are excessive or poorly managed may not provide protective effects and may instead contribute to an increased risk of SUI.

Several publications highlight that women experiencing SUI rarely seek medical advice, and many perceive leakage episodes as an unavoidable consequence associated with high training intensity [19,24,26]. This may be related to limited awareness regarding available treatment strategies, as well as concerns about potential athletic consequences, including reduced participation in competitions or the need to modify training routines.

Evidence suggests that **appropriately supervised pelvic floor physiotherapy**, combined with movement pattern correction and core stabilisation, can significantly reduce symptom severity in most affected athletes, without requiring withdrawal from sporting activity [6,21,27]. Successful management, however, requires **multidisciplinary collaboration**, including urologists, gynaecologists, sports medicine physicians, physiotherapists, and coaching staff.

The literature also points to a **shortage of large, well-designed prospective studies** focusing on SUI within specific sports disciplines, as well as limited data regarding athletic performance and training capacity following surgical treatment [18,23,29,30]. Based on current knowledge gaps, further research should address both sport-specific risk profiles and postoperative outcomes among competitive female athletes.

## 9. Conclusions

Stress urinary incontinence (SUI) is a common problem among physically active women, with its prevalence in several sports disciplines reported to be higher than in the general female population [17,24–26].

In intensively training athletes, the development of SUI may be influenced by multiple interacting mechanisms, including overload of pelvic floor support structures, insufficient muscle strength and coordination, increased intra-abdominal pressure, and - among some individuals - unfavorable hormonal conditions [3,4,11,21].
Diagnostic evaluation should include a detailed history focused on the type and intensity of physical activity, assessment of pelvic floor muscle (PFM) function, and, when clinically justified, imaging and urodynamic investigations [2,8,13].
Conservative management remains the first-line therapeutic option and includes comprehensive pelvic floor physiotherapy combined with core stabilisation training and movement pattern correction. Surgical treatment may be considered in cases where conservative therapy fails to provide satisfactory improvement [1,6,13,21].
Further research is warranted to evaluate sport-specific risk profiles, the effectiveness of preventive strategies, and long-term outcomes of surgical treatment in physically active women and competitive athletes [18,23,29,30].

## 10. Limitations

This review is narrative in nature, which inherently carries a risk of subjective selection of the available literature. The included publications vary with regard to methodology, applied definitions of stress urinary incontinence, and diagnostic tools, which makes direct comparison challenging and limits the possibility of drawing quantitative conclusions [1,3,8]. It should also be noted that much of the evidence referring to female athletes originates from studies involving relatively small and homogeneous sample groups, often representing a single sport discipline, which restricts the generalisability of the findings to the broader population of physically active women.

## Discloure

### Author Contributions

Conceptualization: Sabina Ściążko-Gancarczyk and Maciej Gancarczyk;
Methodology: Sabina Ściążko-Gancarczyk;
Software: Not applicable;
Validation,: Sabina Ściążko-Gancarczyk, Maciej Gancarczyk and Jagoda Węgrzyn;
Formal analysis: Sabina Ściążko-Gancarczyk;
Investigation: Sabina Ściążko-Gancarczyk;
Resources: Maciej Gancarczyk;
Data curation, Not applicable (narrative review);
Writing – original draft preparation, Sabina Ściążko-Gancarczyk;
Writing – review and editing, Maciej Gancarczyk and Jagoda Węgrzyn;
Visualization: Maciej Gancarczyk;
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No new data were created in this study.
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**Conflicts of Interest**
The authors declare no conflict of interest.

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