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The effect of powerlifting on urinary incontinence in women

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Introduction Powerlifting is a strength sport that has recently gained popularity among women. It is associated with a high prevalence of stress urinary incontinence, which is known to negatively affect women's quality of life. Therefore, this study aimed to assess the effects of powerlifting on urinary incontinence not only during training but also in daily life. Furthermore, this study aimed to identify risk factors associated with stress urinary incontinence during powerlifting.

Material and methods This cross-sectional study used an anonymous 26-item online questionnaire. Participants were mainly recruited via social media. Responses from 1,072 female powerlifters were analyzed using SPSS.

Results After starting to perform powerlifting, women were 22.7 times more likely to experience stress urinary incontinence overall, 1.6 times more likely to experience stress urinary incontinence in daily life, and 5.2 times more likely to experience urgency urinary incontinence. Among those who experienced changes in the severity of symptoms in daily life after starting to perform powerlifting, a narrow majority indicated an improvement in symptoms. The lifetime prevalence of stress urinary incontinence during powerlifting was 67.3%, whereas the lifetime stress urinary incontinence prevalence in daily life was 31.7%. Risk factors for stress urinary incontinence during powerlifting were older age, years of powerlifting experience, vaginal birth, use of a lifting belt, deadlift stance, and one repetition maximum.

Conclusions While powerlifting appears to increase the risk of urinary incontinence in daily life, it also improves symptoms in some participants—likely those able to activate their pelvic floor during lifting.

Key Words: powerli ting ‹› stress urinary incontinence ‹› urgency urinary incontinence ‹› women ‹› daily life

INTRODUCTION

Powerlifting is a strength sport that has become more popular among women in the past few years. It consists of three lifts: squat, bench press, and deadlift. The aim of this sport is to perform these three lifts with as much weight as possible for one repetition. To achieve maximum force production, athletes perform the Valsalva maneuver, which leads to increased trunk stability by high intra-abdominal pressure [1]. Such an increase in intra-abdominal pressure is a known risk factor for urinary incontinence (UI), in particular for stress urinary incontinence (SUI) [2].

UI is a condition characterized by involuntary urine leakage and can be divided into different types. One of the most common types is SUI, which can be caused by poor pelvic support and an increase in intra-abdominal pressure caused for example by laughing or the Valsalva maneuver, leading to urinary leakage [2, 3]. UI negatively affects health-related quality of life, mental wellbeing, as well as sport performance [4–6].

SUI in female powerlifters is a well-known phenomenon in the powerlifting community [7]. Previous studies in this field show that the prevalence of SUI during training in female powerlifters and other female strength athletes ranges from 23.1%

to 59.1% [7–9]. To date, it is not known whether and how powerlifting affects the prevalence of UI in women's daily lives outside of powerlifting training.
Since powerlifting has become more popular in women and UI can negatively impact quality of life, it is important to investigate whether powerlifting influences the overall UI prevalence. Additionally, it is important to determine how SUI can be prevented to avoid the negative effects of UI.

Research aim

The aim of this study was to investigate the effects of powerlifting on UI in female powerlifting athletes as well as to identify associated risk factors.

MATERIAL AND METHODS

Study design

This research was a cross-sectional study based on an anonymous 26-item online questionnaire, which was tailored to collect information relevant to UI in powerlifting, presented in Table 1.

Data collection methods

The online questionnaire was available through Google Forms. Participants were recruited in two ways. First, participants competing in the powerlifting competition "Latvijas Universiāde" held in April 2024 in Valmiera, Latvia, were personally invited to participate in the online questionnaire. Second, participants were recruited through Instagram direct messages focusing on women who stated "powerlifter" in their Instagram biography or who posted content about powerlifting. Additionally, powerlifting coaches and organizations were invited via Instagram direct messages to share the online questionnaire. The questionnaire was open from April to June 2024.

Selection of participants

The inclusion criteria were being female, ≥18 years old, and practicing powerlifting. The exclusion criteria were contradictory answers. No geographical restrictions were imposed.

Data analysis

Statistical analyses were conducted using IBM SPSS Statistics Version 29.0.0.0 (241). The McNemar test was performed to assess statistically significant changes in SUI and urgency urinary incontinence (UUI) prevalence before and after starting powerlifting. To quantify these changes, paired odds ratios were calculated. To identify variables associated with SUI prevalence during powerlifting, chi-square tests of independence were performed. Variables that showed a statistically significant association were further analyzed using binary logistic regression to compare the odds of experiencing SUI between different groups using a reference category. A p-value <0.05 was considered statistically significant. 95% confidence intervals (CI) were calculated where applicable.

Bioethical standards

The online questionnaire was preceded by an introductory statement containing details about the study and information that participation in the study was voluntary and anonymous. The data were only used in aggregated form. The manner in which the questions were selected ensured that participants could not be identified. The study was approved by the Ethics Committee

Table 1. *Data collected from questionnaire*

Demographic variables	Age group
	Level of experience
	Weight class
Categorial variables	SUI before*
	SUI after* – including powerlifting
	SUI after* – excluding powerlifting
	UUI before*
	UUI after*
Independent variables	Childbirth history Vaginal delivery Cesarean delivery
	Use of a lifting belt
	Squat stance Narrow: hip width or less Medium: 1–2 times hip width Wide: 2 times or more hip width
	Deadlift stance Conventional deadlift Sumo deadlift
	Maximum load (1RM)
	Demographic variables (listed above)
Dependent variables	SUI prevalence in powerlifting
	SUI prevalence during squats
	SUI prevalence during deadlifts

* starting to perform powerlifting
SUI – stress urinary incontinence; UUI – urgency urinary incontinence; 1RM – one repetition maximum

for Research of the Faculty of Medicine at the University of Latvia (Approval No. 16-25/173).

RESULTS

Demographics

In total 1,082 participants completed the online survey. Of these, ten were eliminated due to contradictory responses, leaving 1,072 valid responses. The participants were from a diverse range of 57 countries. The majority of participants were from the UK (n = 233), followed by the USA (n = 190), Germany (n = 137), Australia (n = 72), New Zealand (n = 62) and Canada (n = 55).

The participants were from the age groups of 18–20 years up to 60+ years. The majority were in the age group 21–25 years (n = 351; 32.7%). In the older age groups, participation continuously declined. There was a variety of experience levels, ranging from <1 to 5+ years. The majority of participants had 1–2 years (n = 329; 31%) and >5 years of experience (n = 97; 18%). Furthermore, there were participants from all powerlifting weight classes. The number of participants increased with higher weight classes, peaking in the under 76 kg category (n = 218; 20%) before declining again in the heavier weight classes.

Prevalence of urinary incontinence

Out of the 1072 participants, 721 (67.3%; 95% CI: 64.5–70.1%) reported to have experienced SUI during powerlifting at least once. Forty-two (4%) had been diagnosed with UI by a doctor, half before and half after they started to perform powerlifting. The reported lifetime SUI prevalence was higher during deadlifts (n = 631; 58.9%; 95% CI: 55.9–61.8%) than during squats (n = 484; 45.2%; 95% CI: 42.2–48.1%), as illustrated in Figure 1.

Figure 2 displays lifetime prevalence of SUI and UUI before participants started to perform powerlifting and after. The lifetime prevalence of SUI, including during powerlifting, increased by 42.4 percentage points, whereas the lifetime prevalence during daily life outside of training increased by 4.5 percentage points. The lifetime prevalence of UUI increased by 5.1 percentage points.

Participants were 22.7 times more likely to experience any SUI after starting to perform powerlifting (OR = 22.67; 95% CI: 14.64–35.09; p <0.001) and 1.6 times more likely to experience SUI in daily life outside of training after starting powerlifting (OR = 1.60; 95% CI: 1.22–2.12; p <0.001). Additionally, they were approximately five times more likely to experience UUI after starting to perform powerlifting (OR = 5.23; 95% CI: 2.89–9.47; p <0.001).

Figure 3 illustrates subjective changes in UI severity during daily life among participants who had

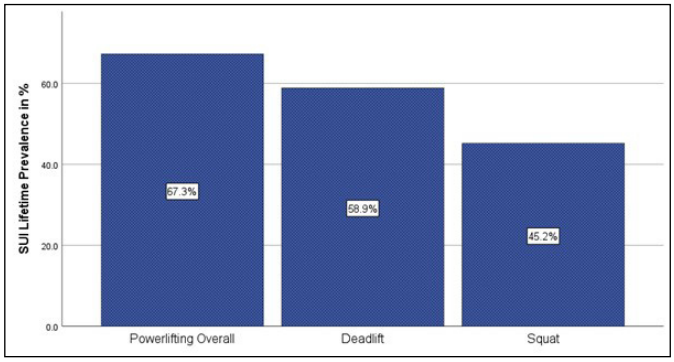

Figure 1. *Lifetime prevalence of SUI during powerlifting overall, for deadlifts and for squats.*

SUI – stress urinary incontinence

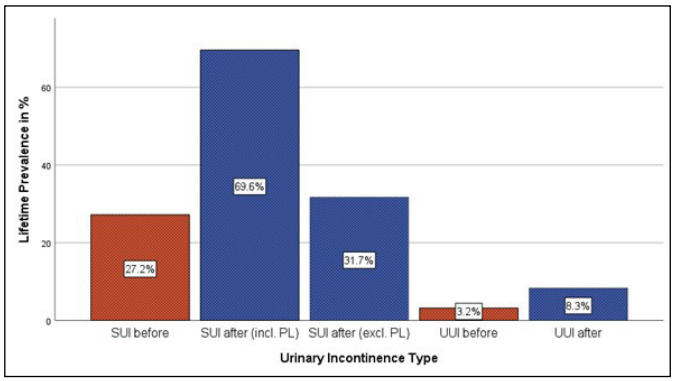

Figure 2. *Lifetime prevalence of different UI types before and after starting to perform powerlifting.*

PL – powerlifting; incl. – including; excl. – excluding; SUI – stress urinary incontinence, UUI – urgency urinary incontinence

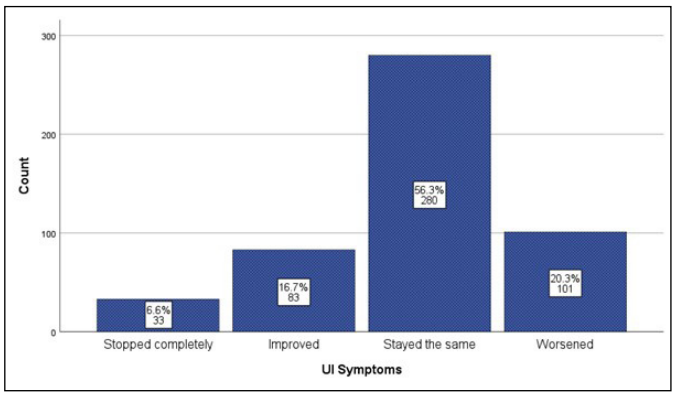

Figure 3. *Subjective changes in UI symptoms during daily life (excluding powerlifting) since starting powerlifting.*

UI – urinary incontinence

experienced UI at some point in their lives. A total of 23.3% of participants reported that their symptoms had either improved or stopped completely after starting powerlifting (95% CI: 19.6–27.0%), which is slightly higher than the proportion of those who reported worsening symptoms (20.3%; 95% CI: 16.8–23.8%).

Variables affecting SUI

Age groups

Age was a statistically significant predictor of SUI prevalence ($\chi^2(6) = 20.549$, $p = 0.002$). On average, the prevalence of SUI during powerlifting increased with age, as illustrated in Figure 4. However, this increase was not strictly linear. All age groups had statistically significantly higher odds of experiencing SUI symptoms compared to the youngest age group of 18–20-year-olds.

Level of experience

Level of experience, meaning for how many years the participants were already performing powerlifting, was a statistically significant predictor of SUI prevalence ($\chi^2(5) = 16.802$, $p = 0.005$). Participants with more experience were significantly more likely to experience SUI symptoms compared to those with less than one year of experience, as illustrated in Figure 5. The highest odds were observed in those with 3–4 years of experience (OR = 2.37, $p < 0.001$) and 4–5 years of experience (OR = 2.198, $p = 0.008$), compared to those with <1 year of experience.

Weight class

There was no statistically significant association between weight class and SUI prevalence in powerlifting ($\chi^2(7) = 5.780$, $p = 0.566$).

Childbirth history

Participants with a history of vaginal birth were twice as likely to experience SUI symptoms during powerlifting (95% CI: 1.28–3.38, $\chi^2(1) = 9.038$, $p = 0.003$). In contrast, participants with a history of caesarean delivery were not significantly more likely to experience SUI symptoms ($\chi^2(1) = 1.364$, $p = 0.243$).

Use of a lifting belt

Participants who used a lifting belt during squats were 3.4 times more likely to experience SUI during squats compared to those who did not use a lifting belt (95% CI: 1.56–7.47; $\chi^2(1, N = 1,070) = 10.531$, $p = 0.001$). Participants who wore a lifting belt during deadlifts were 2.1 times more likely to experience SUI symptoms during deadlifts compared to those who did not (95% CI: 1.15–3.93; $\chi^2(1, N = 1,070) = 6.052$, $p = 0.014$).

Stance

Regarding stance, a statistically significant association was only found between deadlift stances and SUI prevalence during deadlifts ($\chi^2(1) = 14.914$, $p < 0.001$) but not between squat stance and SUI prevalence during squats ($\chi^2(2) = 2.111$, $p = 0.348$). Participants using the sumo stance were 1.64 times more likely to experience SUI during deadlifts compared to those using the conventional stance (95% CI: 1.27–2.11), $p < 0.001$).

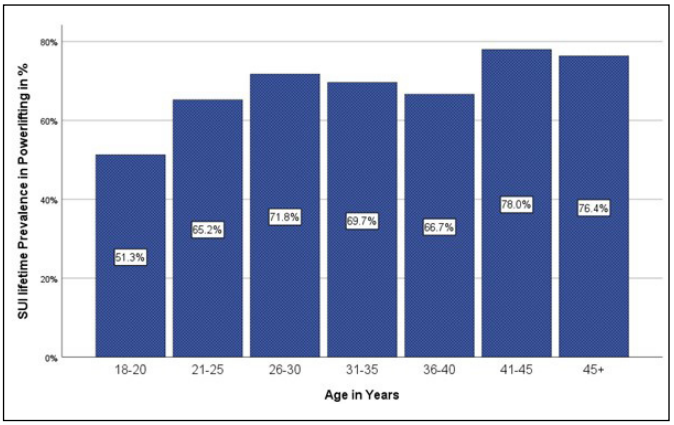

Figure 4. *Lifetime prevalence of SUI during powerlifting stratified by age group.*
SUI – stress urinary incontinence

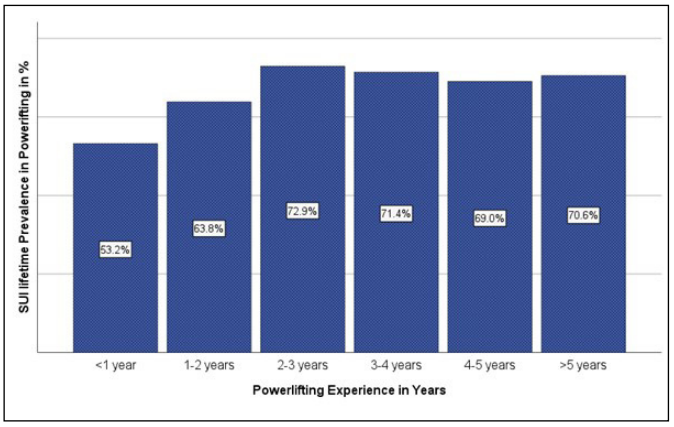

Figure 5. *Lifetime prevalence of SUI during powerlifting stratified by powerlifting experience in years.*
SUI – stress urinary incontinence

Maximum load

There was a statistically significant association between SUI prevalence and 1RM for both squats ($\chi^2(7) = 33.780$, $p < 0.001$) and deadlifts ($\chi^2(6) = 45.074$, $p < 0.001$). In both lifts, the SUI prevalence increased with higher 1RM, as illustrated in Figures 6 and 7.

DISCUSSION

This study primarily aimed to investigate the effects of powerlifting on lifetime prevalence of UI in female powerlifting athletes. The results indicated that women were more likely to experience SUI and UUI after starting to perform powerlifting. The lifetime prevalence of SUI during powerlifting training was 67.3%, and was significantly associated with age group, years of powerlifting experience, vaginal birth, wearing a lifting belt, deadlift stance, and 1RM. In contrast, it was not associated with squat stance, weight class, or history of cesarean delivery.

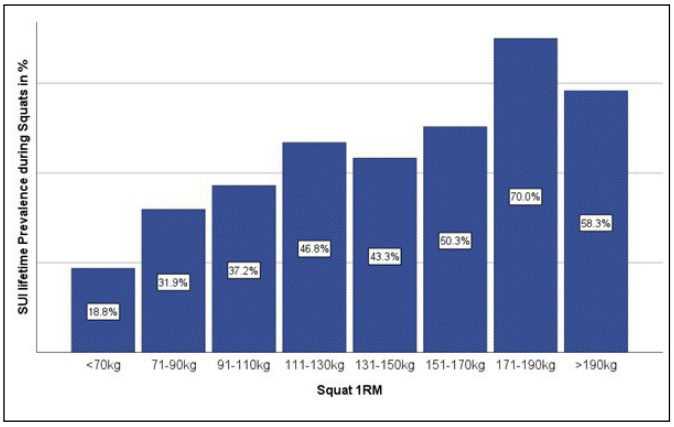

Figure 6. *Lifetime prevalence of SUI during squats stratified by squat 1RM.*

SUI – stress urinary incontinence; 1RM – 1 repetition maximum

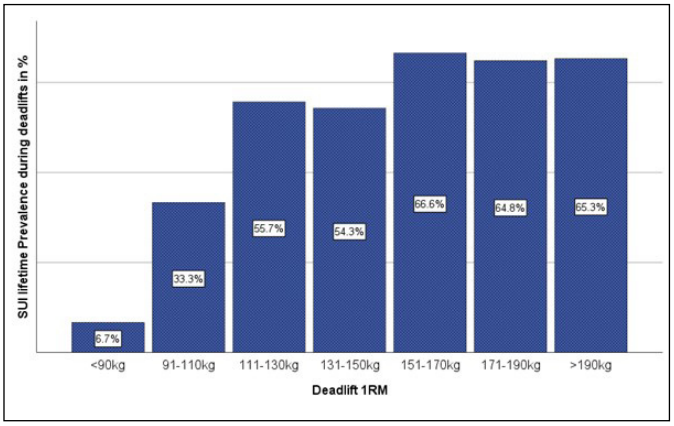

Figure 7. *Lifetime prevalence of SUI during deadlifts stratified by deadlift 1RM.*

SUI – stress urinary incontinence; 1RM – 1 repetition maximum

SUI prevalence during powerlifting

The lifetime prevalence of 67.3% for SUI during powerlifting training is the highest observed prevalence in the literature to date. Two previous studies by Wikander et al., with 134 and 480 participants from Australia and English-speaking countries, respectively, reported a prevalence of 37% and 23.1% during training [8, 9]. Another study, by Mahoney et al. [7], which included female powerlifters, weightlifters, and strongmen, reported a prevalence of 59.1% during training, closely aligning with the prevalence observed in this study. Unfortunately, the study did not report prevalence specifically for powerlifters, although the movements performed in these sports follow a similar pattern. A difference between these studies is that the participants in the studies by Wikander et al. were recruited by contacting powerlifting federations, whereas Mahoney et al. and this study mainly recruited participants through social media [7–9]. It is possible that through social media, more participants interested and affected by UI were reached, leading to selection bias. Another difference was that this study investigated lifetime prevalence, as participants were asked if they had ever experienced SUI during powerlifting, whereas in the studies by Wikander et al. participants were asked if they currently or in the last three months had experienced symptoms during powerlifting training [8, 9].

UI prevalence in daily life

In this study, the lifetime prevalence of SUI in daily life after starting to perform powerlifting was 31.7%. Previously, Wikander et al. reported that 11% of participants had UI during daily life and Mahoney et al. reported a prevalence of 43.1% in daily life [7,9]. The results of this study were within this range, although the previously reported prevalence differed significantly. The result of this study also lies within the upper range of reported UI prevalence of the general population of 4–35% [10].

Impact of powerlifting on UI

This study found that participants were 22.7 times more likely overall to experience SUI after starting to perform powerlifting, which is a very strong

association and can be explained by the high prevalence of SUI during powerlifting. Further, participants were 1.6 times more likely to experience SUI in daily life after starting to perform powerlifting. Although this association was weak, it was statistically significant. These findings suggest that powerlifting could result in damage to the pelvic floor or its supporting structures, leading to UI outside of training.

In contrast to these findings, participants reported slightly more often that their symptoms in daily life had either improved or stopped completely after starting to perform powerlifting (23.3%), compared to those participants who reported that their symptoms had worsened (20.3%). This indicates that powerlifting may also have a protective or healing effect for some individuals.

Question remains as to why some experience improvement of symptoms in daily life, while participants were overall more likely to experience UI in daily life. One could hypothesize that factors such as awareness of the pelvic floor, ability to activate the pelvic floor during lifting, or bracing technique could affect the outcome. Wikander et al. reported that women who were confident in performing pelvic floor exercises were more likely to experience less severe SUI symptoms [9]. It is possible that these women were also able to activate their pelvic floor more effectively during powerlifting. Especially since training of muscle leads to hypertrophy and an increase in strength, it is likely that proper activation of the pelvic floor during lifting could have a protective effect against UI. Similar improvements have been observed in women undergoing structured pelvic floor muscle training, where enhanced pelvic floor strength led to a reduction of SUI severity [11]. Some participants of the study by Wikander et al. reported that as they were getting stronger in powerlifting and lifting heavier weights, they were no longer incontinent at weights at which they had previously experienced leakage and were now incontinent only at heavier weights [8]. This finding supports the idea that the pelvic floor could be strengthened during powerlifting training. On the other hand, it would be plausible that improper activation of the pelvic floor under high loads could lead to damage resulting in new cases of UI.

While previous literature examined only SUI or UI in female powerlifters, this study additionally examined UUI. Participants in this study were 5.2 times more likely to experience UUI after starting to perform powerlifting. UUI is most commonly caused by idiopathic detrusor overactivity, recurrent urinary tract infections, or neurological causes. Sports are generally not reported to cause UUI [2]. Related evidence comes from a meta-analysis which reported that vaginal delivery was associated with a 3% higher risk of developing UUI compared to caesarean delivery, indicating that vaginal delivery might cause some kind of tissue damage favoring UUI [12]. A proposed mechanism to explain how powerlifting could cause UUI is that repeated increases in intra-abdominal pressure during powerlifting could damage nerves innervating the bladder, internal sphincter and detrusor muscle, thereby causing UUI. However, this remains a hypothesis, as the available data do not allow for a definitive explanation.

Maximum load, intra-abdominal pressure, and stance

SUI was observed more frequently during deadlifts (58.9%) than during squats (45.2%), which aligns with results reported by Wikander et al., who also observed a higher prevalence during deadlifts. In addition, SUI prevalence increased significantly with higher 1RM for both squats and deadlifts in this study, as well as with a higher total (sum of 1RM for bench press, squat, and deadlift) in the study by Wikander et al. [9]. Therefore, the higher prevalence of SUI during deadlifts might be attributed to the higher loads moved during the deadlift.

Further, this study found that participants using a lifting belt, which is used to increase intra-abdominal pressure to maintain trunk stiffness, were significantly more likely to experience SUI during both squats and deadlifts [13]. Notably, intra-abdominal pressure is much higher during squats than during deadlifts, which may seem surprising since the SUI prevalence during squats is lower and lighter weights are moved [13]. It would have seemed logical that higher loads moved during deadlifts would require higher intra-abdominal pressure to provide trunk stiffness, though this does not seem to be the case. This indicates that other factors such as biomechanics and positioning during a lift itself are equally or more important regarding SUI than intra-abdominal pressure alone.

In this study, participants using the sumo stance for deadlifts were more likely to experience SUI during deadlifts. This is in line with the study by Wikander et al. in which some participants reported to have SUI more commonly during the sumo stance [8]. These findings further indicate that positioning may play a role in SUI. One could speculate that specific variations in positioning

favor a descent of the bladder neck and proximal urethra, which is known to lead to urinary leakage [14, 15]. Such variations in positioning, apart from stance, may include pelvic tilt, the positioning or tightness of a lifting belt, and the degree of hip flexion.

This study is limited by its cross-sectional design, which allows for correlation but not causation. Selection bias may have inflated SUI prevalence, as women interested in the topic were more likely to participate. Additionally, all data were self-reported, with no objective measurements. The strength of this study was the large sample size, with over 1000 participants. This study was also the first to analyze the effects of powerlifting on UI prevalence.

Further research should concentrate on prospective longitudinal studies with controlled objective outcomes to further assess the effects of powerlifting on SUI and UUI. UI severity should be measured objectively, for example, using a pad test. Specific positioning during squats and deadlifts should be investigated with the help of experienced trainers. Pathophysiology could be assessed by ambulatory urodynamic monitoring and electromyography of the pelvic floor muscles during the lifts.

Practical applications:

1. Female powerlifters should be taught how to activate their pelvic floor during squats and deadlifts.
2. Female powerlifters should receive education from coaches or healthcare professionals on the causes, prevention, and treatment of UI.
3. If indicated, structured pelvic floor muscle training should be implemented.

CONCLUSIONS

Powerlifting has an effect on UI in female powerlifters by increasing the odds of SUI overall by 22.7 times, for SUI in daily life by 1.6 times, and for UUI by 5.2 times. Despite this, powerlifting appears to reduce the severity of symptoms in daily life, likely among those who are able to properly activate their pelvic floor during lifting. This study identified several risk factors for stress urinary incontinence during powerlifting, including age, years of lifting experience, history of vaginal birth, use of a lifting belt, deadlift stance, and one repetition maximum. Future research should focus on modifiable factors such as stance, including biomechanics and positioning during the lift itself. Additionally, further investigation is needed to understand the mechanism by which powerlifting increases the risk of UUI, as this topic has not been researched yet.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

ETHICS APPROVAL STATEMENT

The study was approved by the Ethics Committee for Research of the Faculty of Medicine at the University of Latvia (Approval No. 16-25/173).

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