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Urinary Incontinence and Women CrossFit Competitors

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Purpose: Urinary incontinence is a common condition that potentially discourages women from participating in physical activity. This study aimed to determine the prevalence of urinary and athletic incontinence and establish which activities and contexts were most likely to provoke urine leakage in women CrossFit competitors.

Patients and Methods: This research was an international, cross-sectional, survey-based study. The online survey was completed by 452 women CrossFit competitors. The Incontinence Severity Index was used to determine the frequency and severity of urinary incontinence.

Results: Urinary incontinence was experienced by 41.8% of participants in the three months prior to the study and 17.7% experienced athletic incontinence. Women came to experience athletic incontinence through two different pathways. Some women were continent before commencing CrossFit (9.7%), remain continent during everyday activities but now experience urinary incontinence during exercise. Alternatively, 8% of women were incontinent before commencing CrossFit, are now continent during everyday activities but remain incontinent during exercise. High impact CrossFit activities were most likely to provoke urinary incontinence.

Conclusion: This study highlighted the importance of distinguishing between urinary incontinence that develops after commencing an exercise program in otherwise continent women and urinary incontinence that persists only during exercise in previously incontinent women.

Keywords: resistance training, pelvic floor, squats, running, high impact exercises, women's health, continence

Introduction

Urinary incontinence (UI) is a significant issue for many women with most studies determining a prevalence in the range of 25% to 45%.¹ Age, BMI, parity, and delivery type are the common risk factors unambiguously associated with UI in young and middle-age women.¹ While coughing and sneezing are examples of everyday activities that may trigger urine leakage, physical activity and sport can also provoke involuntary leakage. Therefore, UI may be a common issue in women participating in sports with the most common form of UI being stress urinary incontinence.²

The term "athletic incontinence", while not an officially recognised term, has been used to describe either UI that is experienced during athletic activity or more specifically, UI experienced by otherwise continent young nulliparous women only during training and competition.^{3,4} For the purpose of this study, we defined athletic

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incontinence as UI experienced during exercise by otherwise continent women of any age or parity.

Urinary leakage during exercise can be a barrier to women participating in physical activity.⁵ It is estimated that 23% of incontinent women either stop exercising or reduce their amount of exercise due to UI and 60% of women with severe UI are likely to be insufficiently active.^{6,7} High impact activities, exercising at an elite level, high training volume and high repetition activities resulting in pelvic floor muscle fatigue are exercise specific risk factors for UI.^{8–13} The prevalence of UI in athletes is associated with activity type and ranges between 5.56% in low-impact activities to 80% in trampoline gymnasts.¹⁴

CrossFit is a popular competitive sport that incorporates resistance training with high impact activities, and training to fatigue. The incidence of UI in competitive women CrossFit participants is expected to be less than that found in recreational women CrossFit participants and fall towards the higher end of the prevalence found in the general population due to the presence of athletic incontinence. This study aimed to determine the prevalence of urinary and athletic incontinence and identify which activities and contexts (everyday activities, training or competition) are most likely to provoke leakage of urine in women CrossFit competitors.

Materials and Methods

This research was an international cross-sectional survey-based study. Women CrossFit participants between 20 and 89 years who were competing at a local, national, or international level and able to read English were eligible to participate. The survey was circulated through Facebook and emailed to intermediaries such as CrossFit boxes located in the following countries: the United Kingdom, United States of America, Australia, Canada and New Zealand. Data were collected through an anonymous link which was shared using the Qualtrics platform between March 10 and April 29, 2019.

The study was restricted to competitive women CrossFit participants only as there is evidence that exercising at an elite level, rather than for general health benefits or recreation, is associated with a higher prevalence of UI.^{9,10} Furthermore, competitive athletes commonly train several hours per week, so they represent a more homogenous group that experience significantly greater training volume and intensity than recreational athletes.

The survey was based on a pilot study which investigated the prevalence of UI in women powerlifters. The pilot study

included an open-ended question where some participants chose to include feedback and suggestions for further research.¹⁵ Based on feedback from the previous pilot study, consultation with industry experts and journal reviewers, the 34 question survey for this study ([Supplementary material](#)) was developed specifically for CrossFit participants. The survey questions focused on the context in which UI occurred (everyday activities, training or competition) and the exercises most likely to cause leakage rather than the traditional classifications of UI such as stress, urgency and mixed incontinence.⁴ Additionally, the survey incorporated the Incontinence Severity Index (ISI); a validated tool that quantifies the frequency and severity of UI.¹⁶

The survey was prefaced by a plain language statement assuring that the questionnaire was anonymous and participation was voluntary. In addition, participants could withdraw from the study before submitting their responses by closing the browser. Completion of the survey was deemed as informed consent to participation. Ethics approval was given for this project by the Charles Darwin University Human Research Ethics Committee, approval number H18106 and the study was conducted in accordance with the Declaration of Helsinki.

Data were analysed using Statistical Package for the Social Sciences (SPSS 24.0 Inc., Chicago, IL) and the central tendency and dispersion were reported as means \pm standard deviation (SD). Descriptive data were calculated from participants' responses and were presented in percentages and the number of responders.

Results

The survey received 614 responses. However, 97 participants exited before completing the survey and therefore, as specified in the participant information sheet, their data were excluded. A further 65 responses were removed as respondents indicated that they were not competitive female CrossFit participants. The data reported in this paper were based on the responses from the remaining 452 participants. Participants of this study were women CrossFit competitors (Age: 36 ± 9 years, ranging from 20 to 63 years; Height: 1.66 ± 0.07 m; Body Mass: 71 ± 13 kg; and BMI: 25.72 ± 4.87 kg/m²) who spent on average 5.73 ± 2.9 hours per week training.

In this cohort, 46% (N=208) of women had experienced UI at some point in their life and 41.8% (N=189) reported having experienced UI in the last three months prior to the study. According to their ISI score 21% (N=95) of participants experienced slight leakage, 18.4%

(N=83) moderate, 1.3% (N=6) severe and 1.1% (N=5) very severe UI. Figure 1 illustrates the distribution of the ISI categories according to UI context.

The data showed that 38.3% (N=173) of women in this study experienced UI during training and/or competition. In the cohort of women who experienced UI during training and/or competition, 46.2% (N=80) experienced UI only in training and/or competition but not during everyday activities (athletic incontinence). This number represented 17.7% of the total number of participants in this study.

The results suggested that women came to experience athletic incontinence, as defined in our study, through two different pathways. The first group of women (N=44, 9.7%) was continent prior to commencing CrossFit, remain continent during everyday activities but now experienced UI during training or competition (referred to as “type one athletic incontinence”). The second group of women (N=36, 8%) who had experienced UI before

commencing CrossFit no longer experienced UI during everyday activities but still experienced UI during training or competition (referred to as “type two athletic incontinence”).

A comparison between women who experienced type one athletic incontinence and women who experienced type two athletic incontinence showed a significant difference in age and the number of births the women had experienced. Only 59% of women experiencing type one athletic incontinence had given birth, whilst 83% of women experiencing type two athletic incontinence had given birth. There was no significant difference between the women who experienced type one or type two athletic incontinence when the type of delivery (vaginal, caesarean, or both), timing of birth (before or after commencing CrossFit), or instrumental birth was considered. Demographics of women experiencing either type one or type two athletic incontinence are presented in Table 1.

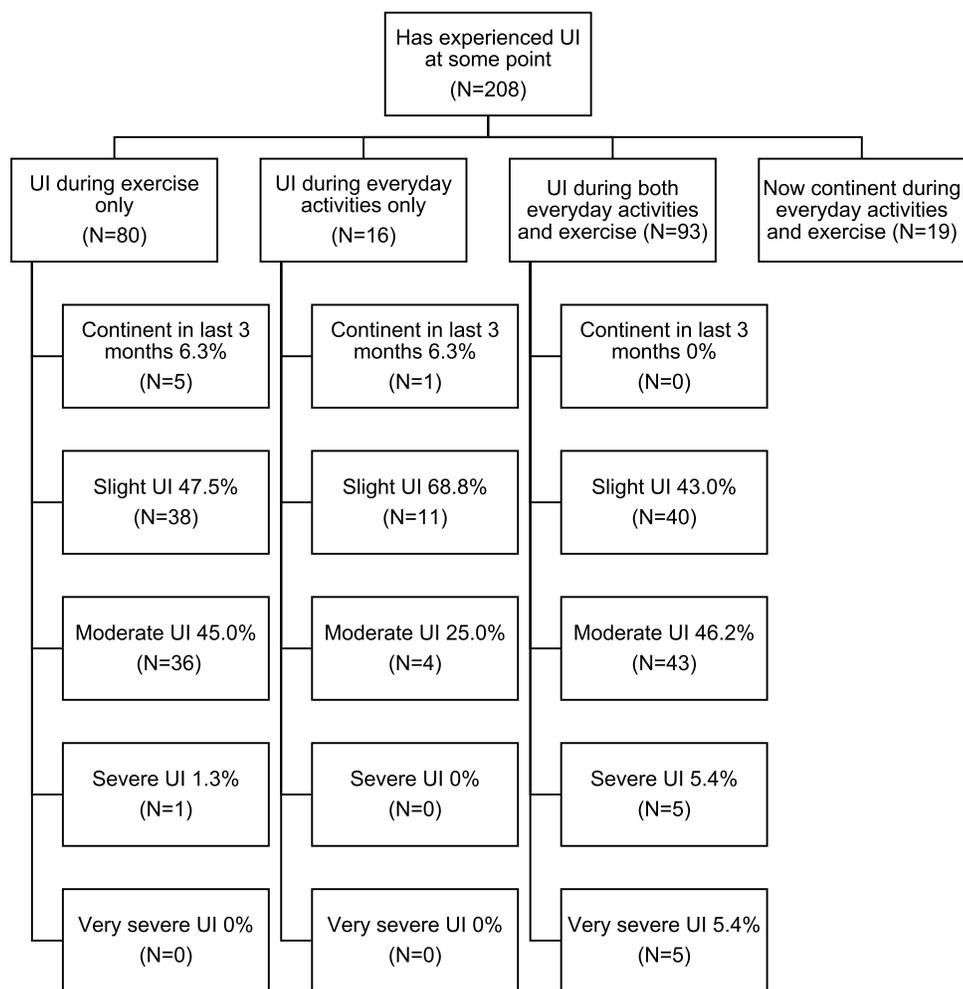


Figure 1 Incontinence Severity Index category distribution for each context-based urinary incontinence scenario.

Table 1 Demographics of Participants in This Study with Type One and Type Two Athletic Incontinence. Data Presented in mean±SD

	Type 1 (N=44)	Type 2 (N=36)	p
Number of births	1.05 ± 1.03	1.75 ± 1.16	0.005
Age	35.57 ± 7.73	39.69 ± 7.68	0.020
BMI	24.36 ± 3.63	25.52 ± 4.33	0.197
Years strength training	6.57 ± 4.52	5.61 ± 4.3	0.339
Years participating in CrossFit	4.41 ± 2.47	3.69 ± 2.39	0.195
Weekly training hours	6.16 ± 2.42	5.67 ± 2.07	0.337
Incontinence severity index (ISI)	3.02 ± 1.79	2.67 ± 1.94	0.396

The activities which were most likely to cause UI were high impact high repetition activities involving jumping and running. The activities least likely to provoke leakage were low impact, body weight activities such as lunges and rowing. The full list of activities and corresponding severity of UI is presented in Table 2. Leakage was likely to occur during high repetition sets in 28.7% (N=60) of incontinent women. Half of these women indicated that leakage was most likely to occur at the end of high repetition sets. The intensity also appeared to be an important factor with 28.2% (N=59) of incontinent women

reporting leakage during heavy sets. Fewer incontinent women reported experiencing UI during competition (32.1%, N=145) than training (37.4%, N=169).

Despite the established role of pelvic floor muscles in UI, 73.6% (N=153) of participants who had experienced UI at some point had never undergone a pelvic floor assessment. Furthermore, 26% (N=54) of women who reported UI at some point in their life were not confident in their ability to correctly perform pelvic floor exercises.

Discussion

The prevalence of UI in our cohort, while being more than that of resistance training based sports such as powerlifting,¹⁵ falls within the range for UI in the general population.¹ This rate is in the middle of the range for sporting activities and similar to that of elite athletes in general.^{14,17} It is possible that the difference in prevalence between this cohort and other strength based sports such as powerlifting can be attributed to the repetitive, high impact nature of some CrossFit activities such as running and skipping.

Our results showed that 17.7% of women only experienced UI when exercising and not during everyday activities (athletic incontinence). After examining the data, it was apparent that some previously continent women experienced UI for the first time at some point after commencing

Table 2 Urinary Incontinence During CrossFit Activities in Percent and Numbers

	Total UI	Severe	Small Splashes	Drops	No Leakage	Do Not Know or Missing
Jumping rope	39.16% (N=177)	9.07% (N=41)	16.81% (N=76)	13.27% (N=60)	59.29% (N=268)	1.55% (N=7)
Double unders	36.95% (N=167)	11.28% (N=51)	14.82% (N=67)	10.84% (N=49)	58.85% (N=266)	4.20% (N=19)
Trampoline	25.00% (N=113)	7.74% (N=35)	9.07% (N=41)	8.18% (N=37)	64.82% (N=293)	10.18% (N=46)
Running/Jogging	20.57% (N=93)	2.65% (N=12)	3.54% (N=16)	14.38% (N=65)	76.11% (N=344)	3.32% (N=15)
Box jumps	18.81% (N=85)	1.33% (N=6)	5.75% (N=26)	11.73% (N=53)	77.21% (N=349)	3.98% (N=18)
Deadlifts	13.72% (N=62)	0.88% (N=4)	4.87% (N=22)	7.96% (N=36)	82.08% (N=371)	4.20% (N=19)
Weighted back squats	12.61% (N=57)	0.88% (N=4)	3.54% (N=16)	8.18% (N=37)	83.19% (N=376)	4.20% (N=19)
Weighted front squats	11.95% (N=54)	0.88% (N=4)	3.54% (N=16)	7.52% (N=34)	83.63% (N=378)	4.42% (N=20)
Thrusters	11.95% (N=54)	0.44% (N=2)	3.32% (N=15)	8.19% (N=37)	83.41% (N=377)	4.65% (N=21)
Burpees	10.18% (N=46)	0.22% (N=1)	3.10% (N=14)	6.86% (N=31)	85.4% (N=386)	4.42% (N=20)
Sit-ups	7.96% (N=36)	0.44% (N=2)	1.99% (N=9)	5.53% (N=25)	87.61% (N=396)	4.42% (N=20)
Wall balls	6.64% (N=30)	0.44% (N=2)	1.99% (N=9)	4.20% (N=19)	89.15% (N=403)	4.20% (N=19)
Pullups	5.53% (N=25)	0.22% (N=1)	0.88% (N=4)	4.42% (N=20)	88.50% (N=400)	5.97% (N=27)
Kettle bells	4.87% (N=22)	0% (N=0)	1.11% (N=5)	3.76% (N=17)	90.93% (N=411)	4.20% (N=19)
Dead ball carry	4.20% (N=19)	0.44% (N=2)	1.11% (N=5)	2.65% (N=12)	89.38% (N=404)	6.42% (N=29)
Body weight squats	3.54% (N=16)	0% (N=0)	0.22% (N=1)	3.32% (N=15)	91.59% (N=414)	4.87% (N=22)
Lunges	2.65% (N=12)	0% (N=0)	1.11% (N=5)	1.55% (N=7)	92.26% (N=417)	5.09% (N=23)
Rowing	2.22% (N=10)	0% (N=0)	0.22% (N=1)	1.99% (N=9)	93.58% (N=423)	4.20% (N=19)
Push-ups	1.33% (N=6)	0% (N=0)	0.22% (N=1)	1.11% (N=5)	93.81% (N=424)	4.87% (N=22)
Air bike	0.44% (N=2)	0% (N=0)	0% (N=0)	0.44% (N=2)	94.47% (N=427)	5.09% (N=23)

CrossFit (type one athletic incontinence). Furthermore, we discovered some women who had experienced UI prior to commencing CrossFit were no longer incontinent during everyday activities but still experienced UI during CrossFit training or competition (type two athletic incontinence). Therefore, we propose that while the continence of most women commencing CrossFit will remain unchanged, some previously continent women may participate in activities that surpass their continence threshold and consequently experience type one athletic incontinence. On the contrary, some women who were incontinent before commencing CrossFit, for reasons beyond the scope of this study, are now continent during everyday activities but remain incontinent during training or competition. Studies determining the prevalence of UI in athletes do not always differentiate between daily life UI and athletic incontinence when reporting the prevalence of UI.^{10,17,18} Furthermore, studies that differentiate between daily life UI and athletic incontinence do not differentiate between type one and type two athletic incontinence.^{7,12,19}

Type one and type two athletic incontinence may affect how women view exercise differently. For example, women who experience incontinence for the first time during exercise may become concerned and discontinue the activity. In 2005, Nygaard et al identified a cohort of women who considered themselves continent but stated that UI was an inhibiting factor to participating in exercise.⁶ It may be possible that these women, who identified as continent but were reluctant to exercise due to fear of incontinence, had at some point experienced type one athletic incontinence. Alternatively, women with type two athletic incontinence, who improve to the point where they are continent during everyday activities, may feel that their continence has improved and be more likely to continue exercising. Therefore, it is essential to differentiate between the two types of athletic incontinence when counselling women regarding UI and physical activity.

In addition, it is important to differentiate between athletic incontinence that occurs in women who are otherwise continent, and UI that occurs during physical exercise in women who also experience UI during everyday activities. Participants who experienced UI during both everyday activities and physical exercise were more likely to be in the severe and very severe ISI categories than women who only experienced athletic incontinence.

Restricting the definition of athletic incontinence to young nulliparous women limits the potential usefulness of the term. Urine leakage that only occurs during training

or competition, but not during everyday activities, is found in women of any age and parity.^{7,12,19} Alternatively, using the term athletic incontinence in the more general sense to describe UI during physical exercise fails to differentiate between women who also experience UI during everyday activities and those who only experience leakage when training or competing. Our intention, in this article, is not to argue for a new category of UI but to highlight discrepancies in the use of the term athletic incontinence. We would like to see the term athletic incontinence consistently be used to describe UI that is experienced during training or competition by otherwise continent women of any age and parity. As research in this area develops it may then be necessary to further distinguish between subtypes of athletic incontinence.

The prevalence of athletic incontinence in our study was lower than that found in two previous studies.^{20,21} The first study reported that 47.6% of participants experienced UI during exercise.²¹ It is difficult to compare the result from this study as it may have included women who experienced UI during both everyday activities and training. To compare, we added the number of women who experienced UI only during exercise to the number of women who experienced UI during everyday activities and exercise (Figure 1) and calculated a comparison figure of 38.3%. The second study found an overall prevalence of UI during CrossFit exercises of 29.95%.²⁰ This second study excluded women who experienced UI in situations other than physical activity and therefore our athletic incontinence rate of 17.7% would serve as the best comparison rate.

Several methodological differences could explain the discrepancies in findings between the two studies and ours. Firstly, not all participants in these studies were competitive CrossFit athletes. Women who experience athletic incontinence, particularly type 1 athletic incontinence, and women who experience an exacerbation of their UI during training may associate additional training with greater UI and not progress to the competitive stage. Therefore, it is possible that participants of our study were naturally selected to be competitive CrossFit athletes with a lower rate of UI. Secondly, it is possible that competitive CrossFit participants have developed strategies such as reducing water intake or urinating prior to exercise to decrease or manage leakage. Finally, the time for data collection method used in the first comparison study was different to our method of data collection. Our participants relied on recall while the participants in the

first comparison study completed their questionnaires immediately after training.

The possibility that competitive CrossFit participants have a lower prevalence of UI than recreational CrossFit participants is important as some studies suggest that UI is more prevalent in women competing at elite levels.^{9,10} The reports on the effect of training at the elite level and UI are inconclusive. Some studies have reported higher rates of UI in elite athletes,^{2,10} while other studies reported no association between competing at an elite level and UI later in life.²² Nonetheless, UI is a multifactorial phenomenon and therefore it is difficult to investigate the effect of each risk factor on UI separately.

The rate of UI during common CrossFit activities was similar to previous reports.^{7,20,21} High impact activities such as skipping and running were most likely to cause UI. Activities which increased intra-abdominal pressure through lifting a weight rather than impact with the ground had an intermediate effect on UI, while low or no impact activities involving body weight had the lowest rate of UI. There is a large range of activities that can be drawn on for a given “work out of the day” (WOD). Women should be informed what exercises they will be exposed to, prior to each training session so that they can plan accordingly.²³ If women are aware of planned activities they may choose not to attend, select low-impact alternatives, wear a pad or darker clothing and make sure their bladder is empty.

Our study showed that there were many women CrossFit competitors who experience UI during training who were not confident in their ability to correctly perform pelvic floor exercises. All women, especially those who are not confident in their ability to correctly activate their pelvic floor muscles, should be encouraged to discuss their interest in starting CrossFit with a specialised women’s health professional.

The strengths of our study were the large sample size, relative homogeneity of participants, including the input from participants of the pilot study into the design of the survey, and the use of a reliable and validated tool to assess UI.²⁴ The major limitations of this study were relying on recall information and only making the questionnaire available to English-speaking participants. Consideration must also be given to our recruitment method which relied on circulation through social media as it is possible that incontinent participants were more drawn to the survey when it appeared in their Facebook feed.

Conclusion

It is important to develop a consistent definition of the term athletic incontinence. Practitioners who support women experiencing UI during exercise need to develop an understanding of the two different ways athletic incontinence may present. Giving women prior warning of proposed CrossFit activities will enable them to take precautions to prevent, minimise or manage leakage. While it is recognised that research, specific to CrossFit participants, examining the impact of pelvic floor muscle exercises is not yet available, we recommend that more women, especially those who are incontinent or at a high risk of experiencing leakage during CrossFit, should discuss their intentions with a women’s health professional prior to commencing training.

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Disclosure

The authors report no conflicts of interest in this work.

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