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Evaluation of the quality of life and the incidence of stress urinary incontinence in nulliparous women training selected sports: a cross-sectional survey pilot study

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Abstract

Introduction. The number of women suffering from urinary incontinence is increasing every year. The most common type of this condition is stress urinary incontinence. Involuntary leakage of urine occurs when sneezing, coughing, laughing, and standing up, as well as during physical activity. The problem of urinary incontinence is very embarrassing for athletes and affects their sports performance. The aim of the study was to assess the occurrence of urinary incontinence symptoms in women regularly training in selected sports.

Methods. 64 women athletes were selected for the study. This pilot study involved women training in athletics (short-distance running, long-distance running, hurdles and jumping (high jump, long jump, triple jump, pole vault), basketball, volleyball, or strength sports). Women were selected based on sample size calculation from those training in specified clubs. Women who had given birth were excluded from the study. The subjects completed a proprietary questionnaire consisting of 8 questions. They also completed the Urinary Distress Inventory, Short Form (UDI-6SF) questionnaire and the Incontinence Impact Questionnaire, Short Form (IIQ-7).

Results. In this study, 43% of women who trained had symptoms of urinary incontinence. Regression analysis results with UDI-6SF and IIQ-7 total scores as dependent variables and age as an independent variable showed that the slopes of regression were not statistically significantly different (p-value > 0.05). The results of the analysis of the correlation between SUI (stress urinary incontinence) and age (p = 0.0247) and practiced sport (p = 0.0476) turned out to be statistically significant.

Conclusions. The type of sport practiced affects the occurrence of UI (urinary incontinence) symptoms in women. In this study, female athletes practicing strength sports had the greatest predisposition to the occurrence of UI symptoms. The occurrence of UI symptoms has little impact on the deterioration of the quality of life among women practicing selected sports.

Key words: SUI, quality of life, training selected sports

Introduction

Urinary incontinence (UI) is becoming an increasingly common social problem, especially in women. Until now, patients often underestimated their symptoms, did not report to the doctor, and did not tell anyone about their ailments. However, nowadays, the term UI is increasingly becoming a public topic that raises society's awareness about the possibility of treatment [1].

The most common type of UI is stress urinary incontinence (SUI). About 40–50% of women suffer from this type [2, 3]. Involuntary leakage of urine occurs during sneezing, coughing, laughing, and standing up, but also during physical activity (mainly when jumping and/or running) [4]. According to a study by Chisholm et al. [5], physically active women more often report the occurrence of SUI symptoms than those who do not practice sports regularly. The study involved nulliparous women who led an active lifestyle and additionally attended strength trainings. 24.6% of them reported having SUI. In the control group of inactive women, only 14.3% declared SUI symptoms. Another study by Bø [6] compared the incidence of SUI between women who trained professionally and those who did not practice any sport. It was observed that the training group was more at risk of urine leakage during physical activity. Middlekauff et al. [7] showed that as many as 27.7% of women regularly training cross-fit had symptoms of SUI, while in the control group not practicing this sport, it was only 8.6% of cases.

McKenzie et al. [8] showed that physical activity also increases the onset of symptoms in women who already have one risk factor for SUI (e.g., childbirth, pelvic surgery, urinary tract infections, etc.). As many as 49.3% of physically active women reported incidents of urine leakage.

A review of the literature shows that physical activity increases the risk of UI. It is caused by an increase in intra-abdominal pressure (IAP) during exercise. The pelvic floor of a person who trains intensively is constantly loaded by the pressure generated in the abdominal cavity with each jump or tension of the abdominal muscles. The pelvic floor, accepting the pressure force, returns it with the same value. A long and frequent stimulus overloads the muscles [9]. In addition, IAP puts pressure on the pelvic floor muscles (PFMs), stretch-

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ing the ligaments and fasciae. Often occurring strong pressure can lead to damage to the pelvic floor [10]. It has also been found that during regular physical activity, there is a risk of stretching the pudendal nerve, which innervates the urethral sphincter muscle. In the event of its damage, the sphincter will not function properly [11, 12].

The problem of UI is very embarrassing for athletes and affects their sports performance. In her study, Bø [13] showed that 84% of athletes have never discussed the problem with a coach, doctor, or psychologist, and even a small amount of urine leakage causes embarrassment. The occurrence of such ailments may reduce the level of physical fitness and psychological comfort of an athlete. Sports such as basketball, volleyball, track and field, and strength sports have one thing in common. During their practice, pressure in the abdominal cavity increases, which, with many repetitions strains on the pelvic floor, can result in urine leakage [13].

The aim of the study was to assess the occurrence of UI symptoms in women regularly training in selected sports.

It was hypothesized that women practicing selected sports experience symptoms of UI. In addition, the following research questions were posed:

1. Which of the assessed sports predisposes the most to the occurrence of UI symptoms?
2. Does the intensity of training affect the occurrence of UI symptoms?
3. Does training experience affect the occurrence of UI symptoms?
4. Does the occurrence of UI symptoms affect the quality of life of training women?

Subjects and methods

64 women who regularly practiced a selected sport were qualified for the study. The study involved women practicing athletics short-distance running (from 60 m to 400 m, $n = 7$), long-distance running (from 800 m, $n = 11$), hurdles (from 100 m to 400 m, $n = 6$), jumping [high jump, long jump, triple jump, pole vault, $n = 1$)], basketball ($n = 11$), volleyball ($n = 10$), or strength sports ($n = 15$). They belonged to a sports club or regularly participated in non-affiliated competitions. Women were qualified for the study based on the sample size calculation among all those training in the indicated clubs. The following parameters were taken into account when selecting the sample: confidence level 95%, fraction size 0.5, and maximum error 5%. Women training in sports clubs such as AZS AWF Wrocław athletics section, AZS Poznań athletics section, UKS Citronex Basket Zgorzelec, amateur volleyball group Pizza Party, and non-associated women training multiathlon and CrossFit participated in the study. All women exercising in specific clubs had equal opportunities to participate in the study. Random selection was used within a given club. Three women who gave birth were excluded from the study. Ultimately, the study group consisted of 61 people. The authors delimited the study to nulliparous women because pregnancy and childbirth are factors that may influence the occurrence of SUI symptoms, regardless of the sports discipline practiced. A group of women aged 18–40 years was examined. This study is a pilot study intended to demonstrate which sports discipline has the greatest impact on the occurrence of SUI symptoms. There are few articles in the available literature that provide detailed information on this subject. The small number of study participants was a significant limitation of this study. Nevertheless, the article is intended to indicate which sports disciplines are worth focusing on in future projects in the context of SUI.

The subjects completed a proprietary questionnaire consisting of 8 questions regarding the patient's age, the number of births, and the sport practiced (type of competition, intensity of training, duration of training, and training experience). They also completed the Urinary Distress Inventory, Short Form (UDI-6SF) questionnaire to diagnose the symptoms of UI. UDI-6 is more commonly employed than its lengthier counterpart, primarily due to its practicality. UDI-6 comprises six items: 1 – Frequent urination, 2 – Leakage associated with a sense of urgency, 3 – Leakage related to physical activity, 4 – Coughing or sneezing-induced small amounts of leakage (droplets), 5 – Difficulty in bladder emptying, and 6 – Pain or discomfort in the lower abdominal or genital region. Elevated scores on the UDI-6 scale signify increased disability, with the total score ranging from 0 to 100 [14, 15]. In the case of positive answers confirming the presence of UI, the subjects additionally completed the Incontinence Impact Questionnaire, Short Form (IIQ-7), to assess their quality of life. The IIQ-7 has attained a validation level of according to the ICI grading system. This questionnaire comprises seven items that address various aspects: 1 – Household chores, 2 – Physical recreation, 3 – Entertainment activities, 4 – Travel > 30 min away from home, 5 – Social activities, 6 – Emotional health (nervousness, depression, etc.), and 7 – Feeling frustrated. These items are further categorized into four domains: PA – physical activity (items 1 and 2), TR – travel (items 3 and 4), SA – social activities (item 5), and EH – emotional health (items 6 and 7). The total score on the IIQ-7 ranges from 0 to 100 [16]. The subjects' completed questionnaires were successfully translated and validated into Polish.

The results of the study were collected in an Excel spreadsheet and then statistically analyzed using Statistica 13. Arithmetic mean, standard deviation, minimum and maximum value, median, and coefficient of variation were calculated as part of primary descriptive characteristics for measurable properties. Initially, it was confirmed whether the distributions of the assessed variables were consistent with the normal distribution. Because there was no such agreement (Shapiro–Wilk test, p-value < 0.05), the statistical significance of differences between groups was verified using the Mann–Whitney U test. Spearman's rank correlation coefficient was used to determine the correlation between the groups. The significance level for all statistical tests was $p < 0.05$.

Results

The mean age of the women in the study group ($n = 61$) was 22 years. Table 1 provides total score information for the UDI-6SF and IIQ-7. Table 2 shows the distribution of answers to questions, categorized into two groups: under 18 years and 18–29 years.

Table 1. Total score of UDI-6SF and IIQ-7 for women in specific age groups

Score	*n*	Minimum score	Maximum score	Mean score	*SD*	VC (%)
UDI total score	61	0.00	100.00	16.39	25.68	156.68
IIQ total score	29	0.00	100.00	10.86	26.26	241.73

UDI-6SF – Urinary Distress Inventory, Short Form;
IIQ-7 – Incontinence Impact Questionnaire, Short Form,
VC – variation coefficient

Table 2. Total score of UDI-6SF and IIQ-7 for women in specific age groups

Score	Under 18 years	18–29 years	*p*-value	Effect size
UDI total score	19 0 (0–92.31) 13.36 (27.48)	42 7.69 (0–100) 17.77 (25.06)	0.0965	0.214 (small)
IIQ total score	5 0 (0–85) 19.00 (37.15)	24 0 (0–100) 9.17 (24.12)	0.397	0.164 (small)

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
Data are presented as number, median (range), and mean (*SD*).
Given *p*-values are from the Wilcoxon test for independent samples.

Table 3 presents the total scores obtained in the UDI-6SF and IIQ-7 questionnaires for women practicing specific sports disciplines. Statistically significant differences were found in the results of the UDI-6SF questionnaire between groups ($p = 0.0239$); however, post hoc analysis showed no significant differences. No statistically significant differences were found between the groups for IIQ-7.

The impact of weekly training frequency was also assessed (Table 4), as well as the duration of a single training session (Table 5), on the results obtained in the UDI and IIQ questionnaires. There were no statistically significant differences in these respects.

The obtained results showed a statistically significant difference ($p = 0.0161$) in terms of training experience. Responses from the UDI questionnaire showed that women who have been training for 5 or more years are more likely to suffer from

Table 3. Total score of UDI-6SF and IIQ-7 for women practicing specific sports

Score	Athletics	Basketball	Strength sports	Volleyball	*p*-value	Effect size
UDI total score	25 0 (0–23.08) 4.92 (8.85)	11 23.08 (0–92.31) 31.47 (33.79)	15 15.38 (0–100) 24.10 (29.05)	10 3.85 (0–92.31) 16.92 (29.41)	0.0239	0.113 (moderate)
IIQ total score	7 0 (0–0) 0 (0)	7 0 (0–60) 15 (31.23)	10 0 (0–60) 7 (18.89)	5 0 (0–100) 28 (43.82)	0.234	0.0222 (small)

UDI-6SF – Urinary Distress Inventory, Short Form; IIQ-7 – Incontinence Impact Questionnaire, Short Form
Data are presented as number, median (range), and mean (*SD*). Given *p*-values are from the Kruskal–Wallis test.

Table 4. Total score of UDI-6SF and IIQ-7 for women based on training frequency

Score	3–4 times a week	5–7 times a week	*p*-value	Effect size
UDI total score	49 0 (0–100) 16.95 (27.42)	12 7.69 (0–53.85) 14.10 (17.61)	0.687	0.0529 (small)
IIQ total score	22 0 (0–85) 9.77 (22.49)	7 0 (0–100) 14.29 (37.80)	0.659	0.0883 (small)

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
Data are presented as number, median (range), and mean (*SD*).
Given *p*-values are from the Wilcoxon test for independent samples.

Table 5. Total score of UDI-6SF and IIQ-7 based on the duration of a single training session

Score	1–2 hours a day	2–3 hours a day	*p*-value	Effect size
UDI total score	32 7.69 (0–92.31) 15.63 (25.13)	29 0 (0–100) 17.24 (26.70)	0.869	0.022 (small)
IIQ total score	17 0 (0–85) 7.94 (22.15)	12 0 (0–100) 15 (31.77)	0.360	0.175 (small)

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
Data are presented as number, median (range), and mean (*SD*).
Given *p*-values are from the Wilcoxon test for independent samples.

Table 6. Total score of UDI-6SF and IIQ-7 based on the duration of the training period

Score	Less than 5 years	5 or more years	*p*-value	Effect size
UDI total score	25 15.38 (0–100) 25.54 (30.10)	36 0 (0–92.31) 10.04 (20.21)	0.0161	0.309 (moderate)
IIQ total score	16 0 (0–85) 10.31 (24.93)	13 0 (0–100) 11.54 (28.82)	0.977	0.0109 (small)

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
Data are presented as number, median (range), and mean (*SD*).
Given *p*-values are from the Wilcoxon test for independent samples.

Table 7. Total score of UDI-6SF based on the presence of SUI symptoms

Score	Yes	No	*p*-value	Effect size
UDI total score	27 23.08 (7.69–100) 36.18 (27.97)	34 0 (0–15.38) 0.68 (2.91)	1.28×10^{-12}	0.910 (large)

UDI-6SF – Urinary Distress Inventory, Short Form
SUI – stress urinary incontinence
Data are presented as number, median (range), and mean (*SD*).
Given *p*-values are from the Wilcoxon test for independent samples.

UI symptoms than those who have been training for fewer years. There were no statistically significant differences in the correlation of training experience with the IIQ-7 questionnaire (Table 6).

Table 7 presents the results of the UDI-6SF in the entire study group of women. Out of 61 women, 27 indicated symptoms of UI (Table 7).

All Cronbach's alphas were statistically significant (p-value < 0.05). Cronbach's alphas differed significantly between questionnaires (p-value < 0.05) (Table 8).

Tables 9 and 10 show the regression analysis results with UDI-6SF and IIQ-7 total scores as dependent variables and age as an independent variable and training period. The slopes of the regression were not significantly different (p-value > 0.05).

Table 8. Cronbach's alpha values for UDI-6SF and IIQ-7

Score	Cronbach's alpha	95% CI
UDI-6SF	0.597	(0.429; 0.693)
IIQ-7	0.995	(0.991; 0.997)

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
CI – confidence interval

Table 9. Regression analysis results with UDI-6SF and IIQ-7 total scores as dependent variables and age as independent variable

Score	UDI	IIQ
Intercept (p-value)	4.324 (0.800)	15.025 (0.629)
Age (p-value) 95% CI	0.547 (0.472) (–0.967; 2.062)	–0.181 (0.892) (–2.893; 2.531)
R^2	0.008787	0.0006962

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
CI – confidence interval
Regression slopes did not differ significantly (p-value > 0.05).

Table 10. Regression analysis results with UDI-6SF and IIQ-7 total scores as dependent variables and training period as independent variable

Score	UDI	IIQ
Intercept (p-value)	25.507 (0.0101)	1.549 (0.900)
Training period (p-value) 95% CI	–1.847 (0.316) (–5.501; 1.807)	1.943 (0.411) (–2.831; 6.717)
R^2	0.01704	0.02518

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
CI – confidence interval
Regression slopes did not differ significantly (p-value > 0.05).

Table 11 shows the analysis of the occurrence of UI depending on different classification criteria. The results of the analysis of the correlation between SUI and age (p = 0.0247) and practiced sport (p = 0.0476) were statistically significant. Post hoc analysis did not identify statistically significant differences between the groups designated for practiced sports disciplines.

Table 12 shows the correlation analysis of questionnaires within the considered groups. In the case of groups designated by sports discipline, 97.5% confidence intervals were established. It was not possible to determine the correlation coefficient in the group of women practicing athletics due to the zero variability of UDI-6SF total score. The determined correlation coefficients did not differ significantly between the groups.

Table 11. Number of women groups diagnosed with SUI based on age, sports discipline, training frequency, duration of a single training session, and duration of training period

Score		SUI		p-value
		yes	no	
Age (years)	under 18	4	15	0.0247
	18–29	23	19	
Discipline	athletics	6	19	0.0476
	basketball	6	5	
	strength sports	10	5	
	volleyball	5	5	
Training frequency	3–4	21	28	0.751
	5–7	6	6	
Duration of a single training session (hours a day)	1–2	16	16	0.441
	2–3	11	18	
Duration of training period (years)	less than 5	15	10	0.0657
	5 or more	12	24	

UI – urinary incontinence, SUI – stress urinary incontinence
Data are presented as subgroup size.
Given p-values are from Fisher's exact test.

Table 12. Correlation analysis of UDI-6SF and IIQ-7 total scores within specified groups

Score		Correlation		p-value
		coefficient	CI	
Full dataset		0.294	(–0.081; 0.596)	0.1219
Age (years)	under 18	–0.594	(–0.969; 0.606)	0.2911
	18–29	0.551	(0.189; 0.781)	0.005297
Discipline	athletics	–	–	–
	basketball	–0.454	(–0.923; 0.559)	0.3065
	strength sports	0.835	(0.341; 0.967)	0.002667
	volleyball	0.455	(–0.798; 0.969)	0.4409
Training frequency	3–4	0.345	(–0.089; 0.669)	0.1155
	5–7	0.373	(–0.528; 0.879)	0.4093
Duration of a single training session (hours a day)	1–2	0.172	(–0.336; 0.603)	0.508
	2–3	0.394	(–0.232; 0.789)	0.205
Duration of training period (years)	less than 5	0.188	(–0.340; 0.625)	0.4865
	5 or more	0.458	(–0.124; 0.806)	0.1154

UDI-6SF – Urinary Distress Inventory, Short Form
IIQ-7 – Incontinence Impact Questionnaire, Short Form
CI – confidence interval

Discussion

In this study, 43% of training women had symptoms of UI. This result is comparable to research on the occurrence of UI in physically active young women presented by other researchers [17]. The most complaints were found in the group of women practicing strength sports, followed by the groups of basketball and volleyball players. In these groups, more than half of women complain about UI. The occurrence of SUI in women practicing strength sports was also demonstrated by Wikander et al. [18]. Their results showed that 46% of women practicing this type of sport have symptoms of UI. The increased number of women with SUI symptoms in the strength sports group can be explained by the nature of the exercises performed. This discipline is dominated by isometric or dynamic exercises with heavy loads. This causes a sudden increase in IAP that lasts for a long time. The study by Hagovska et al. [19] showed that volleyball players also have an increased risk of UI. In both basketball and volleyball, most of the training is dynamic without load, but many repetitions of jumps and landings cause an increase in abdominal pressure. This is confirmed by the Dias study, which showed that many jumps performed have an impact on the incidence of UI [20]. Bø and Nygaard [21], in their narrative review, tried to summarize the current state of knowledge about whether physical activity is good or bad for the female PFM. They concluded that exercising women generally had similar or greater PFM strength and larger levator ani muscles than non-exercising women, but this did not appear to be associated with a greater risk of difficult labor. Moreover, according to the authors, mild to moderate physical activity reduces the risk of UI, but athletes are approximately three times more likely to develop UI compared to the control group. Both exercise-related IAP and PFM strength vary by activity and gender; thus, the threshold for optimal or negative impact on the pelvic floor almost certainly varies from person to person [21]. In our study group, the smallest number of women with symptoms of UI was found in the group of female athletes. This can be justified by the fact that athletics is a dynamic discipline, with exercises with lower loads, and training units in the gym are less often used than in strength sports. It is interesting that among the surveyed women with symptoms of UI, a small percentage of them complained of the deterioration of the quality of life. Despite this, these women believe that this affects the psycho-social sphere in particular. This indicates the importance of the problem and the need for further research but with a larger number of subjects and an expanded number of sports disciplines.

Conclusions

1. The type of sport practiced affects the occurrence of UI symptoms in women. Female athletes practicing strength sports have the greatest predisposition to the occurrence of UI symptoms.

2. Training intensity does not affect the occurrence of UI symptoms in the women studied.

3. Training experience has an impact on the occurrence of UI symptoms among women practicing athletics or strength sports. In the athletics group, UI symptoms become more frequent with greater training experience. Conversely, novice players in the strength sports group have a higher risk of developing symptoms.

4. The occurrence of UI symptoms has minimal impact on the deterioration of quality of life among women practicing selected sports.

Strengths and weaknesses

Our paper had certain limitations. In particular, the results obtained by the authors were based on a relatively small number of women included in the study. However, it is worth emphasizing that this group was homogeneous in terms of age, place of residence, and fertility.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Bioethics Committee of the Medical University of Wrocław (approval No.: KB-806/2018).

Informed consent

Informed consent was obtained from all individuals included in this study. Before participating in the research, each participant provided written informed consent. For participants under the age of 18, additional consent was obtained from their parents or legal representatives to participate in the study.

Disclosure statement

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Conflict of interest

The authors state no conflict of interest.

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