Effects of Physiotherapeutic Techniques and Combination of Physiotherapeutic Techniques with Core Muscle Strengthening Exercises on Stress Urinary Incontinence and Performance in Athletic Event among Collegiate Females

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Abstract: ***Urinary incontinence affects up to two-thirds of all women. Female athletes who participate in high-impact sports may be at higher risk for urinary incontinence and may lack knowledge of prevention measures. The study aimed to study the effectiveness of a combination of physiotherapeutic techniques and core muscle strengthening exercises on stress urinary incontinence and athletic performance. The combination of physiotherapeutic techniques and core muscle strengthening exercises showed superior results in improving athletic performance among collegiate females.***

Keywords: Stress urinary incontinence, Physiotherapeutic techniques, Core muscle strengthening exercises, Athletic performance.

1. Introduction

Stress urinary incontinence is the involuntary leakage of urine with a physical activity such as coughing or sneezing which can happen if the pelvic floor muscles are weak. A weak pelvic floor and a poorly supported urethral sphincter cause stress incontinence. During episodes of stress incontinence, an increase in intra-abdominal pressure e.g., from laughing, sneezing, coughing, climbing stairs etc. causes increased pressure variations within the bladder to the point where it exceeds the urethra's resistance to urinary flow. It is claimed that incontinence during physical stresses is common in young highly fit nulliparous women. The mean age was 19.9 years and all women were nulliparous and the proportions in different sports varied as follows: gymnastics 67%, basket ball 66% and tennis 50% etc **[1].**

It affects more women than men and is very common with industrialized countries reporting prevalence of 30 to 60% for their adult female populations and 5 to 15% of women reporting daily incontinence. This problem is more pronounced in India, where women usually do not seek treatment for their reproductive health problems and do not vocalize their symptoms. There is a "culture of silence" and low consultation rate among Indian women regarding such problems. Stress urinary incontinence can lead to feelings of embarrassment, shame and powerlessness over one's body. Despite this, incontinence is underreported to health professionals. Urinary incontinence is a chronic health complaint that severely reduces quality of life and has multidimensional impact on every aspect of life of the concerned reporting effects on their social, domestic, physical, occupational and leisure activities. Female athletes who participate in high-impact sports which involves running, jumping and landing represent a group who may be at higher risk for urinary incontinence and may also lack knowledge of prevention measures. The prevalence increases with age, ranging from 20 – 30 % in young adult women, 30 – 40 % in middle – aged women, and 40 – 50 % in older women. The ultimate decision making is based on appropriate clinical decision making to target the correct population of patients to make the proper allocations of heath resources for research and treatment **[2].**

Stress Urinary incontinence has shown to lead to withdrawal from participation in high-impact activities and may be considered as a barrier for life-long athletics participation in women. But women's involvement in competitive sports does carry special health concerns, out of which stress urinary incontinence is facing a grave situation. Called the "SILENT CRISIS" by the American gynaecology association, it affects majority of the people, most of whom are too embarrassed to seek medical help. It has resulted in withdrawal of participants from sports and may be considered as a barrier for life-long athletics participation. In a recent survey of 24, 581 community-dwelling women, 9,002 reported incontinence symptoms within the past 30 days, 41% reported stress incontinence only, with a further 45% reporting symptoms of mixed incontinence, thus totaling more than 85% of women with urinary incontinence with a stress component involved **(3).**

Urine leakage occurs when the pressure in the bladder, the expulsive force is greater than the pressure within the urethra, the closure force. At this point the woman loses urine involuntarily. When there is a weakness in the pelvic floor muscles that support the bladder and other pelvic organs, these organs could prolapse and cause additional pressure on the bladder leading to leakage of urine (**Javachandran, 2007**). It is estimated in our country that only one in four women will seek medical advice for incontinence due to embarrassment, limited access to health care or poor screening by health care providers. Urinary incontinence can significantly impair the quality of life

leading to disrupted social relationships, psychological distress from embarrassment and frustration, hospitalizations due to skin breakdown and urinary tract infection and hospitalizations [4].The basic function of the pelvic floor is to support the pelvic organs. De Lancey and Richardson stated that normal pelvic organ support is achieved by support from ligamentous structures above and pelvic floor muscles function from below. At rest, the pelvic floor muscles maintain a minimal resting tone which increases with increased intra-abdominal pressure. Strong pelvic floor muscles help to support the organs against increased intra-abdominal pressure and also enhance normal functioning. The pelvic floor muscles provide closure of the urethra and thereby a stable continence mechanism. The continence mechanism involves coordination among the various muscles in and around the pelvic cavity. During normal function, quick closure of the orifices is provided by the phasic, fast-twitch fibers of the pelvic floor. Loss of sphinteric function may lead to incontinence [5].

2. Materials and Methods

The present study was designed to examine the effects of physiotherapeutic techniques and core muscle strengthening exercises on reduction of stress urinary incontinence and to improve athletic performance in specific track and field events in collegiate females diagnosed with stress urinary incontinence. To achieve this purpose, 45 collegiate females were selected at random and their ages ranged between 17-25 years. The subjects were divided into three groups each consisting of 15 students. , namely, control group and experimental group I and II, each group consisting of (n= 15) subjects. The control group (n=15) did not undergo any treatment. The experimental group I (n=15) was given selected physiotherapeutic techniques which include pelvic floor muscle exercises and interferential therapy for 3 days per week. The experimental group II (n=15) was given selected physiotherapeutic techniques and core muscle strengthening exercises for 3 days per week. Keeping one group as control group, the other two groups served as experimental groups. The experimental group-I (PTG) was treated with physiotherapeutic techniques comprising of pelvic floor muscle exercises and interferential therapy. Group-II (PTCMSG) was treated with physiotherapeutic techniques along with core muscle strengthening exercises. Pretest was administered to all the subjects before treatment.

The following dependent variables were assessed by using standardized tests with reliability and validity. The stress urinary incontinence variable was measured using modified oxford grading scale. The oxford grading measurement scale is commonly used by physical therapists in the clinical assessment, its use is considered a physical therapist's core manual skill, it is simple to use, and it does not require expensive equipment and is very reliable. The importance and accuracy of the use of oxford grading scale as a reliable source in the evaluation of pelvic floor is well substantiated. Pelvic floor was assessed by using MOGS as a valid and reliable tool to assess the pelvic muscle strength. The athletic performance variable was measured using 100 meters run.

The subjects were treated at, Department of physiotherapy, R.V.S. Hospitals Sulur, Coimbatore. The subjects in the experimental group I were treated with physiotherapeutic techniques which includes pelvic floor muscle exercises and interferential therapy for a period of 16 weeks. Subjects in the experimental group II were treated with a combination of physiotherapeutic techniques and core muscle strengthening exercises also for a period of 16 weeks. The intensity of treatment was increased 10-15% constantly every month. The experimental groups underwent physiotherapy treatment for 16 weeks. The subjects were tested for the selected variables before the commencement of treatment and also after the completion of treatment at the end of 16 weeks. The treatment program and the proceedings were clearly explained to the participants.

The study was pre post experimental study. Simple random sampling method was used in this study. To test the significant changes made from the base line to post test on all the groups individually,'t' test was applied. The significance of the means of the obtained test results was tested at 0.05 level of confidence. The collected data have been processed by using analysis of covariance (ANCOVA) to determine if there was any significant difference among the treatment means on each variable. When analysis of covariance showed significant differences between the treatment means, Scheffe's post hoc test was applied to test the significance of difference between the paired adjusted means at 0.05 level of confidence.

3. Criterion Measures

Inclusion Criteria

1. Clinically diagnosed stress urinary incontinence
2. Unmarried females in the age group of 17-25 years.
3. Physically active collegiate females.

Exclusion Criteria

1. Patients on medication such as diuretics, sleeping pills or muscle relaxants, antidepressants, anti histamines, antipsychotic drugs or calcium channel blockers.
2. Urinary tract infection
3. Vaginal infection
4. Faecal incontinence

Table 1: Computation of 't' ratio between pre and post test on Stress Urinary Incontinence of Control Group

Variable –I(Stress Urinary Incontinence)	*Pre-test Mean*	*Post test Mean*	*Mean diff.*	*SD*	*SE of MD*	*'t' – value*
MOGS	3	2.8	0.2	0.94	0.24	0.823

The obtained't' values of modified oxford grading scale was 0.823. Since, the calculated t values of variable-I (Stress urinary incontinence) is lesser than the 't' table value 2.145 at 5% level of significance with 14 degree of freedom, it implicates that there is no significant difference exists between the pre and post test means scores of the control group. This proves that in the control group, the subjects who did not receive any treatment, there was no improvement.

Table 2: Computation of 't' ratio between pre and post test on Stress Urinary Incontinence of Experimental Group – I (Physiotherapeutic Techniques)

Variable –I (Stress Urinary Incontinence)	*Pre-test Mean*	*Post test Mean*	*Mean diff.*	*SD*	*SE of MD*	*'t' – value*
Modified oxford grading scale	2.73	2.80	0.666	0.617	0.242	4.183*

Table 2 reveals the computation of 't' value of experimental group-I on stress urinary Incontinence. The obtained 't' value of modified oxford grading scale was 4.183. Since, the calculated t values of variable I (stress urinary incontinence) is greater than the 't' table value of 2.145 at 5 % level of significance with14 degree of freedom, it implicates that there is significant difference exist between the pre and post test mean scores of the Experimental group-I. The values reflected in the final column indicate the level of significance which proved to be highly significant. It shows that there is a significant change in the outcome due to the treatment given to the subjects in Experimental group-I.

Table 3: Computation of 't' value between pre and post test on Stress Urinary Incontinence of Experimental Group-II (Physiotherapeutic Techniques with Core Muscle Strengthening Exercises)

Variable –I (Stress Urinary Incontinence)	*Pre-test Mean*	*Post test Mean*	*Mean diff.*	*SD*	*SE of MD*	*'t' –ratio*
Modified oxford grading scale	2.60	3.86	1.266	0.961	0.248	5.104*

Table 3 reveals the computation of 't' value of Experimental group-II on stress urinary incontinence. The obtained 't' value of modified oxford grading scale was 5.104. Since, the calculated t values of variable-I (Stress urinary incontinence) is greater than the 't' table value 2.145 at 5% level of significance with 14 degree of freedom, it implicates that there is significant different exist between the pre and post test mean scores of the Experimental group-II (Physiotherapeutic Techniques with core muscle strengthening exercises). From the results, it is inferred that the physiotherapeutic techniques in combination with core muscle strengthening exercises has highly improved the 100 meters sprint and long jump performance of the subjects.

Table 4: Analysis of Co Variance on pre, post and adjusted post test means among control, experimental group-I and experimental group-II on modified oxford grading scale of variable-I(SUI)

MOGS				Source of Variance	df	Sum of Square	Mean Square	F – ratio
	Control Group	Exp. Group -I (PT)	Exp. Group - II (PTC)					
Pre test	3	2.73	2.6	Between Groups	2	1.24	0.62	0.98
				Within Groups	42	26.53	0.63	
Post test	2.8	3.4	3.87	Between Groups	2	8.58	4.29	4.32*
				Within Groups	42	41.73	0.99	
Adj. Post test	2.64	3.43	3.99	Between Groups	2	13.19	6.59	9.51*
				Within Groups	41	28.41	0.69	

Table 4 reveals the computation of 'F' ratios on pre test, post test and adjusted post test means among Control group, Experimental Group –I (physiotherapeutic techniques) (EXP GRP-I) and Experimental group-II (physiotherapeutic techniques with core muscle strengthening exercises) (EXP GRP-II) on modified oxford grading scale (MOGS) of variable-I (stress urinary incontinence). The obtained F ratio for the pre test means of control group, Experimental G-I and Experimental G -II on MOGS was 0.98 which is less than the table F value of 3.23 at 5 % level of significance; it shows that there is no significant difference. Further, the obtained F ratio for the post test means and adjusted post test means of control group, Exp G-I and Exp G-II on MOGS was 4.32 and 9.51 respectively, which is greater than the table F value of 3.23 at 5% level of confidence for degrees of freedom 2 and 42. Therefore it shows that there is significant difference. From the table, whenever the F value among the adjusted post test means of Control group, Experimental Group –I (physiotherapeutic techniques) (EXP GRP- I) and Experimental group- II (physiotherapeutic techniques with core muscle strengthening exercises) (EXP GRP-II) were found to be significant, in order to find out which of the group has improved in the muscle power on the Modified Oxford Grading Scale (MOGS) better than the other groups, the scheffe's post hoc test was applied

Table 5: Scheffe's Test for the differences between the adjusted post test means on modified oxford grading scale

MOGS			1	CI
Control group	Ex. Group- I	Ex. Group-1I		
2.64	3.43		0.79*	0.66
2.64		3.99	1.35*	0.66
	3.43	3.99	0.56	0.66

Scheffe's Posthoc procedure has been applied for comparing pair of mean values for the adjusted post test observations on modified oxford grading scale. From the Table 4.8, the mean differences of adjusted post test means between the control group and experimental group-I, experimental group-II and control group, experimental group-I and experimental group-II were 0.79, 1.35 and 0.56 respectively. It is observed that the difference between the Control group and Experimental group-I is statistically significant at 5%. Also, difference between the Control group and Experimental group-II is statistically significant at 5%. That is, there is a highly significant increase in the numerical values. However, there is no significant difference between these two experimental groups.

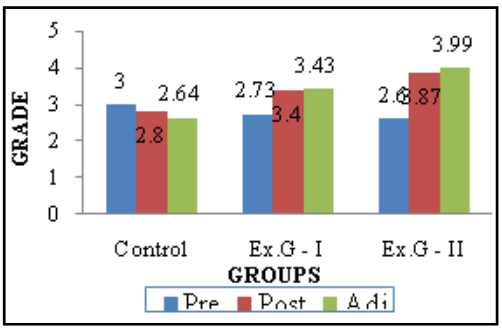

Figure 1: pre test, post test and adjusted means of control Ex. G- I and Ex. G II on modified oxford grading scale

Table 6: Computation of 't' ratio between pre and post test on Athletic Performance of Control Group

Variable –I (Athletic Performance)	*Pre-test Mean*	*Post test Mean*	*Mean diff.*	*SD*	*SE of MD*	*'t' – value*
100 mts Sprint	22.82	23.40	0.573	1.329	0.343	1.670

Table 6 reveals the computation of 't' value of control groups on athletic performance. The obtained 't' values of 100mts sprint was 1.670. The level of significance values indicated in the final column are highly insignificant which proves that in the control group, the subjects who did not receive any treatment, there was no improvement. Since, the calculated t values of all the components of Variable-II (Athletic performance) is lesser than the 't' table value 2.145 at 5% level of significance with 14 degree of freedom, it implicates that there is no significant differences exist between the pre and post test mean scores of the control group.

Table 7: Computation of 't' ratio between pre and post test on athletic performance of experimental group- I (physiotherapeutic techniques)

Variable –I (Athletic Performance)	*Pre-test Mean*	*Post test Mean*	*Mean diff.*	*SD*	*SE of MD*	*'t' – value*
100 mts Sprint	22.71	19.38	3.43	1.445	0.373	9.202*

Table 7 reveals the computation of 't' value of experimental group-I on Athletic performance. The obtained 't' value of 100 meters sprint was 9.202 . Since, the calculated t values of variable-II (Athletic performance) is greater than the 't' table value 2.145 at 5% level of significance with14 degree of freedom, it implicates that there is significant different exist between the pre and post test mean scores of the Experimental group-I **(**Physiotherapeutic Techniques**).** From the results it is inferred that the physiotherapeutic techniques has highly improved the 100 meters sprint performance of the subjects.

Table 8: Computation of 't' value between pre and post test on athletic performance of experimental group- II (physiotherapeutic techniques with core muscle strengthening exercises)

Variable –I (Athletic Performance)	*Pre-test Mean*	*Post test Mean*	*Mean diff.*	*SD*	*SE of MD*	*'t' – value*
100 mts Sprint	21.94	16.71	5.227	1.152	0.297	17.577*

Table 8 reveals the computation of 't' value of experimental group-II on athletic performance. The obtained values of 100 mts sprint was 17.577. Since, the calculated t statistic values of all the components of variable-II (athletic performance) is greater than the 't' table value 2.145 at 5% level of significance with14 degree of freedom, it implicates that there is significant different exist between the pre and post test mean scores of the Experimental group-II **(**physiotherapeutic Techniques with core muscle strengthening exercises**).** From the above table, it is inferred that in 100mts sprint performance there is a significant difference at 0.05(5% level of significance).

Table 9: Analysis of co variance on pre, post and adjusted post test means among control, experimental group-i and experimental group-ii on 100 metres sprint of variable-II

MOGS				*Source of Variance*	*df*	*Sum of Square*	*Mean Square*	*F – ratio*
	Control Group	*Exp. Group -I (PT)*	*Exp. Group - II (PTC)*					
Pre test	22.83	22.71	21.94	Between Groups	2	6.94	3.47	1.05
				Within Groups	42	138.79	3.3	
Post test	23.4	19.27	16.71	Between Groups	2	341.47	170.47	59.07*
				Within Groups	42	121.41	2.89	
Adj. Post test	23.17	19.13	17.09	Between Groups	2	278.43	139.22	98.44*
				Within Groups	41	57.98	1.41	

Table 9 reveals the computation of 'F' ratios on pre test, post test and adjusted post test means among control, Experimental Group –I (physiotherapeutic techniques)(EXP GRP-I) and Experimental group-II (physiotherapeutic techniques with core muscle strengthening exercises) (EXP GRP-II) on 100 metres sprint of athletic performance (variable-II). The obtained F ratio for the pre test means of control, Experimental G-I and Experimental G-II on 100 meters sprint of athletic performance was1.05, is less than the table F value of 3.23 at 5% level of significance, it shows that there is no significant difference. Further, the obtained F ratio for the post test means and adjusted post test means of control, exp G-I and exp G-II on 100 metres sprint was 59.07 and 98.44, which is greater than the table F value of 3.23, therefore it shows that there is significant difference at 0.05 level of confidence.

From the table 9, it is inferred that the significant values represented in the last column are greater than 0.05 for pre test. Whenever the F value among the adjusted post test means of control, Experimental Group –I (physiotherapeutic techniques) (EXP GRP-I) and Experimental group-II (physiotherapeutic techniques with core muscle strengthening exercises) (EXP GRP-II) were found to be significant, in order to find out which of the group has improved in athletic performance 100 metres sprint better than the other groups, the Scheffe'spost hoc test was applied.

Table 10: Scheffe's test for the differences between the adjusted post tests means on 100 metres sprint in athletic performance

100 Metres Sprint(seconds)			*Mean Dif*	*CI*
Control group	*Ex. group-I*	*Ex. group-II*		
23.17	19.13		4.05*	0.94
23.17		17.09	6.09*	0.94
	19.13	17.09	2.04*	0.94

Scheffe's Post hoc procedure has been applied for comparing pair of mean values for the adjusted post test observations on 100 metres sprint of athletic performance.

From the Table 10, the mean differences of adjusted post test means between the control group and experimental group-I, experimental group-II and control group,

experimental group-I and experimental group-II were 4.05, 6.09 and 2.04 respectively. It is observed that the difference between the Control group and Experimental group-I is statistically significant at 5%. Also, difference between the Control group and Experimental group-II is statistically significant at 5%. That is, there is a highly significant increase in the numerical values. However, there is significant difference between these two experimental groups.

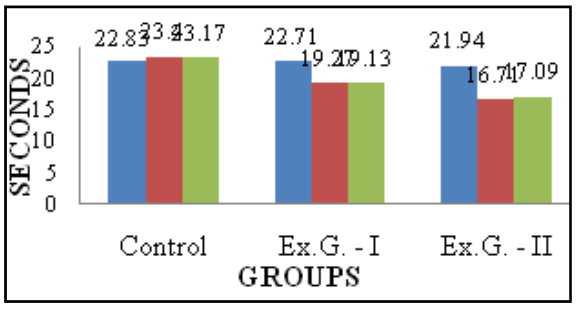

Figure 2: Pre Test, Post Test Means of Control Ex.G- I and Ex.G II on 100 Mtrs Sprint (Sec)

4. Results and Discussion

An effective treatment management was sought in treating the young female athletes diagnosed with stress urinary incontinence through physiotherapeutic treatment techniques comprising of pelvic floor muscle strengthening exercises and interferential therapy and in combination with core muscle strengthening exercises, the reduction in symptoms of stress urinary incontinence and enhancement in athletic performance.

A high prevalence rate (51%) of urinary incontinence is present in a student population of age group 17-25 years[6]. Reported 12% prevalence rate in India[7]. 38% of prevalence rate of stress urinary incontinence among fit nulliparous women[8]. The results from this study indicate that both the subjects treated with physiotherapeutic techniques and a combination of physiotherapeutic techniques with core muscle strengthening exercises produced similar results over stress urinary incontinence which were derived from statistical inference. But in case of athletic performance, very encouraging statistically significant difference was found. Thereby enhancing the quality of life of the collegiate females involved in sports encouraging them to become world class players.

The above findings were very well supported by the observations made by the study conducted by[9]**.** Moreover**,** the study by concluded that PFM exercises done in isolation or in combination with transversus abdominis increased the strength, endurance and decreased incontinence in women with SUI [10]. PFM strength training programs have proven effective in preventing leakage during prolonged provocative physical activities such as running and jumping, during which participants were not instructed to contract the PFM voluntarily during exercise.

The results of the study reveal that between physiotherapeutic techniques with core muscle strengthening group (PTCMSG) and physiotherapeutic techniques group (PT) no statistically significant difference exists. The control group also did not show any improvement in stress urinary incontinence as the subjects did not undergo any intervention. The results of this study are in conformity with the previous studies done by Braekken *et al* (2010), Demiturk *et al*(2008), Neumann *et al*(2006) and Turkan *et al*(2005). Increase in muscle volume following pelvic floor muscle training[11]. Proved the efficacy of a physical therapy program composed of Kegel exercises and interferential current for 5 weeks[12]. Reported the effectiveness of bipolar stimulation technique [13]. The muscle power of pelvic floor muscles had positive correlation when compared with findings of Braekken *et al.*, (2010) and suggests similar improvement with supervised pelvic floor muscle training.

It was inferred that the effects of interferential therapy current on stress urinary incontinence patients showed positive results[14]. The results of the study reveal that physiotherapeutic techniques with core muscle strengthening group (PTCMSG) had significant improvement in athletic performance components such as 100 meters sprint and long jump compared with physiotherapeutic techniques (PT) group whereas control group did not show better improvement in athletic performance as the subjects did not undergo any intervention. But still identifying the right population requires meticulous orientation to the subjects for active participation in the study. Though it is not life threatening, it is a socially embarrassing condition and carries lot of sensitivity among the young females. Performance in athletics and events is one of the main stay of collegiate students especially those belonging to the sports community. A proper training program should be modified to take individual differences into account. The planned treatment program is aiming to maintain, improve or minimize the regression of the condition.

The results of the study are in conformity with the studies of Restrepo (2007), Bo (2001), Patel (1997) and Nygaard (1994}). Stress urinary incontinence is the most prevalent type of urinary incontinence with prevalence rates between 10% and 55% in women between ages 15 and 64 years [15]. The prevalence during sports among young nulliparous elite athletes varies between 0% and 80% and highest prevalence is found in sports involving high impact activities such as gymnastics, track and field etc[16]. 100 meters sprint is one of the commonest athletic events which being power related sport wherein the participant runs a short distance at a very fast pace which accounts for speed. Moreover, the related literature proves that incidence of stress urinary incontinence in young, females is associated with repeated high impact activities like running, jumping etc. High impact sports activities may produce urinary incontinence among female athletes resulting in decline of performance in athletic activities [17]. The study showed 35% physical education students age 18 through 27, reported stress urinary incontinence. The prevalence during sports among young, nulliparous elite athletes varies between 0% (golf) and 80% (trampolinists)**.** While competing in sport, 10.9% and 2.7% of the former elite athletes reported stress urinary incontinence (SUI) and urge incontinence, respectively.

The previous studies were done on the effects of pelvic floor muscle exercises and other conservative physiotherapy

management which include vaginal cones, biofeedback etc in the management of stress urinary incontinence among female athletes. Clear instruction, motivation during therapy and scheduled follow-ups are essential for patients to experience sustained benefits of their exercise protocols. Practitioners should consider the relevant aspects of PFM pathophysiology and the principles of effective muscle training described. The present study indicates that the PFM training program can be applied in SUI women to prevent the leakage. Good benefit of PFM training program can be applied in SUI women with a specific type of the contraction, intensity and duration of the exercise [18].

The present study was done on the effects of core muscle strengthening exercises and physiotherapeutic techniques which comprises of pelvic floor muscle exercises and interferential therapy in collegiate females with stress urinary incontinence. Based on the present results it was concluded that physiotherapeutic techniques and core muscle strengthening exercises given for a period of 16 weeks improves the condition of stress urinary incontinence through the components of modified oxford grading scale and in athletic performance components of 100 meters sprint. Therefore, it was concluded that the combination of physiotherapeutic techniques with core muscle strengthening exercises given for 16 weeks improves the condition of stress urinary incontinence in collegiate females in experimental group II. There is significant improvement in almost all the components of stress urinary incontinence and athletic performance variables when compared to the control group. Among the experimental group I and II, there was no statistically significant difference; marked improvement in athletic performance of 100 meters sprint was observed.

The discrepancy between these results and the results of previous studies might be attributed to several reasons, such as training experience level of the subjects involved, the training programme, the intensity used and the duration of the training program. Before the implications of these findings are presented, it is necessary to discuss the possible delimitations of the current investigation. First, the subjects were recruited from different colleges on the basis of certain characteristics. Therefore, with a fairly homogenous population, it is possible that adolescent females of sample size determined in this study may be too small to be generalized to a similar age with different characteristics would have responded differently to the physiotherapeutic techniques and combination of physiotherapeutic techniques with core muscle strengthening exercise intervention undertaken in the present study. Thus, the effects noted in the present interventions may not have been observed in other populations. Secondly, the presence of no exercises (true control) group made it easy to pinpoint the exact benefits of physiotherapeutic techniques and physiotherapeutic techniques with core muscle strengthening exercises that may have had on the selected variables. Finally, the length of the physiotherapeutic interventions in the current study was sufficient to produce sustainable changes in the selected areas.

5. Conclusions

Based on the results of the study, the following conclusions have been arrived within the limitations. Sixteen weeks of physiotherapeutic techniques and physiotherapeutic techniques with core muscle strengthening exercises have significantly increased the pelvic muscle strength of stress urinary incontinence females. Both Physiotherapeutic techniques and Physiotherapeutic techniques with core muscle strengthening exercises have significantly reduced the severity of symptoms of stress urinary incontinence. The athletic performance variable of 100 metres sprint improved significantly due to influence of sixteen weeks of physiotherapeutic techniques and a combination of physiotherapeutic techniques and core muscle strengthening exercises. It was concluded that the control group diagnosed with stress urinary incontinence had showed statistically no significant improvement in reduction of symptoms.

Further, it was concluded that the subjects who received physiotherapeutic techniques and a combination of physiotherapeutic techniques with core muscle strengthening exercises produced similar results over stress urinary incontinence. It was concluded that there who received a combination of physiotherapeutic techniques and core muscle strengthening exercises, showed improvement in athletic performance compared to the group which received only physiotherapeutic techniques.

6. Recommendations

It is recommended that future research can be designed to study the prevalence of stress urinary in the male athletic population. Similar studies can be conducted on the prevalence of stress urinary incontinence among young, nulliparous female athletes in different districts of Tamil Nadu on a larger scale. It can be designed to investigate the effects of other physiotherapeutic modalities and manual therapy in treating stress urinary incontinence among female athletic population. Similar studies can be done on other dependent variables such as sport specific skills in relation to a particular game such as track and field, gymnastics, basket ball, volleyball, combat sports etc can be carried out. The effects of physiotherapeutic techniques in combination with core muscle strengthening exercises in enhancing the athletic performance on other dependent variables related to the sport population such as speed, agility, muscle strength etc can be studied. The study may also be conducted as a long term study with intermittent follow-up.

7. Implications for Physiotherapist and Physical Educators

Periodic classes can be inculcated as part of curriculum for the female athletes on the anatomy of pelvic floor, pathology, aetiology and prevalence of stress urinary incontinence in female athletes. The board of physical therapy curriculum can consider including content on urinary incontinence in entry-level physical therapy programmes. The physical educators should give more importance by conducting awareness programs on stress urinary incontinence described aptly as ‘SILENT CRISIS’ for the female physical education students to create an understanding on the negative impact caused by the condition which may act as a barrier in life-long athletics participation in women. The present study will give an

insight to the physical educators to frame exercises as part of training protocol for female physical education students.

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