

Efficacy of Whole Body Vibration Training and Yoga along with Resistance Band Exercise for Urinary Incontinence: A Pilot Study

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ABSTRACT

Introduction: Urinary incontinence is the involuntary loss or leakage of urine. It occurs in both sexes but is more frequent in women. The most common subtypes are stress and urge incontinence. A patient exhibiting symptoms of both stress and urge incontinence is said to have mixed incontinence. Whole Body Vibration Training (WBVT) is a novel intervention reported as an effective training method for muscle enhancement and has recently been added as a modality for strengthening the pelvic floor muscles. Pelvic floor exercises performed using a resistance band have been proven to reduce urinary incontinence and improve Quality of Life (QoL). Yoga is a mind-body practice that is increasingly popular in the West, particularly among women, and involves the practice of physical postures.

Aim: To assess the efficacy of whole body vibration training and yoga combined with resistance band exercises for urinary incontinence.

Materials and Methods: This pilot study was conducted at Dr. MGR Research Institute, Department of Physiotherapy, Chennai. A total of 30 married multiparous women with any subtype of urinary incontinence, aged between 20 and 70 years, were

randomly assigned to two groups. The duration of the study included 45-minute sessions three days a week for six weeks, starting in January 2022 and ending in March 2022. Group A (n=15) was assigned to WBVT with resistance band exercises, while Group B (n=15) was assigned to yoga with resistance band exercises. Pre- and post-test measures were taken using Pelvic Floor Muscle strength (PFMs), the Michigan Incontinence Symptom Index (M-ISI), and the Incontinence Quality of Life (I-QoL) questionnaire scores. Data were statistically analyzed using paired t-tests and independent t-tests.

Results: In this study, the statistical post-test mean values of Group B (yoga with resistance band exercises) showed significant improvement in pelvic floor muscle strength (24.08 ± 1.70) and M-ISI (12.06 ± 2.52). The Incontinence Quality of Life (I-QoL) scores showed significant improvement in both the groups.

Conclusion: This study concluded that yoga combined with resistance band exercises was effective in improving pelvic floor muscle strength and reducing the severity of urinary incontinence symptoms. The quality of life improved in both the groups in patients with urinary incontinence.

Keywords: Pelvic floor muscles, Quality of Life, Urinary bladder dysfunction

INTRODUCTION

Urinary incontinence is the involuntary loss (leakage) of urine. Incontinence in women often arises during pregnancy, childbirth, or at the time of menopause and is typically related to dysfunction of the bladder or pelvic floor muscles [1]. Common types of incontinence in women include stress urinary incontinence, mixed incontinence, and urge urinary incontinence, while rarer subtypes include postural incontinence, nocturnal enuresis, and functional incontinence [2-4]. Urinary incontinence remains a worldwide problem affecting women of all ages, with the prevalence of urinary incontinence (UI) among Indian women reported at 21.87%. The highest numbers were found to have stress incontinence (73.8%), followed by mixed incontinence (16.8%) and urge incontinence (9.5%) [5]. Stress incontinence is characterised by urine leakage associated with coughing, sneezing, or physical exertion, whereas urge incontinence is defined by urine leakage that occurs with a sudden, compelling desire to void that is difficult to defer [6].

Physiotherapy and yoga are important and effective elements in the treatment of Urinary Incontinence (UI), with high levels of evidence indicating that pelvic floor exercises associated with biofeedback promote significant changes in bladder diaries, pad tests, and urodynamic parameters [7,8]. WBVT is a novel intervention

reported as an effective training method for muscle enhancement and has recently been added as a modality for strengthening the PFMs [9-11].

Yoga is a mind-body practice that is increasingly popular in the West, particularly among women. It involves the practice of physical postures (asanas), voluntarily regulated breathing techniques (pranayamas), meditation (dhyana), and a special practice called Ashwinimudra, which incorporates both contraction and relaxation of the gluteal muscles, perineum, sphincter, and the entire pelvic floor [12,13].

Elastic band or TheraBand training, when combined with pelvic floor muscle training, superimposes the hip abductor muscles onto pelvic floor muscle contraction [14]. Pelvic floor exercises performed using a resistance band have been proven to reduce urinary incontinence and improve QoL [15].

This pilot study aimed to estimate the sample size necessary to effectively treat urinary incontinence using three specific treatment approaches. Additionally, this pilot study sought to determine the feasibility of effective treatment approaches for urinary incontinence, obtain sample size calculations for future studies, and identify potential obstacles during the study.

Hence, this study was conducted to assess the efficacy of whole body vibration training and yoga, along with resistance band exercises, for urinary incontinence.

MATERIALS AND METHODS

This pilot study was conducted after obtaining IEC approval from the institutional review board (D-64/PHYSIO/IRB/2022) from January 2022 to March 2022 at Dr. MGR Research Institute, Department of Physiotherapy, Chennai. Written informed consent was obtained before enrollment from all the study participants. The subjects were fully informed about the study and the benefits of participating, ensuring the confidentiality of their personal details.

Inclusion criteria: Thirty patients with any subtype of urinary incontinence, aged between 20 to 70 years, who were married multiparous women, were included in the study.

Exclusion criteria: Pregnant women or those with genital infections, urinary infections, genital prolapse, pelvic or genital cancer, mobility disorders, cardiac diseases, or asthma were excluded from the study.

Sample size: A total of 30 subjects were randomly assigned to two groups of 15 subjects each.

Data collection: A 45-minute session was conducted three days a week for six weeks for both groups. Group A (n=15) was assigned to Whole Body Vibration Therapy (WBVT) along with resistance band exercises, while Group B (n=15) was assigned to yoga and resistance band exercises. Before giving the interventions in both the groups, the pre-test values were recorded by performing Pelvic Floor Muscle (PFM) assessments using a Perineometer and participants were provided with two questionnaires: the M-ISI for assessing the severity of urinary incontinence symptoms and the I-QoL questionnaire for assessing the impacts on urinary I-QoL.

Group A: Whole Body Vibration Training (WBVT)

The WBVT was administered in both static and dynamic positions on a vibration platform with amplitude levels of high=5 mm and low=2.5 mm. In the static position, subjects were asked to contract their hip adductors while sitting with hip joint abduction and their feet off the platform. Additionally, subjects were instructed to sit for progression and to press their buttocks against the vibration platform, as shown in [Table/Fig-1].



[Table/Fig-1]: WBVT-Sitting with hip joints abduction and feet out of platform.

In the dynamic position, subjects sat with their hip joints abducted and their feet off the platform while being instructed to successively bend their hip joints (first the right hip and then the left) to pull their knees into their abdomen. This was also performed while sitting with hip joints adducted and feet off the platform, where subjects relaxed their arms over their thighs and bent their trunks forward, backward, and to the sides, as shown in [Table/Fig-2] [6].

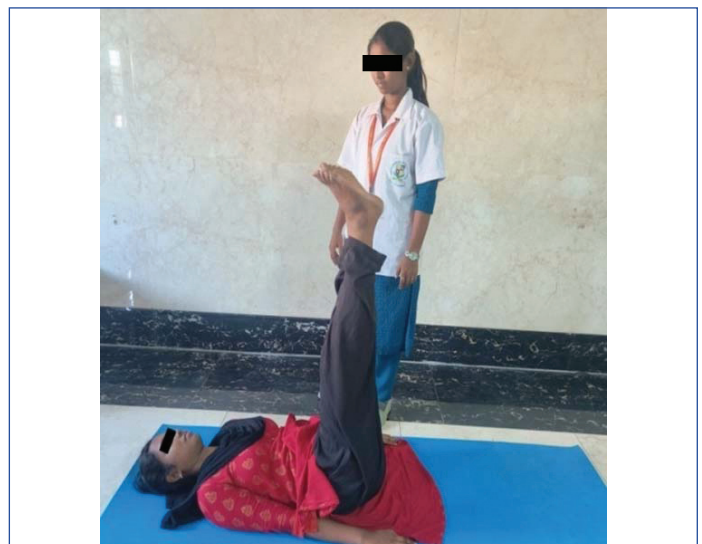
Group B: Yoga Therapy

Subjects participated in yoga asanas, including Uttanapadasana as shown in [Table/Fig-3], Viparita Karani as shown in [Table/Fig-4],

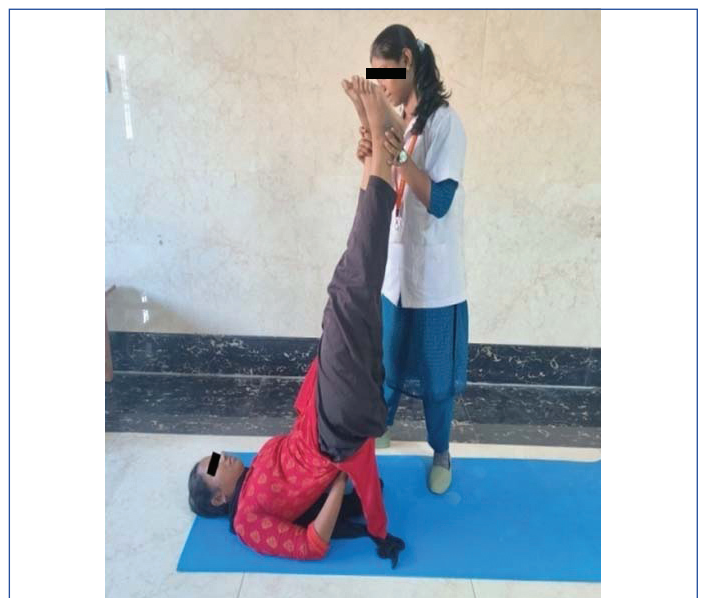


[Table/Fig-2]: WBVT-Sitting with hip joints adduction and feet out of platform.

Naukasana and pranayama for 10 rounds. For the humming bee breath (Bhramari), subjects inhaled through both nostrils and, during exhalation, made a humming sound with their index fingers placed gently in their ears.



[Table/Fig-3]: YOGA- Uttanapadasana.



[Table/Fig-4]: YOGA-Viparita Karani.

Neuromuscular locks (*bandhas*) and mudras included the perineal lock (*Moolabandha*). Subjects were instructed to sit in any

comfortable posture (*Sukhasana*) and pull up the perineum by contracting the entire pelvic floor while simultaneously contracting the muscles around the anus. They were asked to concentrate on the perineal area and hold for three seconds before releasing and relaxing all contracted muscles.

The anal lock (*Ashwini mudra*) involved sitting in any comfortable posture, inhaling deeply, constricting the anal sphincter, and then relaxing the sphincter during exhalation. Finally, meditation techniques guided by breath and awareness of the whole body were performed [12,13]. All the asanas were explained and demonstrated to the participants.

Resistant band exercise for both groups:

Both groups were treated with resistance band exercises. The treatment procedures were explained to the participants using the resistance band. Both ends of the resistance band were aligned and tied in a knot to create a loop. In a lying position, both knees were bent to place both legs inside the loop, with the resistance band positioned beneath the knees. Then, force was applied to keep the knees apart and the buttocks raised; this position was held for a count from 1 to 10, and then the buttocks were slowly lowered. This was done for 20 repetitions each time, three times a day, for a total of 60 repetitions per day [14,15].

The Peritron manometer was used for testing vaginal squeeze pressure reliability in an elderly incontinent population, which showed an Intraclass Correlation Coefficient (ICC) value of $r=0.97$ [14]. The perinometer provides an objective evaluation of perineal muscle strength and is portable (Peritron 9300+, Cardio Design, Castle Hill, Australia). It is connected to a balloon catheter, sized 11.2x6 cm, which is inserted into the vagina. The balloon should be positioned 1 cm from the outside of the vaginal conduit, with the middle of the balloon placed 3.5 cm inside the vaginal introitus [16,17]. The cut-off pressure of the perinometer used in this study was 16-25 mmHg.

The M-ISI is prominent among other questionnaires as it aids clinicians and researchers in discerning the type, severity, and was more related to Urinary Incontinence (UI), while also addressing patients' Pad Usage (PU) [18,19].

I-QoL was initially developed as a condition-specific QoL which measures and reflect the impacts of incontinence in daily life. [18]. The I-QoL contains 22 items, each with a five-point Likert type response scale, yielding a total score and three subscale scores [20-22].

STATISTICAL ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All parameters were assessed using the Statistical Package for Social Sciences (SPSS) version 24.0, with a significance level of a p-value less than 0.05 and a 95% confidence interval set for all analyses. The Shapiro-Wilk test was used to determine the normality of the data. In this study, the Shapiro-Wilk test showed that the data were normally distributed. Hence, a parametric test was

adopted. A paired t-test was used to find the statistical difference within the groups, and an independent t-test (Student's t-test) was used to find the statistical difference between the groups.

RESULTS

The mean age of the individuals included in Group A was 49.8 ± 5.15 whereas in Group B was 50.2 ± 3.97 . The mean duration of incontinence was 0.88 ± 0.34 and 1.3 ± 1.31 in Group A and B respectively [Table/Fig-5].

Characteristics	Group A (mean±SD)	Group B (mean±SD)	p-value
Age (years)	49.8±5.15	50.2±3.97	0.01
Duration of incontinence (years)	0.88±0.348	1.3±1.31	0.01

[Table/Fig-5]: Characteristics of population in both group A and B.

As mentioned in [Table/Fig-6], the post-test mean values of the PFMs score significantly improved with the M-ISI Score and the Incontinence QoL questionnaire in Group A, with a p-value of 0.001.

Group A	Pre-test		Post test		t-test	Significance
	Mean	SD	Mean	SD		
Pelvic Floor Muscle Strength (PFMs)	21.04	1.94	22.07	1.94	-0.977	0.001**
Michigan Incontinence Symptom Index (M-ISI)	23.80	3.52	18.13	2.61	0.211	0.001**
QoL questionnaire	12.20	1.42	16.13	1.55	0.423	0.001**

[Table/Fig-6]: Comparison of pre and post - test mean values of pelvic floor muscle strength score, michigan incontinence symptom index score and incontinence QoL questionnaire in Group A.

*-p>0.05- Not significant and **-p<0.05- Significant

As noted in [Table/Fig-7], the post-test mean values of the PFMs score also improved significantly with the M-ISI Score and the Incontinence QoL questionnaire in Group B, with a p-value of 0.001.

Group B	Pre-test		Post test		t-test	Significance
	Mean	SD	Mean	SD		
Pelvic Floor Muscle strength (PFMs)	21.75	2.04	24.08	1.70	-3.01	0.001**
Michigan Incontinence Symptom Index (M-ISI)	23.53	3.37	12.06	2.52	0.211	0.001**
QoL questionnaire	10.53	1.30	15.86	1.88	3.34	0.001**

[Table/Fig-7]: Comparison of pre and post - test mean values of pelvic floor muscle strength score, michigan incontinence symptoms index score and incontinence QoL questionnaire in Group B.

*-p>0.05- Not significant and **-p<0.05- Significant

The [Table/Fig-8] reveals the mean, Standard Deviation (SD), t-test results, degrees of freedom (df), and p-value of the PFMs score, M-ISI and I-QoL score. There was a significant improvement in the PFM score and M-ISI Score between Group A and Group B. The QoL scores revealed no significant difference between the

Parameters		Pre-test		Post-test			Significance
		Mean	SD	Mean	SD	t-test	
Pelvic Floor Muscle Strength (PFMs)	Group A	21.04	1.94	22.07	1.94	-0.977	0.001**
	Group B	21.75	2.04	24.08	1.70	-3.01	0.001**
p-value				0.01		0.01*	
Michigan Incontinence Symptom Index (M-ISI)	Group A	23.80	3.52	18.13	2.61	0.211	0.001**
	Group B	23.53	3.37	12.06	2.52	0.211	0.001**
p-value				0.001		0.001**	
QoL Questionnaire	Group A	12.20	1.42	16.13	1.55	0.423	0.001**
	Group B	10.53	1.30	15.86	1.88	3.34	0.001**
p-value						0.67	

[Table/Fig-8]: Comparison of pre and post-test mean and standard deviation values between Group A and Group B.

*-p>0.05- Not significant and **-p<0.05- Significant

group; however, there was a significant difference in the pre and post - test values in both the groups.

DISCUSSION

The present study was conducted with a sample size of 30 subjects to compare and determine the effectiveness of WBVT combined with yoga and resistance band exercises to improve PFMs and QoL among female patients with urinary incontinence. In this study, the subjects were randomly allocated into two groups: Group A, which received WBVT, and Group B, which practiced yoga along with resistance band exercises. The results of this study showed a significant difference between both groups. However, when comparing the PFM scores and M-ISI scores between the groups, Group B demonstrated greater effectiveness than Group A.

Yoga is an emerging therapeutic method for improving PFMs and promoting relaxation among patients with urinary incontinence. Additionally, resistance band exercises contribute to the enhancement of PFMs. Yoga therapy is safe and well-tolerated as a therapeutic approach in the management of urinary incontinence. This yoga therapy involved the practice of physical postures, voluntary regulated breathing techniques, meditation, and a special practice called *Ashwini mudra*. *Ashwini mudra* involves the contraction and relaxation of the gluteal muscles, perineum, sphincter, and the entire pelvic floor. Neuromuscular locks, such as the perineal lock (*Moolabandha*) and anal lock (*Ashwini mudra*), were incorporated into this yoga therapy [7,23].

A combined program of pelvic muscle exercises and yoga was effective in improving pelvic muscle strength and the overall incontinence factor in middle-aged women with urinary incontinence. The essential principles of yoga include physical posture, controlled breathing, and meditation. The study included yoga poses that were reported to be helpful for improving pelvic muscle strength, such as the "seated gluteal stretch" to strengthen the gluteal muscles of the thighs and buttocks, the "bound angle pose" to improve circulation through the lower body, and the "bridge" pose to stretch the spine, thighs, and hip flexors. Furthermore, controlled breathing in the proper postures helped concentrate on enhancing muscle strength [8].

The results of the study conducted by Patil NJ et al; showed a significant improvement in the effectiveness of integrated yoga for bladder symptoms in patients with multiple sclerosis. The urge incontinence in Multiple Sclerosis (MS) is attributed to an imbalance of the autonomic nervous system and/or spastic overactivity of the detrusor and sphincter muscles. This study indicated that, in comparison to pelvic floor exercises (PFE), the yogic *Moolabandha* incorporates components of breathing and mindfulness relaxation, which contribute to better neuromuscular coordination. Thus, the effects of yoga seem to be traceable to three factors: balancing the Autonomic Nervous System (ANS), stress reduction, and improved neuromuscular coordination of the pelvic floor muscles [8]. The study suggests that regular practice of *Moolabandha* Yoga Therapy (MYT) enhances women's ability to strengthen their pelvic floor muscles. MYT in the Siddhasana pose is the method used in this study. The asanas included Uttanapadasana, Viparita Karani, and Naukasana, with pranayama exercises performed ten times.

For the humming bee breath (Bhramari), participants inhaled through both nostrils and, during exhalation, made a humming sound while placing their index fingers gently in their ears. Neuromuscular locks (*bandhas*) and mudras included the perineal lock (*Moolabandha*), where subjects were instructed to sit in any comfortable posture (*Sukhasana*). They were then instructed to pull up the perineum by contracting the entire pelvic floor while simultaneously contracting the muscles around the anus. Participants concentrated on the perineal area and held the contraction for three seconds before releasing and relaxing all contracted muscles. The anal lock (*Ashwini mudra*) involved sitting in any comfortable posture, inhaling deeply

to constrict the anal sphincter, and relaxing the sphincter during exhalation. At the end of the session, meditation techniques guided by breath and awareness of the whole body were performed [24].

MYT functions in two ways: first, it increases the pressure in the pelvic floor area by pushing the pelvic floor muscles inward, thus contracting the pelvic floor. The second process involves the contraction of the abdominal muscles, which pushes down and raises abdominal pressure [25].

The results of Lee J et al study demonstrate that, both during the four-week therapy period and the three-month follow-up, WBVT is beneficial in enhancing the strength of the pelvic floor muscles and improving the QoL in individuals with urinary incontinence.

Tantawy SA et al. applied a suggested technique using a vibration platform (Power Plate, USA) in their investigation [10]. This procedure involves using a whole body vibration platform with preprogrammed frequencies and durations to execute a variety of static and dynamic positions. The study demonstrated that the WBVT regimen was effective in reducing the degree of incontinence, increasing the I-QoL score, and strengthening the pelvic floor muscles [10].

The EMG response of the PFMs to WBV was examined by the author, utilizing various body positions and vibration frequencies. The WBV platform for PFMs used in this investigation was the Galileo® Advanced Plus from Novotec Medical GmbH in Germany. The contraction and relaxation signals defined in the EMG software were used during WBV.

Limitation(s)

The study was conducted with smaller populations, and only urinary incontinence subtypes were included. There was a lack of a control group, the treatment duration was shorter, there was no extended follow-up, and only selective treatment approaches were employed.

Additionally, it was difficult to match the age and duration of incontinence at baseline, which could have led to significant bias. Hence, further studies can be conducted in future with a better controlled sample size.

CONCLUSION(S)

This study concluded that yoga combined with resistance band exercises effectively improved pelvic floor muscle strength and reduced the severity of urinary incontinence symptoms. The quality of life in patients with urinary incontinence improved in both the groups. The findings provide initial evidence supporting the feasibility, efficacy, and safety of yoga therapy interventions with resistance band exercises for managing urinary incontinence in women. Overall, the results offer preliminary support for using such interventions to enhance urinary incontinence outcomes in ambulatory middle-aged and older women without complex urological histories.

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