

# EFFICACY OF CORE MUSCLE STRENGTH EXERCISES AND PHYSIOTHERAPEUTIC TECHNIQUES ON STRESS URINARY INCONTINENCE AND PERFORMANCE OF FEMALE ATHLETES

\* Dr. K. Murugavel

\*Professor & Head and Director, Department of Physical education,  
Bharathiar University, Coimbatore, Tamilnadu.

*Stress urinary incontinence is involuntary leakage of urine with a physical activity and happens if the pelvic floor muscles are weak. The incontinence affects quality of life as well as performance in Athletics. Present study investigated the effects of 16 weeks core muscle strengthening exercises and physiotherapeutic techniques on stress urinary incontinence and performance over 45 female athletes aged between 17 and 25 years by screening with King's Health Questionnaire. After exposed to initial assessment the subjects were divided into three equal groups consists of 15 (n=15) each. Stress urinary incontinence was assessed by using modified Oxford Grading Scale, Sandvik severity scale and King's Health Questionnaire. 100m run and long jump test were used to assess the performance. After the training period the post test data was collected from the participated female athletes. The collected data was subjected 't' test and analysis of covariance, to find out the individual and combined effect of treatment. The analysis speculated that the core muscle strength training as well as physiotherapeutic techniques produced significant changes over incontinence and athletic performance. There is a need to improve core muscle strength to prevent the incontinence and improve the athletic performance. Exercise and games should be mandatory at all level of education.*

*Key Words: core muscle strength exercises, physiotherapeutic techniques and Stress urinary incontinence.*

## INTRODUCTION

Incontinence is any loss of urine, faecal or gas at a time that is socially unacceptable. "Incontinence is a condition that will not kill us but it took my life away" is an emotional quote that aptly describes the impact of urinary incontinence on the patient. Approximately more than 80% of incontinence patients can be helped with non-invasive conservation methods employed by physical therapists. Incontinence can be an adverse limiting factors causing athletes to withdraw from sport activities and cause embarrassment among female athletes. Some women even stop exercising because of this problem. The therapist may face poor

compliance with exercise the results in incontinence. In some cases incontinence causes a negative impact on quality of life of the individual and many result in seclusion from social activities family functions and works. Pelvic floor muscle strengthening exercises can help these individuals return to a normal and active life style without fear of embarrassing episodes of leakage (**Hall and Thein 2007**). The pelvic floor muscle contributes significantly to the continence mechanism, contributing about one-third of urethral closure pressure (**Cpater, 2006**).

Physiotherapy is the key to restoring and maintaining a level of physical functions that permits independent **lisy**. The benefits of physiotherapy include decreasing pain, important of joint mobility, increasing strength, coordination and cardio respiratory function. On the whole it offers a range of specialize service of benefits to patient's with cardiac and respiratory disease, occupational and athletic injuries, incontinence, amputation septic joints, stroke, brain injury.

In women especially the pelvic floor is the only transverse muscle group that support load and it is responsible for several functions such as; support of the abdominal and pelvic organs, maintenance of urinary and faecal continence and in increasing intra-abdominal pressure during respiration and in stabilizing the body as a whole.

The supervised pelvic floor muscle training has a positive increase in muscle volume; shorten muscle length and elevation of the resting position of the bladder and return in relations to the morphological are functional changes of the pelvic floor (**Brackken et al 2010**).The strong muscle contractions can be achieved without any significantly uncomfortable skin sensation with the help of Infrerferential therapy in the treatment of stress incontinence (**low et al 2000**) women who completed the pelvic muscle exercise experienced with significant reduction in the amount of urine loss as well as a significant increase in pelvic muscle characteristic (**Dougherty et al 1993**).

The most accepted core muscle exercises program improved and cured 90% of the stress urinary incontinence (**Hodges et al 2007**).

The primary aim of this study was to create awareness and stress urinary incontinence of women athletes and secondly to examine the influence of physiotherapeutic technique and core muscle strengthening exercise on stress urinary incontinence and athletic performance of women.

The internal consistency of kings health questionnaire was high, item characteristics were good, most assumption of summed scale were met and it is extremely valid and consistent psychometric testing supports the reliability and validity of king's Health Questionnaires as a specific measure of Health related quality of life (**Reese et al 2000**). The effectiveness of 4 months PFM stretching program was influenced by the severity of symptoms and improvement score of PFM strength instead of exercise adherence (**Hung et al 2000**). Abdominal muscle strengthening training has superior effects compared to pelvic floor strength training for mild SUI in obese patients (**kamel et al 2011**).

Several investigations have reported the performance changes that occurs during the season in female athletes of various sports, but despite the attention given to performance assessments by sports scientist, there is a paucity of research examining incontinence in female athletes.

Although maximizing the long term development of core muscles is one of the primary goals of core muscle strength training program. Much of what we know about neurological and morphological adaptation to core strength training arise from short term (8 -10 weeks intervention). This is a serious limitations of current knowledge because of the principles of diminished returns dictates that initial improvements in muscular functions are easily invoked and further improvements are progressively harder to achieve. Therefore the purpose of this study was to examine changes over urinary incontinence that occur in female athletes during a 24- week physiotherapeutic and core muscle strengthening training. It was hypothesized that this information would assist the coaches and physiotherapist in designing optimal training programmes and assisting female athletes with developing sports specific training goals.

## **METHODS**

### **EXPERIMENTAL APPROACH TO THE PROBLEM**

To assess the prevalence thousand samples were subjected to assess the changes in stress urinary incontinence (SUI) and performance in female athletes, assessments of incontinence, 100m speed and long jump were conducted on a group of inter collegiate level female athletes over a 24 weeks period. We tested urinary incontinence with King's Health Questioner, 100M sprint and long jump as these change been observed to be key athletic abilities with female athletes. Initial testing commenced after 3 week general preparation phase that included familiarization with test and exercises associated with testing to increase reliability of base line measures. All the testing sessions including final testing were supervised by certified physiotherapist and physical educationist.

### **SUBJECT**

Forty five intercollegiate athletes with stress urinary incontinence (SUI) age  $18 \pm 3.1$  years, height  $160 \pm 56$ cms, body mass  $-60.5 \pm 5.7$  kg, 1RM-  $80 \pm 17.8$  kg participated in his investigation, participants had  $\geq 6$  months of structured strengthening exercises. All athletes volunteered for the testing as part of their normal training and monitoring regime. Ethical approval was provided by the Institutional Review Board (IRB), and all the subjects provided written informed consent. All the procedures confirmed to the declaration.

### **PROCEDURES**

Tests were selected to assess stress urinary incontinence (SUI), sprint and long jump performance of female athletes. 500 collegiate athletes were screened for stress urinary incontinence by using modified King's Health questionnaire to select that the samples are eligible for participation in the study. Other information obtained in this study through initial screening questionnaire included age, height, weight,

marital status, etc. a prevalence of 100(20%) of subjects were diagnosed with stress urinary incontinence (SUI). Out of which 45 athletes were randomly selected and divided into three equal groups (n=15). The experimental group I and II treated with physiotherapeutic techniques which include floor muscle exercises and interferential therapy and physiotherapeutic techniques and core muscle strengthening exercises respectively for three days per week for a training period of 16 weeks. Control group did not engaged with any treatment. All the subjects were evaluated on Sandvik Severity Scale (SSC) and Modified Oxford Grading Scale (MOGC) during both initial evaluation and after the completion of 16 weeks treatment intervention program. Athletes has obtained from training for 48 hours prior to testing and were asked to maintain a consistent fluid and dietary intake on each day of testing. Before the start of test day, athletes were instructed to performance standardized dynamic warmup as directed by their certified physiotherapist and core muscle strength training specialists.

## TRAINING

Athletes confined with training program for a typical season, although the athletes in this study were from intercollegiate participants, they are not professional and therefore train and complete part time. This involved treatment session for 45 minutes for a period of 4 month in .3 days per week.

The physiotherapeutic techniques program was designed with pelvic floor muscle exercises and interferential therapy modality to maximize the long term development of pelvic floor muscle in order to overcome incontinence. A complete pelvic floor exercise programme include fast twitch and slow twitch contraction interference therapy with frequency of 10-50hz rhythm of bipolar placement in posterior pad ulnar is chial tuberosity and the anterior pad on perineum just below the symphysis pubis at an intensity equal to maximum of patient comfort was applied.

Athletics in the experimental group II were treated with four core muscle exercises commencing from a single set and five repetitions to two sets on ten repetitions with rest period of 30 second the exercise are progressed from the basic supine lying position in the first month to side lying in the second month followed by quadruped position in the third month to sitting position in the fourth month.

Moreover this study focused on lower body adaptations throughout the season as this was controlled more among all the athletes are of groups. Some modification to exercises were made during the programme it required due to technique or injuries status.

## STRESS URINARY INCONTINENCE TESTING

Modified oxford Grading scale (MOGS) was used to assess pelvic floor muscle strength and sandvik severity scale (SSS) was used to measure severity of incontinence were used as outcomes measures (**Jose and Sheela** 2000). Pelvic floor muscle strength was assessed by internal examination which is involves muscle strength evaluation through modified oxford grading scales to examine the ability to contract the

pelvic floor muscles. The pelvic muscle were graded by modified grading by lay **Cock and Jerwood** in 2001 from 0- no muscle activities to 5 – strong muscle contractions.

The stress urinary incontinence was assessed with four level severity index by sandvik severity scale. It is based on information about frequency of amount of leakage (sandvik *et al.*, 2000). SSS scale is calculated from frequency and amount of urine loss on a scale of 1 to 12. 0- dry, 1-2 mild, 3-6 moderate, 8-9 severe, 12 or more very severe incontinence.

(KHQ) kingis health questionnaires was employed to screen the SUI among female athletic. This consists of 21 question divided into eight areas namely, general health perception, and impact of urinary incontinence, limitation of daily activities, social limitations, physical conditions, personal relationship, emotion and sleep. In addition to these, there are two minimum interdependent scales, one assess the severity of urinary incontinence and another presence and intensity of urinary symptoms. These scales, likert are graded four options and general health perception domain with five options of responses. The score ranging from 0-100 and the higher the score obtained worse is the quality of life related to that area

### **SPRINT TESTING (100M)**

After a standardized warmup athletes performed 100M Spiriting on an outdoor track wearing standard training shoes. All athletes began with their front foot positioning 0.5 m behind the start line and were instructed to perform sprint with maximum effort. The previous research shown test re-test measurements of sprint performance change the direction speed, and reactive agility to be reliable. Time to 100 m was assessed by electronic stop watch.

### **JUMP TESTING (LONG JUMP)**

To determine the jumping ability, athletes were asked to perform long jump over standardized jump pit. Athletes performed 3 jump with 1 minute rest between each attempts, best jump distance was recorded. Long jump performance can be influenced by body position during flight; therefore athletes were instructed and carefully observed to maintain legs while air bones.

### **STATISTICAL ANALYSIS**

Statistical analyses were performed using SPSS version 17.0 the changes in performance measures over time were analyzed by 't' test for individual effect and analysis of covariance (ANCOVA) with significant main effects examined by Scheff's post hoc analysis. A Criterion alpha level of  $P \leq 0.05$  was used to determine statistical significance. All data are reported as mean  $\pm$  SD to examine the magnitude of the changes independent variables, effect size (ES) was also calculated for all measures using the formula  $ES = \frac{\text{posttest mean} - \text{pretest mean}}{\text{Pretest SD}}$ .

Table I

Computation of 't' Ratio between Pre and Post Test on **Stress Urinary incontinence** of Control group and Experimental group I & II

Variables I	't'- Value		
	Control Group	PPT	PPT+CMT
Modified oxford grading scale	0.823	0.823	5.104*
Sandvik severity scale	0.222	0.222	10.435*
Gen health problem	0.695	0.695	14.000*
Incontinence impact	0.590	0.590	6.205*
Role limitation	0.292	0.292	11.227*
Physical limitation	0.106	0.106	9.025*
Social limitation	0.000	0.000	8.290*
Emotions	0.652	0.652	10.460*
Sleep	0.430	0.430	5.916*
Severity	0.863	0.863	9.023*
100 mts Sprint	1.670	9.202*	17.577*
Long Jump	1.647	8.015*	14.038*

Table II

Analysis of co variance on Pre, Post and Adjusted Post test means among control, experimental group I and experimental group II

Variables I	'F'- Value		
	Pre	Post	Adjusted
Modified oxford grading scale	0.98	4.32	9.51
Sandvik severity scale	1.47	4.52	22.25
General health problem	0.10	7.98	23.33
Incontinence impact	1.43	9.52	11.43
Role limitation	0.37	4.34	20.03
Physical limitation	0.18	5.24	13.17
Social limitation	0.64	4.41	11.66
Emotions	2.20	5.13	22.12
Sleep	0.81	5.16	10.54
Severity	1.24	4.55	21.67
100 mts Sprint	1.05	59.07	98.44
Long Jump	0.95	4.26	63.52

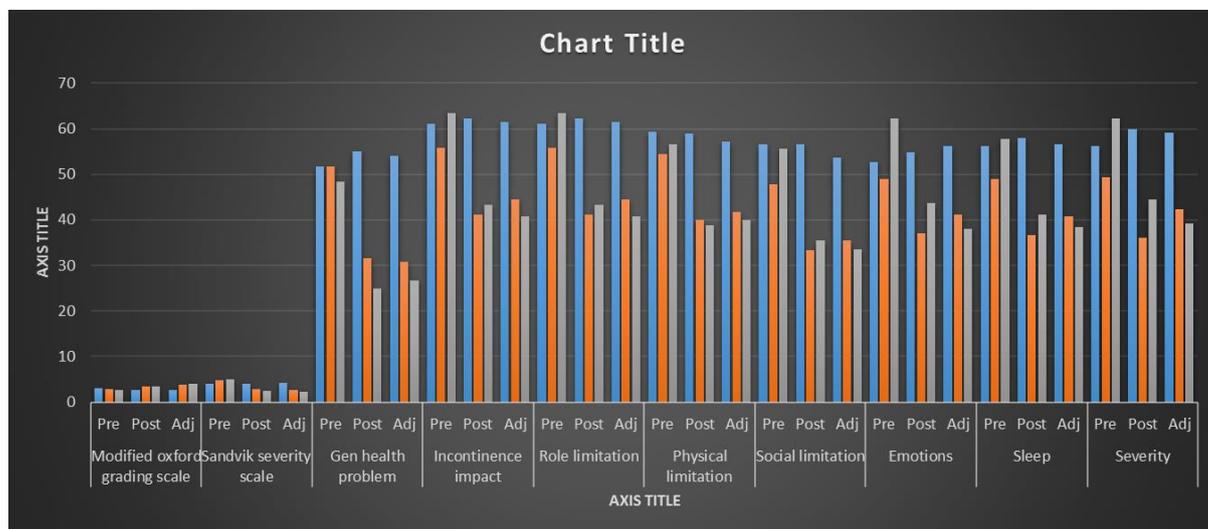


Figure I Pre,Post and Adjusted means of Thre groups on Sress Urinary Incontinence

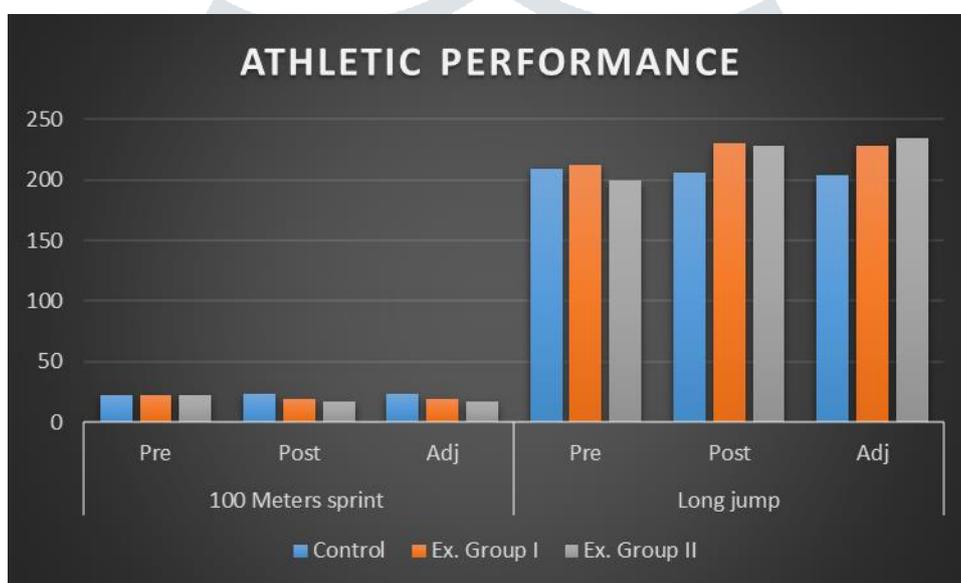


Figure II Pre,Post and Adjusted means of Thre groups on Athletic Performance

**RESULT**

Analysis of co variance demonstrated that, the results from this study are very encouraging and it demonstrates the benefits of physiotherapeutic techniques and core muscle strengthening exercise over stress urinary incontinence and athletic performance functions. Not only can the collegiate female athletes use the combination treatment to get cured from SUI but also becomes more actively involved in sports and become world class athletes. In addition pre mature retirement form sports can be referred and health complication arising due to sudden seclusion can also be prevented

**SUI**

Physiotherapeutic techniques training for 16 weeks resulted with significant improved MOGS,SSC and King’s Health questionnaire domains of general health, incontinent impact, role of limitation , physical limitation ,social limitation, limitation, emotion,

sleep and severity over 24.16%, 41.67%, 38.71%, 26.67%, 26.45%, 26.53%, 30.23%, 24.24%, 25.11% and 26.97% respectively in comparison from baseline to the post test. When physiotherapeutic techniques are combined with core muscle strength training produced improvement in the domains over 45.24%, 53.25%, 38.84%, 24.69%, 27.84%, 27.33%, 36.18%, 34.06%, 28.68%, and 25.99% respectively the athletes in the control group had not expressed any changes over the domains selected in this study. The subjects treated with combination of physiotherapeutic techniques and core muscles strength training had greatly improved their results MOGS (48.69% vs 24.16%), SSS (45.32% vs 41.67%) general health (48.27% vs 38.71%), incontinent impact (24.69% vs 16.32%) role limitation (31.56% vs 36.45%), physical limitation (31.38% vs 26.53%) social limitation (35.99% vs 30.23%), emotion (29.76% vs 24.24%), sleep (28.85% vs 25.11%) and severity (28.57% vs 26.97%). The greatest growth increase of 48.69% was found on MOGS as in SSS it was 45.32%.

Sprint and jumping performance significantly improved with 23.82% and 8.52% respectively. Sixteen weeks of physiotherapeutic treatment improved performance of 100 m sprint and long jump over 15.12% and 8.52% respectively in comparison from baseline to post test performance in 100 m sprint and long jump improved over 23.82% and 14.32% respectively due to influence of combined effect of physiotherapeutic techniques and core muscle strength training. Combined treatment has greatly improved their results in 100 m Sprint (23.82% vs 15.12%) and long jump (14.32% vs 8.52%).

## DISCUSSION

From the research of present investigation speculates that two treatment programs of physiotherapeutic techniques which comprises of pelvic floor muscle training and interferential therapy and a combination of physiotherapeutic with core muscle strengthening exercises are effective methods to improve the stress urinary incontinence through MOGS, SS scale and king's health questionnaire which include domains like general health incontinence impact, role of limitations, physical limitation, social limitation, emotional problem, sleep energy, disturbance and symptoms of serenity measure. The other variable of athletic performance is to measure through 100 m Sprints and long jump. In case of both variables, the statistical influence was sought after sixteen weeks of combination of PPT and core muscle strengthening exercise

PFM Strength training programs have proven effective in preventing leakage prolonged provocative physical activities such as running and jumping during which participants were not instructed to contract the PFM voluntarily during exercise, it is suggested that PFM can be trained indirectly by training the transverse abdominal muscle. This is based on an understanding that the PFM are part of the abdominal capsules surrounding the abdominal and pelvic organs. The structures included in this capsule are the lumbar vertebral and deeper layers of the multifidus muscle, the diaphragm, the TrA and PFM (Bo 2004).

The findings of the study are in conformity with those of previous studies done by the investigators on this area. **Bracken** et al., (2010) supervised pelvic floor muscle training had an increase in muscle volume,

shorten muscle length and elevate the resting position of bladder and rectum. **Demirturk** et al., (2008) use of interferential currents show positive results on severity in patients with stress urinary incontinence. **Talaz** et al., (2009) there is a positive correlation between PFM contraction strength and forced expiratory flows indicating core muscle exercise effectiveness in improving stress urinary incontinence.

The physiotherapeutic techniques examined in the current study emphasized on pelvic floor muscle exercise (kegel's exercise) are interferential therapy along with core muscle strengthening exercise. The finding of the current study also have positive relation when the finding of **Low** et al., (2005) suggesting similar physiotherapeutic techniques combining PFM exercise and interferential therapy in treating females with stress urinary incontinence the positive influence of a combination of PPT with core muscle strengthening exercise on the reduction of SUI is registered. The severity of incontinence symptoms were reduced remarkably in the final assessment.

There is a lot of supportive studies existing to indicate the prevalence of SUI among young, nulliparous collegiate females especially those involved in sports activities. But still identifying the right population requires meticulous orientation to the subjects for active participants in the study. Though it is not life threatening, it is a socially embarrassing condition and carries lot of sensitive among the young females.

Performance in athletics is one of main study of collegiate students especially those belonging to the sports community. Because every subject is different, each person's response to exercise and treatment will vary. A proper training programs should be modified to take individual difference into account likewise the treatment techniques should be tailor – made to suit the individual. The planned training programs is aiming to maintain improve or minimize the regression of the condition **Restrepo** (2007) 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. Females athletes involved with track and field (long jump, triple jump) are at higher risk, although frequency of SUI is noted is tennis player, jogger etc. **Bo** (2001) 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. **Patel** (1997) activities must commonly associate with sudden increase in intra-abdominal pressure and jumping, landing and dismount. It is speculated that athletes are more incontinent during sports that requires running into a jump, which adds moment to the dynamic impact of abdominal viscera on pelvic floor. **Nygaard** (1994) incontinence during physical exercise is common in young highly fit nulliparous women. The proportions in different sports were gymnastics 67%, basketball 66%, tennis 50% etc.

Therefore, our results seem to place an emphasis on the importance of stimulating physiological requirements, while at the same time honoring the external structure of women athletes. From an overall analysis, it is clear that 4 months of physiotherapeutic technique and core muscle strengthening modelling have produced different adaptations on athletes is incontinence. Our data support the notion that stress

urinary incontinence and probably athletic performance were most likely result of the performed training models, with experiment groups showing significant improvements, whereas no improvements were detected in the control group. Our overall results demonstrate that physiotherapeutic technique training model not only better exemplifies the stress urinary incontinence of athletes but also develops sprint and jumping performance.

The results of this study should be viewed in the context of the analysis sample (college Women athletes). Further research on the chronic effects of physiotherapeutic technique and core muscle strengthening training in athletes is needed. However, the implementation of physiotherapeutic technique and CMT specific intermittent, high intensity exercises programme during the competitive season appears to be beneficial to prepare junior athletes according to metabolic and psychological specific determinants. In fact, this type of training seems to be better suited for with stress urinary incontinence because it exactly simulates the core muscle and structure of sport and became extrinsic motivation is enhanced during training.

## CONCLUSION

Our results suggest that both physiotherapeutic technique and CMT training modalities were able to maintain initial values of stress urinary incontinence and athletic performance, however, stress urinary incontinence and performance increased only in the women from experimental group. Therefore, the physiotherapeutic technique and CMT may be more beneficial to performance junior women athletes according to cardiovascular and metabolic specific determinants.

## REFERENCE

- 1. Bo K and Borgen Sundgot ,(2010)** Are former female athletes more likely to experience urinary incontinence later in life than non-athletes, *Scandinavian Journal of medical Science and Sports*, Volume:20(1),pages 100-4.
- 2. Braekken Hoff, et al., (2010)** Morphological change after pelvic floor muscle training measured by 3-dimensional ultrasonography; A randomized controlled Trial, *Obstetrics and Gynaecology*, volume :115,pages:317-324..
- 3. Demirturka Funda, et al., (2008)** Interferential Current Versus biofeedback results in urinary stress incontinence, *swiss medical weekly*, Volume 138 (21-22),page 317-321.
- 4. Dougherty M, et al., (1993)** Graded pelvic muscle exercise. Effect on stress urinary incontinence. *Journal of reproductive medicine*. Volume :38(9), page 684-91.
- 5. Hodges P.(2007)** Postural and Respiratory Functions of the Pelvic Floor Muscles *Neurourology and Urodynamics*, volume 26(3), pages: 362-371.
- 6. Hung Hsiu – Chuan, et al., (2012)** Exercise adherence to pelvic floor muscle strengthening is not a significant predictor of symptom reduction for women with Urinary incontinence, *Archives of Physical Medicine and Rehabilitation*.

7. **Kamel M.Dalia, Ali A Thabet, Sayed A Tantawy and Mohamed M.Radwan, (2011)** effects of Abdominal Versus Pelvic floor Muscles Exercise on Vaginal and Leak point Pressures in Mild Stress Urinary Incontinence in obese women. Life Science Journal, Volume:8(4), Page :542-548.
8. **Lo,S et al., (2005)** Additive effects of interferential therapy over pelvic floor exercise alone in the treatment of female urinary stress and urge incontinence: A randomized controlled trial. Hong Kong Physiotherapy Journal, Volume :21,Page 37-42.
9. **Nygarrrd, et al., (1994)**,Urinary incontinence in nulliparous elite athletes.Obstetrics & Gynecology volume 84(2),page 183-7
10. **Patel A, Datta S,Kovoor ET (2008)** Pelvic floor muscle training versus other active treatment for urinary incontinence in women (protocol) Cochrane Database of Systematic Reviews,Issue :2.
11. **Talasz Helena, et al., (2009)** Breathing with the pelvic floor? Correlation of Pelvic floor muscle function and expiratory flows in healthy young nulliparous women,International Urogynecology journal, volume: 23,pages 1231-1237.

