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Pelvic floor dysfunctions in female athletes

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Abstract
Pelvic floor dysfunctions (PFD) consists of disorders that involve urinary incontinence (UI), anorectal dysfunction, pelvic organ prolapse (POP), sexual dysfunction and pelvic pain. While physical activity benefits overall health, high-impact and strenuous exercise may contribute to PFD due to increased intra-abdominal pressure. This study examined PFD prevalence in female athletes and their knowledge of the condition. The prevalence of UI is significantly higher in female athletes compared to the general population, with high-impact sports such as gymnastics, basketball, and volleyball demonstrating the greatest risk. Anorectal dysfunction is less studied but appears more prevalent in endurance and high-intensity athletes. POP remains underexplored, though some studies suggest sports do not worsen the symptoms. Additionally, sexual dysfunction, particularly dyspareunia, is common but poorly understood among athletes. Despite the high prevalence of PFD, knowledge among sportswomen remains limited, with misconceptions contributing to reluctance in seeking medical care. There is a pressing need for educational interventions to improve awareness of PFD in female athletes. Additionally, the implementation of pelvic floor muscle training (PFMT) has shown promise in preventing and managing UI. Future research should expand beyond UI and particularly include sexual health and anorectal dysfunction, to ensure comprehensive care for female athletes.

Keywords: pelvic floor dysfunction, pelvic floor disorders, pelvic floor, urinary incontinence, pelvic organ prolapse, anorectal dysfunction, sexual dysfunction, dyspareunia, pelvic pain, female athletes, sportswomen, physical activity, exercise

Introduction

Pelvic floor is defined as "structures located within the bony pelvis: urogenital and anorectal viscera, pelvic floor muscles and their connective tissues, and nerves and blood vessels" in a joint report by an International Urogynecological Association (IUGA) and International Continence Society (ICS).[1] The pelvic floor muscles (PFM) have two major functions: they provide support for the organs in the abdomen and they are essential for the closing of the urethra, vagina and rectum.[2]

Pelvic floor dysfunctions (PFD) are a large group of disorders that include urinary incontinence, anorectal dysfunction, pelvic organ prolapse, sexual dysfunction and pelvic pain.[1] While these dysfunctions are not inherently life-threatening, they can significantly impact an individual's quality of life, potentially leading to psychological distress and depression.[3]

Regular physical activity has been identified as a significant and modifiable health factor for individuals of all age groups as well as a prevention of a wide range of diseases and conditions. The positive effects on health include a decrease in the likelihood of the progression of certain chronic conditions, including osteoarthritis, hypertension, and type 2 diabetes. Moreover, physical activity has been demonstrated to enhance cognitive abilities and reduce the risk of developing dementia and various types of cancer. [4]

However, the pelvic floor in women may be the sole bodily region for which the positive effects of physical activity have been called into question[5] as strenuous exercise characteristic for professional sport is often related to increased intra-abdominal pressure which in the long-term may be associated with increased risk of PFD.[5,6]
The aim of this review is to assess the prevalence of PFD in female athletes and the level of knowledge about these dysfunctions in this specific population.

Materials and methods

The review was based on an analysis of scientific papers with full text collected from the PubMed database. In order to identify relevant scholarly articles, a search was conducted using the following keywords: pelvic floor dysfunction, pelvic floor disorders, pelvic floor, urinary incontinence, pelvic organ prolapse, anorectal dysfunction, sexual dysfunction, dyspareunia, pelvic pain, female athletes, sportswomen, physical activity, exercise.
Articles were subjected to a verification process to ascertain their relevance with respect to the topic of pelvic floor dysfunctions in female athletes.

Prevalence of Urinary Incontinence among female athletes

Out of variety of different pelvic floor disorders, the most frequently studied condition is urinary incontinence (UI). UI is defined as "a complaint of involuntary loss of urine" and could be classified into two types. One is stress urinary incontinence (SUI), which is related to physical exertion (e.g. sports) or sneezing or coughing, and the other is urgency urinary incontinence (UUI), which means that involuntary loss of urine is associated with urgency.[7]
The risk of developing UI is three times higher in female athletes than in the general population.[8] Da Roza et al.[9] conducted a study that compared the prevalence of UI among four groups of women based on the time spent in organized exercise. The prevalence of UI was found to be 2.53 times higher among women engaged in competitive training than among those with inactive lifestyles. It is noteworthy that the prevalence of UI in women who engaged in physical exercise for recreational purposes did not appear to be higher compared to inactive participants. This finding indicates that women should not be discouraged from participating in organized exercise under the assumption that it prevents UI.
A number of studies have identified differences in the risk of prevalence of UI depending on the specific sport in question. A systematic review conducted by de Mattos et al.[10] revealed a direct correlation between the prevalence of UI and the impact of given sports. High-impact sports (e.g., basketball, football, gymnastics, tennis, volleyball) demonstrated a higher prevalence of UI than low-impact sports (e.g., bodybuilding, cycling, hiking, pilates, swimming) (58.10% and 12.48%, respectively). Similarly, Cerruto et al.[8] in their review reported two high-impact sports, namely volleyball and basketball, to have an overall prevalence of UI and SUI of 29.1% (lower than the cumulative) and 27% (similar to the cumulative), respectively. Urinary incontinence was observed in 80% of cases during sports practice, and in 44% of cases during daily life. Professional gymnasts who compete in trampoline jumping reported a high level of SUI control during daily life and performance (73% and 80%).

Paradoxically, this type of exercise, which is thought to be the most associated with SUI and with a high pressure on the pelvic floor, gains an eccentric contraction of the pelvic floor muscle, resulting in a good level of continence control.
It has been demonstrated that certain activities have a detrimental effect on UUI (cumulative prevalence of 17.8% in daily life and 11% during sport). These include swimming (17% during sport) and track and field sports (34%). Some authors have proposed that this data may be a possible misinterpretation of urgency and UUI.[8]
It has been suggested that the presence of UI in young nulliparous athletes without other risk factors may be related to increased intra-abdominal pressure associated with physical activity. This leads to changes in the morphology and functionality of the ligaments and connective tissues of the pelvic floor.[6,10]

Anorectal dysfunction among female athletes

Anorectal dysfunction is characterized by a multifaceted array of symptoms, including, but not limited to, fecal urgency, incontinence, straining to defecate, constipation, a sensation of incomplete bowel evacuation, diminished rectal sensation, rectal prolapse and rectal bleeding. However, the symptom most commonly associated with this condition is fecal incontinence, which is defined as "a complaint of involuntary loss of feces or flatus". [7]
In comparison to the substantial body of research focusing on the relationship between physical activity and UI, there is a paucity of studies specifically investigating the association with anorectal dysfunction/anorectal incontinence (AI). The available literature on this subject is inconclusive. Some studies have indicated an increased frequency of AI in women who engage in regular physical activity, while others have demonstrated no significant difference between female athletes and women who do not exercise regularly.[5]
One study made a comparison between AI in two distinct groups of women, which were defined as follows: the first group was designated as the “intensive sport (IS) group”, characterized by high-level sport with a weekly participation time of >8 hours; the second group was designated as the “non-intensive sport (NIS) group”, which included all other subjects. The prevalence of AI was found to be statistically higher in the IS group compared to the NIS group (14.8% vs. 4.9%, p=0.001). Within the IS group, AI primarily manifested as loss of flatus in 84% of cases. However, there was no significant difference between women in IS group and NIS.[5,11]
In a study comparing runners and CrossFit participants the reported prevalence of AI was equal 34.0% in the runners group and 27.7% among women practicing CrossFit. In both groups AI mainly present as “losing gas beyond control” while complaints related to loss of stool were much rarer.[12]
Yi et al.[13] conducted an online survey which was completed by 311 female triathletes, and the prevalence of AI was reported to be 28%. One potential explanation for the unexpectedly high rate of AI found in young participants, irrespective of whether or not they have given birth, is proposed by the authors of the study. This explanation is that there could be a neurological impact on participants engaging in endurance sports which involve prolonged pressure on the ischial tuberosities, particularly in cases of long-distance cycling, and possibly on the pudendal nerve and its branches.

A retrospective study of 40 female athletes and 80 matched controls reported the prevalence of AI before, during and after pregnancy. The study found that no woman in either group reported AI during pregnancy or several years after pregnancy. However, it should be noted that the sample size was rather small.[5,14]

Pelvic organ prolapse and physical activity

The condition known as pelvic organ prolapse (POP) is characterized by the protrusion or herniation of the pelvic organs through the vaginal walls and pelvic floor.[15] The reported prevalence of POP varies significantly based on the method of ascertainment (1–65%), i.e. symptoms (1–31%), pelvic examination (10–50%), or both (20–65%).[16]

Similarly to AI, there is a scarcity of research that has been observed on the relationship between regular physical activity/exercise and POP in comparison to that observed for UI.[5]

A narrative scoping review conducted by Bo et al.[17] demonstrated that the prevalence of POP symptoms exhibits discrepancies between studies and between sports. A small Brazilian study found that no athlete, regardless of discipline, reported symptoms of POP compared to non-athletes, however, the difference was not statistically significant.[17,18] On the other hand, a study conducted on powerlifters and Olympic lifters in Norway found a 23% prevalence of POP symptoms in this group of women.[17,19]

A survey of triathletes found an overall prevalence of POP of 5% based on the symptom of vaginal bulging alone, with a higher prevalence of POP in parous women (8 vs 3%, $p = 0.05$) compared to their nulliparous counterparts.[13] Forner et al.[12] compared the prevalence of symptoms of PFD in runners to women who participate in CrossFit training and their findings indicated that 12.7% of runners exhibited symptoms consistent with POP, which is considerably higher than the 7.8% observed in the CrossFit group. In the study, additional analysis of the prevalence of PFD symptoms based on the parity status was performed which revealed that parous runners have a higher prevalence of PFD symptoms compared to parous CrossFit participants, whereas PFD symptom prevalence in nulliparous women is comparable in the runners and CF groups.

One study comparing women who lift heavy (>50 kg), moderate (16-50 kg), and light (≤15 kg) weights versus no weight lifting found that there was lower prevalence of POP symptoms in the heavy lifters (7.1%) than in the inactive (21.3%) and light lifters (19.4%, $p<0.001$) groups. The authors concluded that there is no increased prevalence of POP symptoms in physically active women who lift heavy weights for exercise and further research is needed to provide insight into the contribution of heavy weight lifting, as part of a physical activity regime, to the pathophysiology of POP. [20]

Machado et al.[21] found that nulliparous, healthy women who practice CrossFit and those who do not engage in exercise showed no differences in their ability to contract the PFM. There were also no differences in resting tone, maximal voluntary contraction, rapid contraction and sustained contraction as assessed by surface electromyography (sEMG).

Sexual dysfunction and pelvic pain in female athletes

There is a paucity of data on the relationship between the amount and type of physical activity and sexual dysfunction in women. Fergus et al.[22] researched the prevalence of sexual pain among physically active women. The authors concluded that the prevalence of sexual pain in a healthy cohort of 2,039 women was high (54%) and that cycling was a protective factor against sexual pain. However, genital nodules from cycling as well as genital numbness during cycling are strong risk factors for sexual pain. It should also be pointed out that muscle hypertonus has been identified as a risk factor for sexual pain and that it may be more common in cyclists and other athletes.

A total of 255 female athletes took part in an online study by Bosch-Donate et al.[23] which demonstrated that 63.5% of participants reported dyspareunia and 42.4% reported pelvic pain. In a study conducted by Cardoso et al.[24] the prevalence of dyspareunia among high-impact sports athletes was 30%. A notable finding was observed in the prevalence of dyspareunia, where a significantly higher proportion of women reporting UI symptoms exhibited symptoms of dyspareunia (35%) in comparison to those who did not report UI (17%). The authors concluded that dyspareunia was a predisposing factor to UI by approximately 3 times.

Knowledge regarding pelvic floor dysfunctions among sportswomen

An interesting study by Bosch-Donate et al.[23] was conducted with a sample of 255 Spanish female athletes to ascertain their knowledge of the various types of PFD and its correlation with symptoms of PFD and gender stereotypes. It was categorized as adequate knowledge if the answers were $\geq$ 70% correct, and as low or inadequate knowledge if the answers were <70% correct. The findings indicated that female athletes exhibited a limited understanding of PFD, with knowledge scores falling below 70% for all dysfunctions except UI, which reached 70.8%. Notably, comprehension was particularly deficient in the domain related to sexual dysfunction, where the average score was approximately 40%, which is especially concerning regarding the fact that 63.5% of participants reported experiencing dyspareunia. The prevalence of symptoms of UI was 51.8%. Nevertheless, no significant associations were identified between the level of knowledge about PFD and the presence of PFD symptoms. Notably, a higher prevalence of gender stereotypes was correlated with lower knowledge levels ($p < 0.05$) and greater reluctance toward seeking professional healthcare for PFD ($p = 0.010$).

On the other hand, Cardoso et al.[24] reported that athletes with adequate knowledge of the relationship between UI and sports, its prevention and treatment were 57% less likely to develop UI. Although the prevalence of UI among athletes was found to be high, few of them sought medical attention, none sought physiotherapy and none reported urine loss to the coach. Knowledge of pelvic floor exercises was also very low. Unfortunately, the focus of the study was on the UI, and the other PFDs were not the subject of an in-depth study.

Nevertheless, that limited data seem to confirm that there is a necessity of developing targeted educational interventions to enhance awareness and knowledge regarding all types of PFD with special focus on sexual dysfunction as dyspareunia was shown to not only be highly prevalent among female athletes but also poorly understood.[23] Another priority should be education on the prevention and treatment of UI, as it is also very common among sportswomen.[23,24]

Pelvic Floor Muscle Training Interventions

Pelvic floor muscle training (PFMT) is recommended as first-line treatment for UI with level 1 evidence.[25,26] However, despite the increased risk of developing UI, few studies have focused on women who compete in professional sports.[6]

The effectiveness of PFMT to treat and prevent UI in young nulliparous female athletes was analyzed in a systemic review and meta-analysis by Rodríguez-Longobardo et al.[6] The research focused on the analysis of 3 variables: maximal voluntary contraction (MVC) of the PFM, vaginal resting pressure (VRP) and amount of urinary leakage (AUL), as these were considered markers of the effectiveness of the intervention. Despite the limited number of available articles, it was concluded that sportswomen who participated in PFMT showed improved MVC ($p = 0.02$). This parameter serves as a reliable indicator for assessing PFM strength and contractile function, which are essential for maintaining structural support during elevations in intra-abdominal pressure resulting from physical exercise and routine activities such as coughing or sneezing. Female athletes who trained their PFM also displayed a significant reduction of AUL ($p < 0.01$). There was no effect on VRP and results were not significant ($p = 0.93$).

Another research conducted by Demeco et al.[27] similarly demonstrated that PFMT is an effective approach for both the prevention and management of UI. The researchers suggested that a tailored rehabilitation program could enable female athletes to develop strategies for regulating intra-abdominal pressure during both competitive sports and daily activities. Furthermore, authors observed the need to include educational programs aimed at increasing awareness of UI symptoms and improving knowledge of possible treatment options.

Conclusions

Pelvic floor dysfunctions (PFD) are prevalent among female athletes, particularly UI, AI and sexual dysfunction in a form of dyspareunia. High-impact and endurance sports appear to increase the risk due to elevated intra-abdominal pressure and repetitive strain. Despite the significant prevalence, knowledge of PFD among athletes remains limited, leading to underreporting and reluctance to seek medical care.

Raising awareness through targeted education and early intervention strategies is crucial in addressing PFD in sportswomen. Pelvic floor muscle training (PFMT) has shown potential in both prevention and management, yet its implementation in athletic training programs remains insufficient. The importance of pelvic floor health should be recognized to ensure long-term well-being and athletic performance of the female athletes.

Future research should expand beyond UI to explore the impact of sports on anorectal dysfunction, POP, and sexual health. A multidisciplinary approach integrating sports medicine, physiotherapy, and gynecology is essential for developing evidence-based guidelines that support female athletes in maintaining both pelvic health and athletic success.

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