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The Impact of Sport and Physical Activity on Urinary Incontinence: Does Exercise Act as a Protective Factor or Increase Risk?

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Abstract

Introduction: Urinary incontinence is a health problem which affects women more often. The condition manifests itself as uncontrolled urine leakage. A basic distinction is made between stress urinary incontinence (SUI), urgency urinary incontinence (UUI), and mixed urinary incontinence (MUI). Physical activity is commonly used in the treatment of UI.

Interestingly, numerous studies show that athletes and especially female athletes are more likely to develop UI. In this study, we will try to answer the question of whether sport and physical activity have a protective effect or are a risk factor for the development of UI. In this review, we will focus on sports and physical activity that does not directly target pelvic floor muscle training.

Aim of the study: A review of the literature on the impact of sport and physical activity on the prevalence of urinary incontinence in both sexes in different age groups and different health and fitness statuses.

Materials and methods: A review of the recent literature available in PubMed and Google Scholar databases was conducted, using keywords such as 'urinary incontinence', 'stress urinary incontinence', 'prostatectomy". This review was enriched by urological guidelines on urinary incontinence.

Conclusion: Urinary incontinence is a common ailment, especially among women. Particularly at risk are those who participate in high-intensity sports and do prolonged training, performing exercises such as jumping and sprinting. On the other hand, limited physical mobility is also a risk factor for incontinence. Keeping active in seniors can reduce symptoms. Exercises with positive effects include Pilates, which has very good efficacy in men after total prostatectomy surgery. Physical activity may also help to reduce body weight, as obesity is a recognised risk factor for urinary incontinence. Further research into the therapeutic use of exercises such as yoga and Pilates is warranted and may help treat patients with incontinence.

Keywords: urinary incontinence, stress urinary incontinence, prostatectomy

Introduction

Urinary incontinence (UI) is included in the group of Lower Urinary Tract Symptoms, in short LUTS. A basic distinction is made between 3 types of UI - stress urinary incontinence (SUI), urge urinary incontinence (UUI) and mixed urinary incontinence (MUI) [1,2]. In addition to the basic division, overflow incontinence and others can be distinguished [2]. SUI is caused by an increase in abdominal pressure, which occurs e.g. during exercise, coughing. It also occurs with urethral sphincter insufficiency and urethral hypermobility. Urethral sphincter dysfunction is a complication that patients experience after radical prostatectomy surgery [2,3]. In the course of UUI, the patient experiences a strong urge to micturate before urine leakage, which is often seen in patients with an overactive bladder. The aetiopathogenesis of MUI involves a combination of the inducing factors of SUI and, in addition, an overactive bladder. Women are more at risk of developing UI, especially women who have been pregnant and given birth. Vaginal delivery carries an approximately twice greater risk of developing UI than caesarean section. Other risk factors include older age, obesity, menopause, smoking, surgery and radiotherapy to the pelvis and perineal area, trauma, neurological diseases (e.g. multiple sclerosis), taking diuretics, constipation, and chronic cough [2,4]. The treatment of UI includes interventions such as weight reduction, pelvic floor muscle exercises, pharmacological treatment and surgical treatment (e.g. sling surgery) [2].

Methodology

The review was based on publications available in PubMed and Google Scholar databases. A literature search was performed using keywords such as 'urinary incontinence', 'stress urinary incontinence', 'prostatectomy'. The focus was on large sample studies and meta-analyses. Current medical literature and urology guidelines were also used.

The focus of this publication is on sport and physical activity that is not directly related to physiotherapeutic exercise of the pelvic floor muscles.

Professional athletes

A meta-analysis of the prevalence of UI among female athletes calculated that 36.1 % of them suffer from UI, which is obviously a very large group. The risk of UI among female athletes was 2.77 times higher than among women with a sedentary lifestyle [5].

Female rugby players

Among Canadian female university rugby players, 54% of the female athletes in the study declared UI, most commonly of the SUI type. Longer training sessions were a risk factor - it was calculated that each one extra hour increased the risk of UI by 15.3%. Surprisingly, only 18% of female athletes were motivated to undertake UI therapy, suggesting that urine leakage is not a problem for female athletes [6]. In another study on female rugby players, the prevalence of SUI was assessed in this group 63% of the players declared UI, while up to 88% had UI symptoms as shown by the Urinary Distress Inventory Short Form (UDI-6). A higher BMI, postpartum status and constipation were predictive of SUI among female players. In addition, female athletes playing in the forward position had a higher risk of SUI (OR=1.97, 95% CI 1.29-3.01) [7]. Female rugby players are a group of female athletes who are at risk of developing UI, particularly SUI [6,7].

Women weightlifters

Among female weightlifters, 54.1 % experienced UI. Predisposing factors in this group included higher BMI, history of pregnancy, depressive disorders, previous participation in high-impact sports (e.g. football). The greatest number of UI symptoms were associated with the performance of squats and clean and jerk, which is probably related to the pelvic muscle loading in these exercises [8]. In another study on female weightlifters, 36.6 % of women had ever experienced UI and 31.9 % had symptoms in the past 3 months. Risk factors for UI in this study were a higher number of past births and older age. Squats were also an exercise that predisposed to urine leakage [9]. Weightlifting is a sport in which a large percentage of women have complaints of UI [8,9].

Cross fit

In a large international survey of female Cross Fit trainers, it was found that 46% had ever had UI and 41.8% had symptoms in the past 3 months. 38.3% of the female trainers had symptoms of UI while exercising in workouts or during competitions. Urine leakage was most

commonly associated with activities such as running and jumping. High number of repeats also influenced the occurrence of leakage [10]. An interesting study was conducted in Brazil, during the COVID-19 pandemic and post-pandemic period.
Women who took part in the experiment before and during the pandemic outbreak regularly trained CrossFit. Before the pandemic and quarantine period, 32% reported experiencing UI, whereas during the pandemic only 14% had UI symptoms (OR = 0.32, $p < 0.001$). Women who experienced symptom alleviation were most likely to declare that they reduced the amount of exercise and stopped rope training. The study suggests that reducing the intensity of workouts may be helpful in managing UI symptoms [11]. A meta-analysis of the prevalence of incontinence among female CrossFit trainers was conducted, according to which UI among these women was 32.1% (95% CI = 22.2-43.8%, n = 2187), while the prevalence of SUI was 35.8% (95% CI = 19.4-56.4%, n = 1323). Exercises identified as predisposing to urine leakage were jumping including those using a rope and weightlifting. Other factors considered to increase the risk of urinary incontinence included delivery (especially vaginal births) and older age [12].

High-impact sports athletes
High-impact sports are activities that expose the body to stresses and strains. Examples of such sports include athletics, volleyball, basketball and football. In a study evaluating the influence of high-impact sports on urinary incontinence in women , up to 70% of the women tested experienced urinary leakage, of which 23% suffered from SUI, 23% from UUI and 54% had symptoms of MUI. The sport with the highest frequency was judo, followed by athletics [13]. Among women performing various exercises classified as high impact, it was shown that 14.3% of the 503 participants in the study had UI with the vast majority having SUI, less frequently MUI. It was found that women suffering from urinary leakage presented a higher level of physical activity and their workouts were for a longer period of time [14]. In the group of women performing high impact exercise at the gym, 24.6% had urine leakage during physical activity, compared to the control group where only 14.3% of women reported such complaints ($p = 0.006$). Female participants declared that jumping was the exercise that most influenced the appearance of urine leakage [15].
The researchers checked the frequency of IU in female athletes training in athletics, basketball and indoor football. They found that IU was a common problem, as it occurred in 41.5 per cent of female athletes with a similar frequency across all sports studied [16]. Another study of 278 professional female athletes training at a high intensity, fulfilling the criteria of a minimum of 3,000 MET-minutes per week, showed that women training in volleyball, athletics and handball had the highest incidence of SUI [17]. In an Irish study on women playing professional Gaelic sports such as camogie and Gaelic football, 61.6% of 159 female athletes reported symptoms of IU. Women with a history of childbirth and relatively more time devoted to sport were at risk of IU. Jumping and the sprint were reported to be the activities that triggered IU symptoms [18]. Surprisingly, despite this high prevalence of IU, women did not search for medical help and did not consult a medical doctor about the problem [16,18]. Among rope-skipping athletes of male and female athletes over 13 years of age, it was found from a questionnaire survey that 75% of active female athletes and only 7%

of male athletes had symptoms of SUI. Despite this high prevalence of UI among this group of athletes, retired athletes very rarely gave up skipping for this reason. This study once again showed that athletes, despite having a UI problem, do not look for medical help. This may suggest poor education of coaches and athletes in the context of urinary tract health or poor access to specialists [19].
In a study on a group of Spanish male and female athletes. UI was present in 51.7% of women in whom SUI predominated and 18.8% of men, who were more likely to suffer from UUI. Females had the highest risk of UI when performing horizontal jumps (OR = 5.238, p = 0.040), practising middle-distance running (OR = 4.138, p = 0.033) and obstacle running (OR = 4.359, p = 0.043). Importantly, performing vertical jumps (e.g. high jump) was associated with a lower risk of UI [20]. In Portuguese female football players, it was examined whether the structure and biomechanical characteristics of the pubovisceral muscles influence the occurrence of urinary leakage. It was found that female players with UI had thicker pubovisceral muscles compared to the control group, but no difference in the strength of contraction of these muscles was observed between the groups. Due to the small study group, this issue requires further research [21].

Other types of training and sports

A study was conducted to determine what number of women attending fitness classes and gyms had stress urinary incontinence (SUI). It was found that up to 49.3 % of the women presented symptoms of stress urinary incontinence for example during exercise. Women with SUI used interventions such as micturition before or during exercise or using pads accordingly. It is worrying that only less than half of the participants acknowledged that the trainer paid attention to the activation of the pelvic floor muscles during training, but 47.2 % learned to perform such exercises from a physiotherapist. The group of women exercising in a fitness or gym requires much attention due to the very high prevalence of UI in this community [22]. In a study on Norwegian male and female fitness coaches, using the International Consultation on Incontinence Questionnaire - Urinary Incontinence short form (ICIQ-UI SF), 26.4 % of female coaches had symptoms of UI compared to only 2 % of male coaches reporting this symptom. Factors that increased the risk of UI in women included older age, longer work activity, lack of oral contraceptive use and participation in resistance sports (e.g. running). The high incidence of incontinence among women in this occupational group should result in better education regarding prevention and treatment options, e.g. during refresher courses for professional trainers [23].

Postmenopausal women

Postmenopausal women were investigated to see whether physical activity and body weight affect the incidence of UI. The study was called EXERNET and was conducted by Spanish researchers. A large sample of 471 women who completed the International Consultation on Incontinence Questionnaire - Short Form (ICIQ-SF) was collected and it was found that 28.5 % of them suffered from UI. There were more cases of women with UI in the obese group (especially those with abdominal obesity) with a high percentage of fat. Additionally, women with UI had lower physical fitness status and lower upper body flexibility. This

suggests that obesity and a high percentage of body fat are a predisposing factor for the development of UI [24]. In another study, postmenopausal women who had physical activity ≥30 MET-hours/week had a 16% lower risk of developing urinary incontinence than women who had low physical activity of <0.1 MET-hours per week.

For mixed incontinence, the risk was reduced by 34%. Walking at an intensity of ≥10.4 MET-hours/week showed sensational effects, as it reduced the risk of urge incontinence by 13% and the risk of mixed incontinence by 36%, compared to women who did not walk. Attention to physical activity is very important in this age group [25]. A very interesting study was published by Chinese researchers who investigated whether post-menopausal women performing rhumba dancing and doing breathing training would alleviate SUI symptoms. They found that the 16-week programme resulted in a reduction in the intensity of urinary leakage, increased pelvic floor muscle strength and improved quality of life among the women who underwent the intervention [26].

Urinary incontinence in a population of young women

Among physically active women aged 14 to 33 years, the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF) survey was conducted, which showed that 19.9 per cent of women had complaints of UI with the majority being SUI. The highest incidence of UI was among women training competitively in sport with a 2.53 times higher risk of UI compared to women considered not physically active. Heavy sports training probably has an adverse effect on urinary physiology [27]. In an Australian long-term study on young women, where two cohorts of women aged 22-27 were compared, the first cohort was studied in 1996 and 2000, while the second cohort was studied in 2013 and 2017. In both cohorts, there was a higher incidence of UI in the second study, but definitely more cases of UI were in the second cohort - it was already higher in the first study and scored a greater increase in UI in the second study compared to the first cohort. In addition, it was observed that in the second cohort, physical exercise correlated with a lower risk of urinary leakage. A higher BMI was shown to predispose to UI [28]. In a study on young childless women, the effect of physical activity on UI was tested. 22.9% of female participants reported symptoms of UI, of which more than 60% were SUI. It was shown that high-impact sports were associated with a higher risk of UI than low-intensity sports and the amount of urine leakage was related to the number of training hours (increasing leakage as training hours increased). This shows that high-intensity, long-lasting training puts women at risk of developing UI [29]. Among women participating in recreational sports only, 14.9% had symptoms of SUI. They had a higher mean BMI than participants without the condition and more of the women with UI had given birth (29% vs 10.2%, $p < 0.0001$). Sports with the highest risk of development included athletics and basketball. Also in this analysed group of young menstruating women, only 10% with UI had taken an intervention to reduce symptoms [30].

Pregnant women and the perinatal period

Pregnancy and childbirth are known risk factors for UI. For this reason, this is the group that should be particularly targeted for risk minimisation interventions.

A meta-analysis examined the effects of physical activity and sport on urinary incontinence in a population of pregnant women and women in the perinatal period. The analysis did not include pelvic floor muscle training, only activities such as walking, recreational exercise, running, cycling, weight training, aerobics and swimming. Finally, the effect of physical activity on urinary incontinence in pregnant and perimenopausal women was not proven [31]. Another meta-analysis showed that exercise had little effect on urinary incontinence during pregnancy, whereas regular Kegel exercises to strengthen the pelvic floor muscles had a positive effect on symptoms in the postnatal period. Aerobic exercise, strength training and functional training had no clear benefit [32]. Researchers conducted a study on whether Pilates training to prepare women for childbirth also affected incontinence. In the study on a group of 126 primiparas, a division was made between a group doing Pilates twice a week for eight weeks and a group that had no additional intervention implemented. In addition to a higher percentage of successful natural deliveries in the Pilates-trained group compared to the control group (80.6% vs. 45.8%), the Pilates group was found to have statistically significantly fewer symptoms of Stress Urinary Incontinence (SUI) and Urge Urinary Incontinence (UUI), as measured with the Michigan Incontinence Severity Index (M-ISI) scale. At the end of the 8-week experiment, the median score on this scale for the Pilates group for SUI was 2 and for the control group 23, while for UUI for the experimental group the median score was 0 and for the control group 7, with statistical significance. Improvement was also maintained in the postpartum period, indicating the effectiveness of Pilates exercise in reducing SUI and UUI symptoms [33]. In the clinical trial, the Birth Preparation Programme (BPP) was implemented in the patients, which consisted of the implementation of physical exercises (mainly stretching, pelvic floor muscle exercises and back muscle exercises), health education and regular meetings. There was a reduction in incontinence complaints in the experimental group and the frequency of UI was 41% at the final assessment (68% in the control group). The above data show that the implementation of BPP was beneficial in relieving incontinence symptoms [34].

Urinary incontinence in nursing home residents

Urinary incontinence is a common problem among older people. A multicentre study that investigated the effect of mobility on incontinence in nursing homes residents found that 70.3% of participants had incontinence. Patients with limited mobility were in the risk group for UI. It was also shown that assisting with equipment such as a wheelchair, cane, walker, etc. reduces the risk of UI, demonstrating that maintaining patient mobility is an important therapeutic goal in UI therapy [35]. The effect of mobility on incontinence was also analysed on women who were administered the ‘Incondition’ exercise plan, lasting 22 weeks, which consisted of a weekly exercise session of one hour and the exercises included in it were supposed to improve the mobility of the seniors and strengthen the pelvic floor muscles. Unfortunately, the programme used did not result in a statistically significant improvement in incontinence complaints [36]. In a Norwegian study on nursing home residents, it was found that individually tailored exercises combined with activities of daily living training reduced incontinence symptoms compared with the control group, where there was even a worsening

of symptoms; after 3 months, the mean difference in urine volume was 191g (P = 0.03), showing that the applied intervention had a statistically significant benefit [37].

Urinary incontinence in the elderly population

Among elderly women suffering from stress urinary incontinence and mixed urinary incontinence, no relationship was found between physical activity and the occurrence of complaints. However, it was noted that women with frequent urinary incontinence symptoms were less physically active than patients who had less often urine leakage [38].

In a Japanese study, seniors suffering from IU also performed less physical activity than those without the condition [39]. The above data show that IU reduces physical activity in seniors, which may have further consequences for their functioning and health [38,39]. In a study of physically active elderly women aged 60 to 88 years who performed regular physical activity (e.g. gymnastics, dancing), 54.7 % had symptoms of IU. This shows that even physically active seniors have problems with IU. Women with disorders such as imbalance, dizziness and nocturia had a higher risk of IU [40]. Among the Latino population over 60 years of age who participated in the Caminemos programme, which aimed to encourage seniors to do walking as a form of exercise, it was shown that a higher number of steps taken was associated with a lower risk of IU (but statistical significance was not shown after accounting for other factors). Improved physical fitness as assessed by the Short Physical Performance Battery (SPPB) test resulted in an approximately 31% reduction in the risk of UI (OR = 0.69; 95% CI: 0.50-0.95) one year after the start of the study [41]. An interesting study was conducted to assess whether regular physical activity among middle-aged women is related to the onset of UI symptoms. Women who were counted among the most physically active had a 20% lower risk of developing IU symptoms at least once a month than women in the lowest activity group (RR = 0.80; 95% CI 0.72-0.89). Women who had low-intensity exercise also had a lower risk of IU, demonstrating that even moderate and low-intensity physical activity is protective of IU among middle-aged women [42]. One of the supportive treatment options studied was a therapeutic yoga programme in middle-aged and older women with UI. The programme lasted three months and consisted of two 90-minute group meetings and one hour of independent home exercise per week. The control group had stretching exercises without pelvic impact implemented at the same training intervals. The women practising yoga achieved a mean reduction in UI of 76%, compared with 56% in the control group, and stress urinary incontinence decreased by 61% and 35% in favour of yoga, indicating that further research into the use of yoga-based exercises in the treatment of UI is merited [43].

Pilates training in patients with urinary incontinence after prostatectomy

The use of Pilates training has been previously discussed in the context of pregnant women [33]. Another group in which these exercises were used were men after total prostatectomy surgery with urinary incontinence. The researchers compared the effectiveness of Pelvic Floor Muscle Exercises (PFME) with Pilates exercises in alleviating UI. The study group trained Pilates once a week for 45 minutes for 10 weeks, while another group performed PFME and used Anal Electrical Stimulation (AES). The control group did no exercise and had no other interventions implemented. Very promising results were obtained, as the Pilates exercise

group reported a decrease in the average weight of sanitary pads from 223.42 g (±23.8) to 97.65 g (±20.35) ($P < 0.001$) and 57.7 % of the Pilates group discontinued the use of sanitary pads after the intervention ($P < 0.05$). The Pilates exercise plan proved to be as effective as the use of PFME and AES and both groups recorded much better results than the control group [44]. A similar study was conducted comparing Pilates with the traditionally used Pelvic Floor Muscle Training (PFMT) in combination with AES. In this case, there was also no difference in results between the Pilates training group and PFMT and additionally AES, indicating that both methods can be used in rehabilitation after prostatectomy [45].
An experiment was conducted to test the addition of Pilates and Hypopressives (a type of exercise that reduces intra-abdominal pressure) to the standard PFME exercise regimen and found to have significant benefits. The group with combined training (PFME, Pilates, Hypopressives) had fewer episodes of urinary leakage compared to the group using PFME alone, indicating that it makes sense to combine these interventions [46]. Another study on men undergoing radical prostatectomy found no association of preoperative or postoperative physical activity on the incidence of UI [47].

Conclusion

Urinary incontinence (UI) is a very common condition, especially among women. UI is of interest to many researchers, as there have been many studies and meta-analyses on this topic in the last 10 years. Physical activity and exercise can be helpful in reducing the symptoms of UI, but intense training with a lot of jumping can be an inducer of UI, which is clearly seen among female athletes training CrossFit and rope-skipping. The greatest risk applies to high impact sports, which expose the body to impact and stress. Women training in demanding physical activities such as CrossFit, rugby and weightlifting were more likely to have UI disorders than women who did not play sports or who played sports at a lower intensity. Surprisingly, a large proportion of women suffering from UI do not seek medical help for their complaints. The reasons for this are not known. This may be due to ignoring the health problem or to difficult access to urologists or urogynaecological physiotherapists or other specialists dealing with incontinence. An intervention with very good results was Pilates training. These exercises were safe in a group of pregnant women and showed great effectiveness in men with UI after radical prostatectomy. In the future, there should be more research on the effects of Pilates exercises on patients with UI, especially about their long term effects. Most of the published studies are based on short-term implementation of exercise programmes, but the effects are good enough to be worth leading. Given the very high incidence of UI among professional athletes, the emphasis should be on finding methods of prevention, rapid diagnosis and early physiotherapy.
Importantly, there should be increased awareness and knowledge of UI among sports people, especially professional athletes and their coaches. As the study indicates, coaches do not pay attention to this problem among their charges, which may be due to poor education about urogynaecological conditions in the professional group of personal trainers.
Another important finding is that maintaining mobility and physical activity among seniors is very important to reduce the severity of urinary leakage complaints. An example of a workout that may carry benefits in a group of postmenopausal women is therapeutic yoga.

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Author's contribution:

Conceptualization: Anita Ptak, Michał Szyc
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Software: Michał Szyc
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