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Stress Urinary Incontinence in Young Female Athletes- From Prevalence to Treatment- A Review

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Abstract

Urinary incontinence is a prevalent issue among females aged 15-65, with prevalence rates ranging from 10% to 55%. Stress Urinary Incontinence (SUI) is the most common form in young athletes, with rates ranging from 0% (golf) to 80% (trampolinists). Activities like jumping, landing, and running can cause leakage due to an increase in intra-abdominal pressure. This study aimed to identify management strategies and the prevalence of SUI in teenage female athletes. A literature search was conducted on studies conducted between 1990 and the present, excluding abstracted and non-open access studies. The research found that the chance of urinary stress incontinence in young and nulliparous female athletes in sports ranges from 0% (golf) to 80% (trampolinists). These activities, including gymnastics, long jumps, track and field, and ball activities, significantly impact their standard of existence, psychological situation, and athletic performance. Effective conservative treatment options for SUI include behavioral and lifestyle modifications, pelvic floor exercises, and core strengthening exercises. Female athletes require significantly stronger pelvic floor muscles than inactive females, and contraction of these muscles should occur as the inner core muscles are engaged. Future studies, instruction, and focused therapies are needed for female athletes with SUI.

Keywords: Core muscle training, Female Athletes, Pelvic floor muscles, Prevention, Risk factors, Stress Urinary Incontinence.

Introduction

To maintain a healthy lifestyle, nowadays many women take part in various recreational physical activities as a part of their daily routine and fitness. The ability of the body to do tasks and engage in other activities with effectiveness and efficiency is measured by fitness. Physical activity is essential for treating many chronic conditions and offers a number of psychological advantages. Moreover, physical activity also improves strength, increases muscle mass, decreases adiposity, and improves cognitive function, neuromuscular coordination, and physical appearance, hence overall improving the state of existence. The relationship between exercise and bladder function is still a mystery (1, 2). Bladder symptoms are typically linked to pelvic floor muscle dysfunction brought on by aging, obesity, hormone abnormalities, and the number of pregnancies a woman has had (3). Many studies have demonstrated an increased incidence of urine incontinence in young, sporty women, in addition to these recognized risk factors, raising worry about the link between physical exercise and urinary symptoms (4–8). Athletics involvement is a Configurable factor of risk, thus studying the connection between exercise and urinary illness can aid in the establishment of prophylactic interventions to minimize or delay the development of stressed urination in energetic female athletes.

The "International Continence Society (ICS)" defines "urinary incontinence (UI)" as an uncontrollable, involuntary flow of urine in women that compromises quality of life and creates issues with maintaining feminine hygiene (3). Urinary incontinence can be classified as urge, stress, or mixed. Urge urinary incontinence is the condition in which a person is unable to hold back urine after having the urge to urinate (1). The most common type is while executing acts that raise intraabdominal pressure, such as sneezing, lifting, exercising, twisting, and coughing, involuntary leaking, or stress urine incontinence (SUI), occurs (1). Mixed urinary incontinence refers to involuntary leakage that is brought on by urges, as well as by exertion, exercise, sneezing, and coughing. The most prevalent and significant concern for female athletes has to do with

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incontinence of urine, although it remains underdiagnosed and underreported (1, 2). The condition significantly impacts the status, quality of life and sports performance of an athlete. Presently, best practices for assessing, diagnosing and treating stress incontinence of the urine in female athletes have yet to be unanswered. The goal of this review study is to establish physiotherapists with the risk factors, treatment, prevalence, and maybe preventative roles connected with stress urine incontinence.

Objective

The purpose of this review article is to evaluate the incidence of Stress Urinary Incontinence (SUI) among young, nulliparous female athletes in the past few years and investigate potential links between SUI and sports participation in young female athletes. We also looked at the potential effects of SUI on the health of female athletes and the currently available treatments.

Methodology

This review is comprehensive search in Databases like Google Scholar, PubMed and MEDLINE with keywords like Stress Urinary Incontinence, Female Athletes, high impact sports, prevention, risk factors, core muscle training, physical exercise, pelvic floor muscles, treatment. The research search took performed between June 2021 and December 2021. The inclusion criteria of present study were: Research addressing the prevalence, risk factors, prevention, and treatment of stress urinary incontinence for female athletes, as well as English research. Publications posted after 1994 till 2021 are included. The studies were ruled out based on the following criteria, the absence of unrestricted access to articles. Although there were a variety of study designs, the majority were comparative studies, randomised control trials, cohort studies, descriptive studies, surveys, cross-sectional studies, prospective studies, and review studies. Studies before 1994 were excluded. This review's main goal is to provide a summary of the research on the incidence and management of stress incontinence in young female athletes.

Results

A total of 130 publications in Google scholar, MEDLINE and PubMed, were identified. 72 articles were excluded after screening of abstracts and titles (Table 1). The retaining 58 articles were further screened in full text. Of these, 38 articles were included: 20 of SUI prevalence and 18 of SUI treatment in female athletes met eligibility criteria as defined in Figure 1.

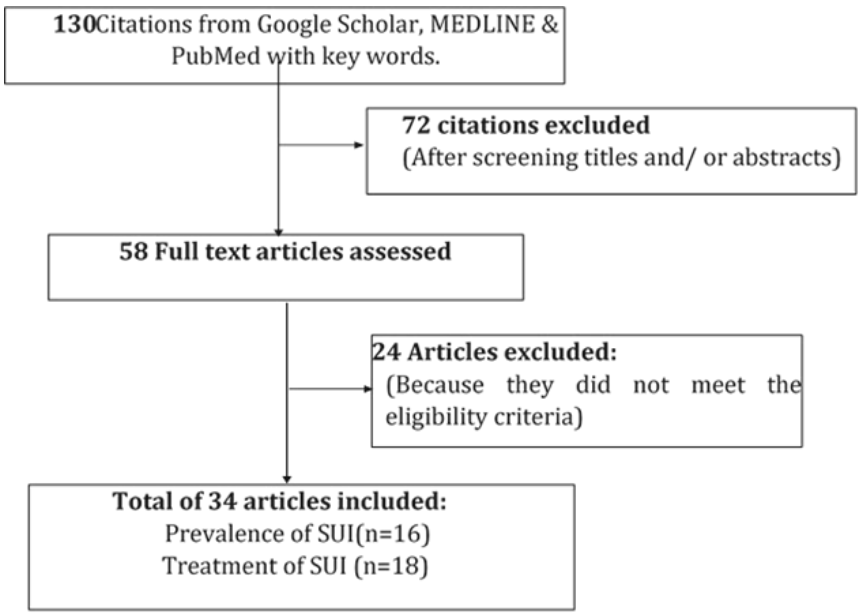

Figure 1: Selection Procedure for Reviewing For Papers of Occurrence and Management of Stress Incontinence for Urination in Female Athletes

The prevalence of urinary incontinence caused by stress in female athletes

Women of all ages experience urinary incontinence frequently. Given prior statistics, the probability of incontinence in female athletes was shown to be 5.45 times larger than in male athletes (4).

Nowadays women have a keen desire to keep themselves fit and maintain in shape which results in high risk to their pelvic floor muscles which leads to urologic symptoms (5). SUI is the most common kind of urine incontinence, with incidence rates ranging from 10% to 55% among women aged 15 to 64 (4). SUI was reported by 28% of female collegiate recreational athletes and around two-thirds of female gymnasts (5, 6). Previous studies deny the customary thinking that athletes involving in regular fitness training don't suffering from urinary incontinence and it offers them the protection from this condition (7, 8).

According to prior studies, women who participated in some physical activities had higher prevalence rates of stress incontinence, which were influenced by things like athleticism and parity.

Prior research tended to focus on young female athletes competing at the collegiate or professional levels, with a lesser representation of females participating in leisure activities (9). Research on parous, nulliparous women suggested a smaller range of 45.5 to 49.3%, women reported SUI rates ranging from 14% to 48% (5).

Running and jumping exercises have the highest frequency of stress urine incontinence, but less is known about women who participate in strength sports (4). It is essential to understand the musculature of pelvic region of the floor in order to understand problem of SUI. With its attachments laterally to the coccyx and anteriorly to the pubic bone, the floor of the pelvis is a collection of muscles that can form a hammock across the pelvis. The endopelvic fascia, which connects the pubic bone to the tailbone and has holes for the anus, vagina, and urethra, is also included in this. The posterior multifidus, the transversus abdominis and the diaphragm are the supportive structures for the pelvic floor musculature, which resembles a three-dimensional cylinder (5). Except before and after urinating, these muscles are always active and can be consciously constricted. According to B, the leading authority in PFM training, the PFM is the sole muscle group in our bodies that supplies skeletal stability to the pelvic systems, along with the vaginal, urethral, and anal. When functioning normally, the phasic and fast twitch fibres of the floor of the pelvis provide quick closure of orifice. Floor of the pelvis muscles contracts along with abdominal muscles and deep muscles of the back to provide stability, strength and support to the spine and internal organs. PFM respond properly while doing exercises when intra-abdominal pressure increases. If any of the muscle of core, including pelvic floor, are weakened or damaged, this normal mechanism may be altered. Hence during high impact activities when intra-abdominal pressure increases, there are chances of overloading of PFM which creates downward pressure that pelvic floor unable to support which may lead to incontinence.

Hormonal issues are also a significant problem for athletes; lower oestrogen levels in female athletes with amenorrhea have been linked to decreased bone mass. Decreased oestrogen may weaken PFM which further reduces the elasticity in urinary tract. These changes make it difficult for bladder to control urination which results in urinary leakage. Some female athletes could have a history of weight issues and eating disorders (10). The female athletic triad, including improper eating, amenorrhea, and osteoporosis, may be referenced in this regard (11). Many research studies have demonstrated that nutritional disease such as anorexia nervosa were also associated to urinary symptoms (12). According to estimates, SUI affects a woman's quality of life in between 12% and 52% of cases. The intensity of symptoms and the standard of existence are closely related, with the former having a more detrimental effect on the latter. SUI is a taboo subject, though. Only 5% of the women with SUI, had spoken with doctors or physical therapists about their condition (13).

Table 1: Prevalence of urinary incontinence in sports women

Publisher, Year, Research Style.	Tittle	Subjects	N	Age median (in years)	The assessment	Outcome
Jorge Velázquez-Saornil (14) 2021 Cross - sectional	An investigation on the prevalence of urine incontinence to female athletes	Female athletes	525	30.78	KHQ and ICQ-UI SF	Prevalence of UI in athletes is 44.4%. Long distance running is most common sport that damages PFM.
Avani Pal et al(15) 2021 Observational	Screening of Urinary Incontinence in female athletes	Female athletes	300	22.8	QUID, RUIS and KHQ	Elite athletes:11.76% Competitive athletes:8.70% Recreational athletes:1.57%
E.S Rodriguez-Lopez et al(16) 2021 Cross-sectional	Urinary incontinence prevalence in male and female top athletes	Elite athletes	754 Elite athletes (455 girls , 299 boys)	23.04	ICQ-UI SF, 3 IQ, ISI	Prevalence found to be 45% in female compared to 14.7% in male athletes. 59.9% is having SUI.40.5% experienced leakage while jumping
Marte Charlotte Dobbertin Gram (17) 2020 cross-sectional study	High level rhythmic gymnasts and urinary incontinence	Nulliparous Rhythmic gymnasts	107 Gymnasts	14.5	ICIQ-UI SF	Prevalence above 30% and 70% reported its influence on sports performance.Gymnasts have no knowledge of PFM training
Hale Uyar Hazar (18) 2020 Descriptive	Urinary incontinence in female volley ball players	Female volley ball players	16	21.19	UI information questionnaire, ISI	Majority of volleyball players have UI(68.8%).
Dobrowolski et al(19) 2019 Cross-sectional	Urinary incontinence among competitive rope-skipping athletes	Female rope skipping athletes	103	15	ICIQ-SF, IIQ-7	75% Girls and 7% Boys reported SUI
Alice Carvalhais et al (20) 2018 cross-sectional	Urinary incontinence in elite athletes is closely correlated with high-	Female Nulliparous elite athletes vs Non athlete	372 Elite athletes and 372	19	ICIQ-UI SF	29.6% Elite athletes Vs 13.4% controls reported SUI

	level athletic participation.	(control gp)	controls			
A. M. Cardoso et al(21) 2018 Observational study	Urinary incontinence in high-impact athletes: prevalence, knowledge, attitudes, and behaviours related to this issue	Female athletes	118	18-25	ICIQ-UI SF	70% of athletes had UI. 23% SUI, 23%UUI, 54% mixed UI.
Almeida et al. (22) 2015 Cross-sectional study	Other pelvic floor diseases and urinary incontinence among women Brazilian athletes	Female athletes(Volleyball,judo,,gymnastics, swi-mming)	67 Amateur athletes and 96 non-athletes	18-25	Questionnaire	Overall: 52.2%; volley ball: 43.5, jumping trampoline : 88.9, swimming: 50, judo: 44.4.
Anna Poswiata et al.(23) 2014 comparative	Stress is common place Elite female endurance athletes who are prone to urination	Female athletes(cross country skiers and runners)	112	18-35	short form of UDI-6	Total 45.5% reported SUI
Fozzatti et al.(24) 2012 Prospective Comparative	Study on the prevalence of stress urination in women who engage in high-impact activity	Contrasting women who go to the gym with those who don't	488	20-45	ICIQ-SF	Attended gym:24.6% Did not attend gym:14.3%
Jacome et al (25) 2011 cross-sectional	Urinary incontinence: prevalence and consequences among female athletes	Female athletes	106	24	Questionnaire	41.5% reported SUI
Simeone et al(26) 2010 Observational	Incontinence and symptoms of the urinary tract in female fitness enthusiasts: prevalence	Female athletes	623	18-56	Self-Questionnaire	Prevalence of LUTS :54.7% and Urinary incontinence :30% Maximum incontinent athletes were involved in football,

	and predictors.					volleyball and Hockey
Caylet et al (27) 2006 cross sectional	The frequency and incidence of stressful incontinence of urine in top female athletes	Greatest female athletes	583	18-35	Questionnaire	Greatest athletes prevalence is 28% vs control group is 10%
Eliasson et al (28) 2002 cross sectional	Stress incontinence is common among nulliparous top trampolinists.	Elite female trampolinist	35	12-22	Questionnaire and Pad test during trampoline	Prevalence of SUI in trampolonists is 80% during trainiing
Bø & Borgen(29)2001 Cross sectional and case control	Stress and urge incontinence rates among professional athletes and controls.	Elie athletes vs non - athletes	N=660 elite athletes N=765 non elite athletes	15-39	Questionnaire and clinical interview	SUI has a prevalence of 41% in athletes and 39% in controls.

Physiopathology

In order to understand how sports affect the pelvic floor muscles, two competing hypotheses are available. According to the first, female athletes who frequently exercise have strong pelvic floor muscles because precontraction of the floor of the pelvic muscles caused by increased intra-abdominal pressure results in strengthening of the pelvic floor muscles (30); Another theory is that women athletes may overload, strain, and injure their floor of the pelvic as a result of increased intra-abdominal pressure when exercising (31). The second theory, however, demonstrates how intense exercise alters the amount of PFM collagen (15), causes PFM fatigue (32), or even how the connective tissue may become continuously injured as a result of recurrent increases in abdominal pressure. In fact, it is possible to anticipate that athletes may gradually experience functional or structural alterations in PFM as a result of persistent IAP brought on by participating in high impact sports. In 2005, Kruger et al. looked at the Pelvic Floor human anatomy in athletes and non-athletes. Between the athletic group and the control group, there were noticeable modifications in the width and the floor of the pelvic muscles' cross-sectional area. Interestingly, both variables were found to be higher in high-impact sport participants than in the control group, with 10646.05 mm^2 vs. 86.428.02 mm^2 and 0.890.08 cm vs. 0.670.15 cm, respectively. These earlier investigations indicate that SUI in athletes may be caused by decreased muscle reactivity to mechanical stimuli (33).

SUI prevention and rehabilitation

Women with UI should take steps to reduce the severity of their symptoms and improve their quality of life. Although there are several treatments available, exercises of the pelvic floor, often known as Kegel exercises, are recommended by the Canadian Association of Obstetricians and Gynecologists (by the name of their creator, Kegel, A).

Gracia et al in 2106 concluded that Training the PFM has been reported to improve urine incontinence and it is considered as first line of

treatment. Increased pelvic floor muscle strength has been demonstrated to be an effective treatment for urinary incontinence, particularly "stress urinary incontinence (SUI)" (34).

Luginbuehl et al concluded that nPFM training with involuntary contractions, was more effective in restoring continence in people suffering from stress urine incontinence. Pelvic floor neuro-muscular preparation should be included in sports training programmes for unexpected abdominal contractions. When the pelvic floor contracts, it should induce ventral and cranial movement, and the perineum should not descend during the Valsalva maneuver without abdominal contraction (35). For PFM stabilisation and incontinence prevention, this contraction prior to a rise in abdominal pressure is crucial. According to studies, these physical activities must be performed in an approach that involves the abdomen and musculature that compose the floor of the pelvic.

When performing workouts, the "pelvic floor muscles (PFM)" cooperate with the two major obliquus internus, abdominal wall muscles and transversus abdominis. Pelvic floor muscles form base of group of muscles called core. Erector spinae, obliques, and posterior floor of the pelvic muscles take over if the pelvic floor is injured, whereas transversus abdominis remains weak. This highlights the need of PFM and core muscle exercises for athletes to avoid the development of SUI. According to this study, PFM contractions should be performed while contracting the inner core, just like with Kegel exercises. Among symptomatic women, abdominal muscles were more active than pelvic floor muscles. As a consequence, women ought to become informed of how to perform exercises for the abdomen that minimize abdominal pressure and lessen their risk of UI. Furthermore, executing PFM workouts incorrectly may worsen symptoms (36).

Combined activation of the abdominal and floor muscles of the pelvis while exercising is advised Gil (36, 37) to increase productivity, Key (2013) proposed a training routine centered on core control, which she describes as the ability to create the optimal interal abdominal pressure to support posture, breathing, and movement control. Pelvic floor muscle, deep abdominal, and retraining diaphragmatic coordinated function has favorable consequences, comparable to the witnessed link between breathing, Core, and PFM. Mazur Bialy et al in 2020 found some additional approaches like magnetic stimulation, biofeedback, whole-body vibration technique (WBVT), dry needling, muscle release techniques, trigger point release, and electric stimulation in treating SUI in young female athletes. There is not enough evidence to support the use of entire-body vibration or magnetic stimulation (38).

The effectiveness of prevention exercises and alternative rehabilitation such core strengthening exercises, Pilates, yoga, posture correction, breathing exercises, and other physiotherapeutic treatments is currently unsupported by research (Table 2). A protocol has been written to demonstrate the value of core strengthening and other physiotherapeutic approaches on UI among females, but research is still in its early stages (38). Workout to strengthen the pelvic floor now appear to be the most effective treatment for SUI in female athletes. Other strategies should be taken into consideration for their potential to improve SUI management. Since PFM demands a long-term commitment from athletes, focus must be paid to behavioral adaptation measures to boost each female's self-efficacy and retain the advantages of an ongoing workout habit (39).

There were no randomised controlled trials of PFMT and core muscle strengthening in young nulliparous sportswomen or female athletes, according to a search of Pubmed, MEDLINE, Scopus, Google Scholar, and Web of Science. Relatively few recent research have examined the impact of PFMT and core muscle training on female athletes. The usefulness of PFMT and core muscle strengthening in terms of long-term results is still under debate at the moment. There is undoubtedly a need for greater research in this area.

Various treatment methods and modalities for treating SUI along with references have been discussed in table given below

Table 2: Prevention types are identified, along with rationalization based on evidence references

S.No	Treatment	Descriptions
A	Modalities	a) Heat (40) b) Ice (40) c) PFM biofeedback (41) o To increase endurance and strength o To enhance coordination o To enhance muscular relaxing d) PFM electrical stimulation (42) o To enhance strength of Pelvic floor muscle (if 2/5 PFM strength) o To improve sensory awareness owing to disability. o To decrease discomfort e) Whole Body Vibration Training (WBVT) (43) o To improve PFM muscle strength, endurance and power e) Interferential therapy (44,45) o To strengthen weak muscles of the Pelvic floor o To increases the low urethral closure pressure o To improve the quality of life
B	Manual physiotherapy	1)Soft tissue mobilization and massage(46,47) o To reduce soft tissue constraints. o To enhance range of motion o To enhance the bladder function and blood distribution in the area o To normalize muscle tone 2) Dry Needling and Trigger point (TrP) release(48) o To soften taut bands o To oxygenate the problem muscles and to relieve pain
C	Procedures	1)Joint mobilization o To improve range of motion (49) 2) Muscle Release technique (38)
D	Exercises	1) Pelvic floor muscle strengthening exercises (49,50) o Gravity eliminated o During functional tasks o Manual facilitation o Down training o Knack maneuver o Anti-gravity 2) Core stabilization o Functional exercises o Transverse abdominis muscle o Multifidus muscle o Obliquus Internus and Other abdominal muscles 3) Flexibility exercises including hip and lumbopelvic region
E	Education	1) Body mechanics and posture 2) Bladder/bowel training 3) Dietary changes 4) Relaxation exercises to relax muscles and mind 5) Teach suicidal ideation methods like PFM contraction before increasing intra-abdominal pressure. 6) Weight reduction program should be followed

Conclusions

The literature suggest that sports activities increases the prevalence of urinary incontinence and stress urinary incontinence is most common of all type of incontinence in athletes. SUI-related research has shown that this condition may cause individuals to stop engaging in high-impact sports like gymnastics, aerobics, running, etc. Our observations led us to the further conclusion that each patient's physiotherapy care plan in SUI should be unique and contain typical physiotherapy interventions. Other exercise programmes for females with stress urine incontinence have not yet been shown to significantly reduce urinary leakage. Previous studies proved that often women with SUI are not able to perform isolated involuntary and voluntary contraction of Pelvic floor muscles; hence, in this case, rely only on PFM exercises will be ineffective. In these conditions, techniques based on PFM sensitization should be focused. The effectiveness of Paula method, core muscle training, the Pilates, postural training, breathing exercises, yoga, general fitness training, and other physiotherapeutic techniques like dry needling, Whole Body Vibration therapy, etc. as an alternative to or in addition to muscle of the pelvic floor training for the prevention or treatment of stress urinary incontinence has not yet been conclusively proven. Before these alternative treatments are used as standard clinical practise, more research is required, ultimately involving randomised controlled trials.

Future recommendations

1. Further study is required to assess conservative, preventative, and successful treatment options for stress urinary incontinence.
2. Analytical studies, which are urgently needed, should be continued with more descriptive study.
3. To prevent or lessen the severity of stress urine incontinence symptoms, future studies on alternative core exercises are required.

Abbreviation

KHQ: Kings Health questionnaire, ICQ-UI SF: International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form, QUID: Questionnaire for Urinary Incontinence Diagnosis, RUIS: Revised Urinary Incontinence Scale, ISI: Incontinence Symptom Index, IIQ-7: Incontinence Impact Questionnaire Short Form, UDI-6: Urinary Distress Inventory Short Form, UI: Urinary Incontinence, SUI: Stress Urinary Incontinence.

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Conflict of Interest

There is no conflict of interest with the content of this article.

Ethics Approval

Nil

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No

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