

A prospective comparative urinary incontinence study between nulliparous female basketball athletes and non-athletes indicates a key role for health professionals in prevention

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Abstract: *Background* The body of a female basketball player undergoes considerable physical effort, since the rigid surface of the basketball court does not absorb the impact. *Aim of the study:* This study aims at estimating the real prevalence of symptoms associated with urinary incontinence (UI) in nulliparous female basketball players in comparison to nulliparous non athletes. *Materials and methods:* Through anonymous surveys and voiding diaries, distributed to 60 female non-athlete and 60 female basketball players, we examined the symptoms related to pelvic floor weakness and urinary incontinence. The participating athletes were asked whether they would agree to undergo a pubococcygeus (PC) muscle test at the Pelvic Floor Rehabilitation Unit of Azienda Ospedaliera di Parma (Italy). Eight of them accepted. *Results:* the percentage of symptomatic subjects amounted to 50% among athletes and 30% among non-athletes. Analyzing the responses of the asymptomatic athletes, we found that 90% of them do physical preparation and 66.6% of them lift weights more than once a week. The responses also showed that 73.3% of the participants were unaware of the pelvic floor functions. The PC muscle tests on the eight volunteers revealed a severe weakness of the analyzed musculature, with antagonistic muscle action, in half of the women who underwent the tests. *Conclusions:* The results highlight the fact that this group of fit professional women were unaware of their anatomy and unable to voluntarily strengthen the perineal muscles. In a female athlete, complementing general training with strengthening exercise for the perineal muscles is of crucial importance. An integrated role of an empathic professional with the necessary expertise in this field is emphasized.

Keywords: Urinary incontinence; Basketball players; Symptoms; Prevention.

INTRODUCTION

In his famous 1889 paper *Studies of the levator ani muscle*, Dickinson observed that “*There is no considerable muscle in the body whose form and function are more difficult to understand than those of the levator ani, and about which such nebulous impressions prevail*”.¹

In recent years, numerous studies have focused on the prevalence of urinary problems in athletes and the correlation that these dysfunctions have with specific sports. It has been proven that female athletes are often affected by dysfunction of the urogenital apparatus. In his study *Urinary Incontinence in elite female athletes and dancers*, Thyssen discovered that “the activity most likely to provoke leakage was jumping. Sixty per cent (91/151) occasionally wore pads or panty shields because of urine loss. Urinary leakage is common among elite athletes and dancers, particularly during training, but also during daily life activities”.² Di Benedetto conducted an epidemiologic investigation on the incidence of urinary incontinence in female volleyball players. He concluded that “frequently raised intra-abdominal pressure, especially intense pressure like the one which characterizes sport training, is likely to damage the myofascial pelvic system”.³ He examined 217 athletes, using a focused questionnaire. The highest prevalence of urinary dysfunction and genital problems was detected in the group of volleyball players.

Basketball players are often subjected to two hours of training up to four times a week, plus games during the weekend. This athletic training often consists of long distance running, sprinting, lunges, jumps and weightlifting; all high impact activities for the pelvic floor.

In this study, the quantity and range of symptoms related to perineum weakness and urinary incontinence in a group of nulliparous basketball player have been determined through an anonymous focused questionnaire and a micturition diary. A second group of nulliparous non-athlete young women has also been asked to complete an equivalent questionnaire and micturition diary. Results have then been compared and assessed.

Basketball players, especially if over 18 years of age, showed a great interest in the subject, but they were also very embarrassed when asked to talk about it and to answer questions about any specific symptomatology. We detected a general sense of resignation toward the problem and some athletes also believed that what they were experiencing was normal, despite the evidence of anomalous symptoms. All female basketball players involved in the study were invited to undergo a Pubococcygeus test (PC test). Only 8 players accepted, proving once again how people were intimidated by the subject.

The aim of this study is to compare the incidence of urinary incontinence between a group of nulliparous basketball players and a second group of non-athlete young women.

MATERIALS AND METHODS

A focused questionnaire (Fig. 1) has been created with the aim of detecting urinary incontinence or other perineal dysfunctions in the sample of women interviewed. The questionnaire was anonymous and integrated with a micturition diary and an explanatory leaflet about the study. The questionnaire was identical for the non-athletes and for the basketball players, but the latter also had to answer additional questions about their physical activity. All questions were easy to understand and they were aimed at detecting the incidence, the typology and severity of the pathology. The micturition diary is a fact sheet covering three days and recording all sensations, fluids intake and urination events of the participant. All the basketball players examined had a minimum of two hours training four times a week. Considering the complexity and the lack of knowledge of the issues covered by the study, the researcher (F.R.) explained its aim to all the young women involved and personally delivered the questionnaire and micturition diary to the participants. All athletes were also invited to undergo a Pubococcygeus test (PC test) carried

Reeducation of the Pelvic Floor at Parma Hospital. out by the researcher at the Clinic for the for the Reeducation of the Pelvic Floor at Parma Hospital.

RESULTS

The study involved 120 nulliparous young women: 60 athletes and 60 non-athletes with an average age of 19.6 years. Symptoms of incontinence were detected in 50% of the athletes and 30% of the non-athletes (see Table 1a and 1b for statistical significance). This difference has a 5% statistical significance (p<0.05, p=0.04 using Fisher’s exact test and the chi-square test with Yates correction). Confounding variables were eliminated so the difference between the two groups was clearly visible. In the group of athletes, 50% had symptoms of urinary incontinence and 50% were asymptomatic. In the non-athletes only 30% of the group were symptomatic. In both athletes and non-athletes, urgency in 80% of daily micturitions was a recurrent symptom.

An overall analysis of the different lifestyles (see details in Tables 2, 3) revealed this picture:

- Non athletes: 25% habitual smokers, 71.6% drinking more than one coffee every day, 65% drinking more than one cup of tea every day, 33.3% constipated, 6.6% on medications, 25% using energy drinks or supplements
- Athletes: 16.6% habitual smokers, 51.6% drinking more than one coffee every day, 41.6% drinking more than one cup of tea, 13.3% constipated, 5% on medications, 18.3% using energy drinks or supplements.

1. Basketball players group

The questionnaires and micturition diaries revealed that 50% of the athletes (30 women from a total of 60) had urinary problems (urinary stress incontinence, urgency and signs of hyperactive bladder).

Symptomatic athletes: 93.3% of the 30 young women were of Italian nationality, 73.3% were not aware of the function or importance of the pelvic floor and only 23% were habitual smokers. None of them was drinking alcohol regularly, 63.3% were drinking more than one coffee every day and 50% more than one cup of tea every day. 26.6% coughed or sneezed frequently and 16.6% suffered from seasonal allergies. 20% were constipated and none of them had diabetes or had pelvic surgery.

TABLE 1A. Data analysis.

	with symptoms	without symptoms	total number
athletes	30	30	60
non-athletes	18	42	60
	48	72	120

TABLE 1B. Data statistical significance.

Test	Value	One tailed p-value	Two tailed p-value
Chi-square	5	0.01267	0.02535
Yates’s correction of Chi-square	4.201	0.02020	0.04039
Mantel-Haenszel Chi-square	4.958	0.01298	0.02597
Fisher’s exact		0.01994	0.03988
Mid-p value		0.1372	0.02744

TABLE 2. Non-athletes lifestyle

	Symptomatic non-athletes (%)	Asymptomatic non-athletes (%)
Habitual smoker	27.7	23.8
Habitual alcohol drinker	0	0
More than one coffee per day	83.3	66.6
More than one cup of tea per day	66.6	64.3
Constipated	45.2	5.5
On medications	5.5	7.1
Using energy drinks	27.7	23.8

TABLE 3. Athletes lifestyle

	Symptomatic athletes (%)	Asymptomatic non-athletes (%)
Habitual smoker	23	10
Habitual alcohol drinker	0	0
More than one coffee per day	63.3	40
More than one cup of tea per day	50	33.3
Constipated	20	6.6
On medications	6.6	3.3
Using energy drinks	36.6	0

Only 6.6% were on medications: antiepileptic drugs and Levothyroxine Sodium. 36.6% were using energy drinks. 13.3% had family members affected by urinary incontinence. Only 10% wore orthotics.

During basketball trainings, 66.6% of the athletes were using weights more than once a week, 90% were mainly doing squats (with or without barbell), race walks, sprints, long distance runs, runs requiring several changes of speed and jumps.

On average the athletes had been playing basketball for 10.6 years at the time of the interview. They drank 0.7 litres of water during each training. 26.6% of the athletes trained on synthetic gym floors installed over concrete and the remaining 73.4% on hardwood gym flooring. 23.3% of the athletes had previous fractures of the lower limbs. Both symptomatic and asymptomatic players did the same training. 16.6% of the young women had no previous sexual intercourse and 6.6% of the women that had previous intercourse reported dyspareunia (painful sexual intercourse). 20% of the athletes wore panty-liners between menstrual periods.

With regards to hydration: 50% of the athletes had drinks at intervals of at least 3 hours, 6.6% drank less than 5 glasses of water a day, 3.3% drank more than 2 litres of water per day and 10% had a drink before going to bed. 66.6% (20 over 30 women) urinated more than 7 times every day and 66.6% had involuntary loss of urine when running, under stress, sleeping, if cold, sneezing or just because unable to hold it.

86.6% of the symptomatic athletes (26 over the total of 30 women) said that 80% of the daily micturition was associated with urgency.

2. Non-athletes group

The questionnaires and micturition diaries revealed that 30% of the non-athlete young women (18 over a total of

TABLE 4. Symptomatic athletes and symptomatic non-athletes discomfort during intercourse

	Symptomatic athletes (%)	Asymptomatic non-athletes (%)
Discomfort during intercourse	16.6 (5 over 30)	16.6 (3 over 18)

TABLE 5. Symptomatic athletes and symptomatic non-athletes with family members suffering of urinary incontinence

	Symptomatic athletes (2) with family history (%)	Symptomatic non-athletes (5) with family history (%)
Habitual smoker	20	50
Habitual alcohol drinker	0	0
More than one coffee per day	60	100
More than one cup of tea per day	40	100
Constipated	20	0
On medications	20	0
Using energy drinks	20	50

60) had urinary problems (urinary stress incontinence, urgency and signs of hyperactive bladder).

Symptomatic non-athletes: 100% of the 18 symptomatic young women were of Italian nationality, 22.2% were not aware of the meaning or importance of the pelvic floor and 27.7% were habitual smokers. None of them was drinking alcohol regularly, 83.3% were drinking more than one coffee every day and 66.6% more than one cup of tea every day. Only 16.6% coughed or sneezed frequently and the same percentage suffered of seasonal allergies. 55.5% were constipated and none of them had diabetes or previous pelvic surgery. Only 5.5% were on medications: contraceptive pill.

27.7% were using energy drinks. 5.5% had family members affected by urinary incontinence and 11.1% wore orthotics. All of the women had previous sexual intercourses and 16.6% of them reported dyspareunia. 5.5% of the group wore panty-liners between periods.

With regards to hydration: 38.8% of the athletes had drinks at intervals of at least 3 hours, no one drank less than 5 cups or more than 2 l of water a day and 44.4% had a drink before going to bed.

88.8% (16 over 18) urinated more than 7 times every day and 66.6% had involuntary loss of urine especially after sexual intercourse, under stress, laughing, if cold or when sneezing or coughing.

83.3% of the symptomatic athletes (15 over a total of 18) said that 80% of the daily micturition was associated with urgency.

The anonymous questionnaire was not enough to properly cover the problem of dyspareunia because the PC test actually revealed a higher percentage of athletes affected by it. The questionnaire revealed that the percentage of painful intercourses is the same in both symptomatic athletes and symptomatic non-athletes (see Table 4), regardless of the incidence of continence problems.

16.6% (5 over 30) of the symptomatic athletes and 11.1% (2 over 18) of the symptomatic non-athletes had family members affected by urinary incontinence. Table 5 shows the lifestyle of the young women with family history of incontinence.

3. PC test results

Only 8 athletes volunteered for the PC test. The average ano-vulvar distance was 1.3 cm. None of these athletes showed vulvar tearing, 37.5% of the young women had no inner thighs or anal reflexes. The stress test (coughing) resulted negative in all of the girls. The mean in the PC phasic test is 3.1, in the PC tonic test is 1.6 and in the PC endurance test is 1.2.

50% of the athletes showed muscle synergies, 50% had reflexive antagonism and 20% reacted with the opposite action to the command (pushing instead of contracting). 10% of the sample had other perineal problems like hemorrhoids. 62.5% had discomfort during intercourse and 20% lamented a frequent urinal urgency.

In the final self-evaluation question, regarding micturition personal satisfaction, the average score was 7.5, in a scale from 1 to 10.

DISCUSSION

This study shows that the prevalence of urogenital disorders is higher in the basketball players' group, compared to the non-athlete young women.

The study started with the same number of female athletes and non-athletes. 50% of the athletes and only 30% of the non-athletes revealed symptoms. Micturition habits, involuntary loss of urine and urgency were very similar between the two groups. Furthermore, a significant difference was detected between the symptomatic athletes that wore panty-liners between periods (66.6%) and the symptomatic non-athletes (5.5%). This corroborates the idea that high impact sports (like basketball) are conducive to early symptoms of stress urinary incontinence.

Because 90% of the symptomatic athletes did athletics training and 66.6% did weightlifting more than once a week, the question arises "Do these and other exercises damage the muscles and ligaments involved in continence control, or is the urine loss reported merely a result of the higher intraabdominal pressure generated by the exercises?" Our study was not able to answer that question. However, our other major finding, that 73.3% of this group did not know what the pelvic floor was or what function had in the body renders this question irrelevant. The athlete group, indeed both groups, would clearly benefit from a better education on the subject of pelvic floor exercises, leading to urinary incontinence prevention.

The PPC test results, though limited, confirmed this view. We objectively discovered an evident weakness and hypotonia of the studied muscles, for instance, presence of muscular reflexive antagonism in half of the girls and of muscular lack of control on command (pushing when asked of pulling) in some of the athletes. This proves once again the inadequate knowledge of human anatomy and the inability of using the perineal muscles. Another concern was that several symptomatic athletes declared a feeling of resignation regarding some of their discomforts.

CONCLUSIONS

Though the causes of urinary incontinence in young nulliparous women are still not completely clear, based on our findings, we are able to draw the following conclusions.

1. A program of education on how to feel and control pelvic muscles even without seeing them would be highly beneficial. Proprioception plays a fundamental role in the complex movement mechanism.

2. A focused strengthening of the perineal muscles (perineal care programs) as an integral part of the training in female athletes is absolutely essential.

3. An empathetic professional figure is required to effect 1&2 above, as self-awareness, transfer of knowledge and self-motivation will all be important keys in the ongoing prevention and treatment of incontinence in the individual athlete.

ACKNOWLEDGEMENTS

The Authors thank Professor Peter Papa Petros for the help in drafting the article.

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Comment

Despite the recent Olympics in Rio, urine loss in female sports has somehow escaped the consciousness of urogynecologists such as myself.

This is an important paper as it potentially opens up a Pandora's Box concerning the effect of sport on urinary incontinence.

I was amazed to discover a 50% incidence of incontinence in female basketball players, basket ball not being as stressful on the female bladder as say, weightlifting.

Many of us have seen the famous video of a female weightlifter squirting urine as she completes the Clean part of the Clean and Jerk.

From a mechanical perspective, the short urethra and the upright stance unfortunately predispose to urinary incontinence, at least when compared to four footed animals.

The authors I think prove quite conclusively that a special pelvic floor training programme for female athletes is necessary and, in my view, should be part of every training session for female athletes. I hope that there will be more papers such as this, specific for other sports and especially long-term effects of sport on the genitourinary system over time.

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