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EFFICACY OF PELVIC FLOOR EXERCISES AND CORE STABILITY EXERCISES IN BHARATANATYAM DANCERS WITH NON-SPECIFIC ACUTE LOW BACK PAIN AND STRESS URINARY INCONTINENCE –A PILOT STUDY

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Abstract

Background: There is abundant literature supporting the effect of core stability exercises in back pain, but lack of evidence to support pelvic floor exercises in back pain and how combined contraction of both the muscles be impactful in treatment of non-specific acute low back pain in Bharatanatyam dancers. Stress urinary incontinence is another emerging condition in Bharatanatyam dancers which can be treated with exercises which again lacks evidence to support it.

Objective: To determine the efficacy of an eight -week core stabilization program (CSE), pelvic floor exercises (PFE) in Bharatanatyam dancers with nonspecific acute low back pain and stress urinary incontinence.

Methods: A sample of 20 Bharatanatyam dancers in the age group 18-30 years participated in core (trunk musculature), pelvic floor and hamstring stretching exercise training program performed three days/week for eight weeks with stretching of other lumbopelvic and hip muscles. Prior to the program, IIQ, ODI and DFOS was measured followed by 6 weeks and 8 weeks. Within-group differences in IIQ, ODI and DFOS were compared by using a Kruskal Wallis test, whereas between-group differences in IIQ, ODI and DFOS, before and after performing the interventions, were analyzed by Mann Whitney U test. The outcomes were regarded as statistically significant at p-value < 0.05.

Results: All the outcomes demonstrated within the experimental group a highly significant mean difference at 8 weeks with p values (IIQ=0.003ODI=0.009, DFOS=0.01) and significant difference at 6 weeks with p values (IIQ=0.039, DFOS-0.035) No significant difference was found within the control group. All the outcomes demonstrated very highly significant mean difference between the two group comparisons only in experimental group at 8 weeks with p values (IIQ=0.001, ODI=0.004, DFOS=0.001).

Conclusion: Core stability exercises and pelvic floor exercises with non-specific acute low back pain and stress urinary incontinence in Bharatanatyam dancers are significant to reduce their discomfort. Thus, the above exercise program is effective.

Key Words: core stability exercises, Bharatanatyam dancers, pelvic floor stability exercises, stretching, stress urinary incontinence. Results: All the outcomes demonstrated within the experimental group a highly significant mean difference at 8 weeks with p values (IIQ=0.003ODI=0.009, DFOS=0.01) and significant difference at 6 weeks with p values (IIQ=0.039, DFOS-0.035) No significant difference was found within the control group. All the outcomes demonstrated very highly significant mean difference between the two group comparisons only in experimental group at 8 weeks with p values (IIQ=0.001, ODI=0.004, DFOS=0.001).

Conclusion: Core stability exercises and pelvic floor exercises with non-specific acute low back pain and stress urinary incontinence in Bharatanatyam dancers are significant to reduce their discomfort. Thus, the above exercise program is effective.

1. Introduction

The Bharatanatyam dance form intricately weaves together music, rhythm, expressiveness, and sculptural postures, characterized by both aesthetically pleasing and technically challenging movements. These movements require precise footwork, a diverse array of significant hand gestures, and considerable mental fortitude for successful execution. Due to the extensive duration and intensity of their training, Bharatanatyam dancers are at a heightened risk of injury. Their rigorous regimen includes frequent performances, prolonged rehearsal periods, skill-intensive motions, and the maintenance of specific postures. The repetitive nature of these movements' places considerable strain on their bodies, increasing the likelihood of overuse injuries that may adversely affect their long-term health.[1] In the realm of Indian traditional dance, posture is a critical element, encompassing three primary positions: "Araimandi," a half-sitting position; "Muzhumandi," a full sitting position; and standing. The most sustained posture in this dance form is Natyarambham, which involves a specific arrangement of arm positions while in the "Araimandi" stance. In this position, the dancer sits deeply on the floor in a V-formation, with her heels grounded, feet together, hips abducted, externally rotated, and knees flexed and spread apart to properly execute Aramandi. In contrast, the dancer in Muzhumandi retains a similar stance, but her heels lift off the ground when she fully squats.[1]

Among Bharatanatyam dancers, the back was identified as the most frequently injured area, accounting for 42.5% of injuries, followed by the knee at 28.3% and the ankle at 18.64%.[2] The back pain experienced by Indian dancers is attributed to several factors, including weak and elongated hamstring muscles, tightness in the back extensor muscles, excessive anterior pelvic tilt, and insufficient core strength.[2] Hyperlordosis leads to a shortening of the erector spinae and hip flexor muscles, while the abdominal muscles become elongated and more susceptible to weakness, resulting in hamstring strains and tightness in the lumbodorsal fascia among young dancers.[2] Bharatanatyam incorporates various movements such as single-leg holds, spins (both single and double-legged), rapid transitions, and changes in postures and stances, including 'aramandi', 'mandi', 'samam', lunge throws, full sits, and side sits. To mitigate the risk of back injuries, dancers engage in warm-up activities (43.7%), rest (31.6%), fitness routines (30%), strengthening exercises (26%), and often have a physical therapist available (23.7%). Symptoms of patellofemoral joint syndrome include knee hyperextension and tightness in the lateral tissues. Additionally, Bharatanatyam dancers frequently exhibit postural deviations that lead to adaptive shortening of the external rotators and posterior capsule of the hip, which restricts internal rotation of the femur, causes foot pronation, creates myofascial trigger points in the calf, and results in flat feet and weakened intrinsic foot muscles.[2]

In NALBP, motor control exercises are focused on reinstating the stabilizing and protective role of the multifidus muscle. These exercises are specifically crafted to activate and enhance the isometric holding capability of the multifidus at the affected vertebral segment, in conjunction with the transversus abdominis muscle. Certain Pilates exercise concepts have been linked to reductions in pain, disability, and improvements in functional range of motion within the neurological control system of the surrounding musculature. The following motor control exercises (MCEs) have demonstrated effectiveness in enhancing spinal stability. Pilates exercises prioritize the strengthening of the core, often referred to as the powerhouse, while also focusing on breath control to engage the diaphragm, lumbar multifidus, transversus abdominis, internal oblique, and pelvic floor muscles, among another local musculature. It has been proposed that more generalized stabilization exercises may be beneficial following

physical training, as they can aid in restoring muscle size at the segmental level.[3]

According to Sungkue S et al., stretching and strengthening exercises are equally beneficial for reducing low back pain. Hamstring tightness and core stability exercises are related, according to the anatomy of the hamstring, which is made up of the biceps femoris attached to the ischial tuberosity, an extension of the sacrotuberous ligament whose position is crossed on the os sacrum and attached to the thoracolumbar fascia. By reducing the anterior pelvic tilt, this connection can limit pelvic mobility and perhaps position the pelvis in a position that puts more strain on the low back. [4] Contract-relax and core stability exercises show how this exercise increases the flexibility of the hamstrings. Since stretching and core stabilization work together to produce a greater stretch, there are numerous programs available to help those who suffer from nonspecific low back pain caused by hamstring tightness.[5]

There is a notable occurrence of stress urinary incontinence among dancers. The Araimandi posture, characteristic of Bharatanatyam, involves a squatting position with both arms extended for extended durations, which places significant strain on the individual's body weight. This position bears resemblance to certain ballet forms, which similarly exert pressure on the lower pelvic support. To sustain this posture during Bharatanatyam performances, the pelvic floor and abdominal muscles must contract in unison, leading to an increase in intra-abdominal pressure.[6] Research indicates that during the initial six to ten years of training, there is a rise in instances of urinary incontinence, likely attributed to overuse or recurrent injuries stemming from altered postures or enhanced flexibility in the lower extremities.[6] Stress urinary incontinence is particularly prevalent among female dancers who have undergone between five to twelve years of training. This phenomenon may be linked to prolonged training sessions that result in overexertion of the pelvic floor muscles while maintaining extended standing positions, as well as longer durations of moderate to high-impact exercises.[7] It is suggested that as the training period lengthens or as exposure to significant forces on the pelvic floor muscles increases, the likelihood of urinary incontinence escalates among female dancers.

A systematic review conducted by Balakrishnan PS et al. on stress urinary incontinence in young nulliparous females revealed that this condition can be effectively managed through various preventive strategies and pelvic floor muscle training. Consequently, it can be inferred that the prevalence of urinary incontinence and the implementation of exercises can aid in its reduction among nulliparous female athletes and dancers.[8]The highest rates of stress urinary incontinence have been observed in young, physically active nulliparous women. Acute injuries are less frequent compared to overuse injuries. Symptoms of incontinence can significantly impair a dancer's overall quality of life, irrespective of the dance style.[6] Urinary incontinence may arise from overuse injuries due to prolonged dance practice, which places stress on the lower pelvic support in Bharatanatyam, contributing to an increase in symptoms.

Reports indicate that 28% of female college students, 22.5% of dancers, and two-thirds of female gymnasts' experience stress urinary incontinence. Notably, hip hop dancers and Bharatanatyam dancers exhibit higher incidences of this condition, with rates of 28% and 26%, respectively.[12] Research conducted by H. Thyssen focused on urinary incontinence among elite female athletes and ballet dancers, revealing that 50% of these individuals have experienced urine loss.[7]However, literature addressing stress urinary incontinence specifically in Bharatanatyam dancers is limited. There are few randomized controlled

trials examining the impact of pelvic floor strengthening activities on the pelvic muscles of Bharatanatyam dancers.[7] Strengthening the pelvic floor muscles may not only support spinal stability but also reduce the severity of stress urinary incontinence (SUI) during high-impact activities such as Bharatanatyam dance.

Furthermore, numerous studies have established a connection between back pain and stress urinary incontinence. Therefore, it is essential to assess and exercise the pelvic floor muscles in individuals with low back pain.[9] Research has demonstrated the benefits of core stability exercises and hamstring stretching for those suffering from acute low back pain. In such cases, stress incontinence may arise due to the interrelationship between core and pelvic muscles, which serve as primary support for the spine. This correlation suggests that core stability exercises should be recommended to address stress urinary incontinence. Additionally, there is evidence linking low back pain in younger women to their pelvic floor health, indicating that pelvic floor stabilization exercises should be performed when a woman experiences acute low back pain. However, limited research exists on the effectiveness of pelvic floor and core stability exercises in alleviating stress urinary incontinence and low back pain in younger females.

There is a lack of extensive research regarding the advantages of incorporating hamstring stretches alongside pelvic floor and core stability exercises specifically for Bharatanatyam dancers. Existing literature indicates a correlation between hamstring tightness and back pain.[10, 11] Stretching has been shown to alleviate hamstring tightness, while core stability exercises, in conjunction with stretching, are effective in addressing this issue.[6] Furthermore, studies suggest that tight hamstrings can exert pressure on the lower pelvic support structures. However, to date, there is no research that demonstrates the combined effects of pelvic floor and core stability exercises, along with hamstring stretching, in the treatment of low back pain and stress urinary incontinence among Bharatanatyam dancers.

2. Review Of Literature

Pavana and Amrutha SV (2021) performed a study to assess the effectiveness of motor control exercises in improving lumbar stability among Bharatanatyam dancers. A total of 85 females with Quebec score >20 was included and given motor control exercises for 6 weeks. Pre and post interventions were examined with Pressure Biofeedback Unit, flexible curve ruler and Modified Oswestry Disability Questionnaire. The core muscle activity and Modified Oswestry disability score significantly ($p<0.001$) improved after the intervention and showed strong significance. The correlation between lumbar lordosis angle and core muscle activity showed positive relation ($r = 0.859$) and statistically significant ($p<0.001$). Thus, results suggest that motor control exercises may be significantly effective in improving lumbar stability among the Bharatanatyam dancers. [8] **P Sneha Balakrishnan and Annie Thomas (2023)** performed a systematic review to find out evidence for the prevalence of low back pain in dancers and to enumerate the causes for low back pain in dance forms like Bharatanatyam, Kathak, hip hop, modern dance and ballet dance[12]. **A L Na'ima et al (2019)** performed a study showing that combination of core stability and contract relax exercises can increase hamstring flexibility.[15] **Rima Musale et al (2020)** did a study to find out the effect of Kegel's exercises, Behavioral Interventions and combination of both on stress urinary incontinence in female dancers using IIQ and Pad test and concluded the effectiveness of various Physiotherapy interventions .[16] **Sara Ellis et al (2016)** performed a pilot study to test the efficacy of an educational exercise program for treatment of stress urinary incontinence in collegiate dancers and found there is a decrease in SUI in 4 weeks and 8 weeks.[17]

P Sneha Balakrishnan and Annie Thomas (2022)

conducted a systematic review of stress urinary incontinence in young nulliparous athletes and dancers females and indicated that SUI can be managed with few preventive techniques and PFM training.[18] **Khan S et al (2021)** performed core and PFM exercise for a period of 6 weeks which is effective in reducing the symptom severity and improving quality of life in females suffering from SUI. These exercises can be of benefit in the rehabilitation of females having symptoms of SUI. Exercises of the abdominal muscles are beneficial in maintaining PFM coordination, support, endurance, and strength.[19]

3. Methodology

Study design:

This is a true experimental (pre-post-test) study. It is a pilot RCT-randomized controlled trial

Study Aim:

The present study aims to compare the effectiveness of core stability exercises and pelvic floor exercises in Bharatanatyam dancers with non-specific acute low back pain and stress urinary incontinence

Study Setting:

It was conducted in the various dance institutions like Sanathana Natyalaya, Natyaniketan, Aradhana Nruthyalaya Kendra,Sri Nrityalaya in and around Mangalore between SEP 2023, and JAN 2024. The research received approval from the Institutional Ethics Committee at Garden City University, Bangalore, India. (GCU-IEC) 03/21 Ph. D-2023.

Sampling Method: Simple random sampling by lottery method technique.

Sample selection

The study sample of 20 Bharatanatyam dancers with non-specific acute low back pain and stress urinary incontinence equally assorted into two groups (n=10 in each group) presenting with complaints of non-specific acute low back pain and stress urinary incontinence and consecutively aged 18 to 30 years who had duration of back pain with NPRS 3 to 8 and not more than 3 months, Nulliparous dancers complaining of stress incontinence or screened with questionnaire QUID -validity: 80%, reliability: ≥0.70%) and Hamstring tightness indicated by passive straight leg, raise-<70 degree hip flexion were selected We included the Bharatanatyam dancers with minimum experience of 5 years in dance and regular training ideally 3 days a week and at least 1hour a day. We excluded the participants based on the history of upper and lower limb bone fracture, spine trauma or vertebral fracture and/or congenital spine disorders, any pathological conditions of the spine. -cancer and inflammatory disease, cardiopulmonary and neurological condition contraindicating the exercise protocol, chronic low back pain, SI joint dysfunction or uterine prolapse degree by stage 2 or higher. Modified Oswestry disability Index (ODI), Incontinence impact questionnaire (IIQ) and Dance Functional Outcome Survey (DFOS) are the outcome measures used.

Sample size calculation

The prevalence of back pain in Bharatanatyam dancers in publication as per Panhale et al was 75%. As per the survey conducted for the proposed study, prevalence of back pain only was found in Bharatanatyam dancers as 73.58%. Sample size Calculation was estimated using the formula, e' is the tolerable margin of error taken as 10% (0.01), Z is taken as either 1.96 ($\alpha = 0.05$) or 2.58 ($\alpha = 0.01$) with 99% confidence interval.

Around 100 Bharatanatyam dancers with back pain

$$=\frac{2.58x2.58x0.74x0.26}{0.01x0.01}$$

$$=128.06$$

If N is 100, value of 'n' is $\frac{128}{1+\left(\frac{127}{100}\right)}$ =56.38 ~57 approximately

Dropout at 10%, final sample size will be 63. Half of this will be randomly allocated to each group under study.

Data collection Procedure:

The data collection consisted of three parts (informed consent, screening questionnaire QUID for stress urinary incontinence and NPRS, duration of back pain and intervention). Upon institutional ethics committee clearance, the participants were randomly selected based on inclusion and exclusion criteria. Instructions and explanation of the procedure were given to the volunteered participants and divided into 2 groups – Experimental group A and Control group B. Both the groups received the protocol for 3 days/week for total duration of 8weeks-6 weeks for supervised session and 2 weeks home based exercises. Bharatanatyam dancers in both groups received a baseline treatment that consisted of hamstring self-stretching exercises and pelvic floor exercises along with core stability exercises. In Control group, self-stretching advice was given along with hamstrings, iliopsoas, rectus femoris, Tendoachilles, and iliotibial band muscles. The baseline data for IIQ, ODI and DFOS were collected on the first day, before the treatment. Furthermore, final data for IIQ, ODI and DFOS were collected on the 3rd day of the 6th week for supervised session and 8th week after unsupervised session (home based exercises).

Treatment:

Protocol was followed with proper guidelines for back pain and stress urinary incontinence where core stability exercises [23, 24] and pelvic floor exercises[20,21] with hamstring stretching[23,24] were recommended.

Warm up session of about 5 mins including all the other muscles like iliopsoas, IT band, Tendoachilles, Rectus femoris self-stretching exercises and jogging were performed. Duration of each session was around 45-60 min in a day. The frequency of exercise was 3 times a week for 6 weeks. Core stability exercises-Abdominal 'tuck in' in crook lying position, Bridge with core activation in supine lying and further exercises of core stability with upper limb and lower limb were given. Pelvic floor stability exercises- kegel exercises and other dynamic exercises like adductors, abductors, TrA with pelvic floor exercises were performed. Both exercises were performed with 60 sec intervals between sets, 3 sets per session (total 30 repetitions) 3 min rest between each exercise. Hamstring stretching was given in different positions like supine, sitting and standing. In control group Bharatanatyam dancers will be advised for hamstring,iliopsoas,rectus femoris, Tendoachilles, iliotibial band self-stretching home-based exercises. No active interventions were given.

Statistical Analysis-The data were analyzed using SPSS software version 26 (IBM Corp., Armonk, NY). Normality of the test was tested with Shapiro Wilk test. The descriptive data was represented as Mean and S.D, Categorical data represented as frequency and percentage. There are two groups- experimental group A and control group B. Within-group differences in IIQ, ODI and DFOS were compared by using a Kruskal Wallis test, whereas between-group differences in IIQ, ODI and DFOS, before and after performing the interventions, were analyzed by Mann Whitney U test. The outcomes were regarded as statistically significant at p-value < 0.05.

Results and Discussion: The 20 participants in the study who met both the inclusion and exclusion criteria were divided into treatment A and control group B, with 10 participants in each group. Both the groups were exposed to core stability exercises and pelvic floor stability exercises along with hamstring stretching.

Table 1 shows the characteristics of the research data. Participants in the experimental group included more 3months or>3 duration and in the control, group included more 2 months duration of back pain and SUI. Both the groups show more dancers who have advanced levels of experience in dance, more than 5 years' experience. The data appears to be not normally distributed, with a similarity of scores of roughly 30 Degrees of freedom, according to the p-values for the IIQ, ODI and DFOS scales, which were significant at $p<0.05$. Furthermore, non-parametric tests were utilized for both within-group and between-group comparisons

Table 1: Baseline socio-demographic characteristics of research data

Variables	Treatment group A (n = 10)	Control group B (n=10)
Age (Years)		
18-23	5(50%)	5(50%)
24-30	5(50%)	5(50%)
Months		
1	1(10%)	3(30%)
2	3(30%)	4(40%)
3 OR >3	6(60%)	3(30%)
EXP LEVEL		
intermed	3(30%)	4(40%)
advanced	7(70%)	6(60%)
EXP IN YEARS		
<5 yrs	3(30%)	4(40%)
>5 yrs	7(70%)	6(60%)
TIME SPENT PER WEEK		
<3 hrs	6(60%)	3(30%)
>3 hrs	4(40%)	7(70%)

It shows the Kruskal wallis test in **Table 2**, non-parametric test with H values where mean difference within the two groups are compared. All the outcomes

demonstrated within the experimental group a highly significant mean difference at 8 weeks with p values (IIQ=0.003ODI=0.009, DFOS=0.01) and significant difference at 6 weeks with p values (IIQ=0.039, DFOS-0.035) No significant difference was found within the control group. **Table 3** provides the comparison –between experimental group A and control group B using the Mann Whitney U test. All the outcomes demonstrated a very highly significant mean difference between the two group comparisons only in experimental groups at 8 weeks with p values (IIQ=0.001, ODI=0.004, DFOS=0.001). **Graphs - Figure 1 a**.IIQ score **b** ODI score **c** DFOS score for both the test scores – Kruskal wallis and Mann Whitney U test

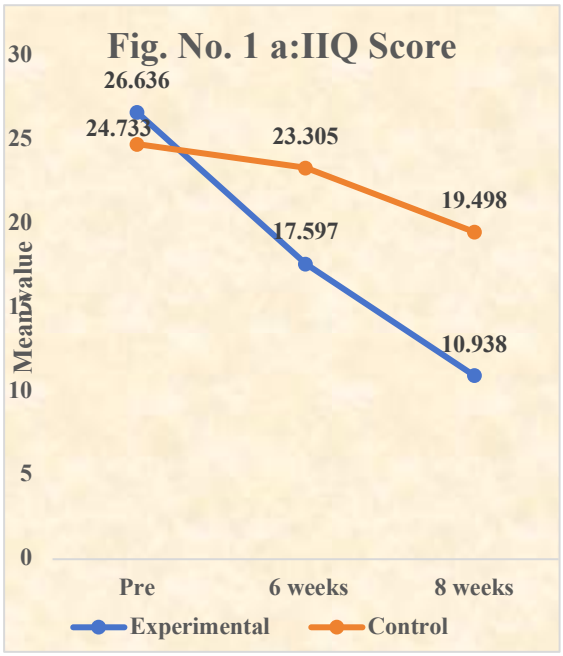
Table 2: Within-Group Comparison (Non-Parametric) of Pre-Treatment and Post-Treatment -6 Weeks and 8 weeks.

***very highly significant, ** highly significant, NS-not significant

Variables	Period	Mean± SD EXP (A)	Mean± SD CONTROL(B)	Z Value	P value
IIQ	pre	26.636±5.117	24.733±6.265	0.671	0.502 NS
	6 weeks	17.597±5.038	23.305±5.697	2.063	0.039 *
	8 weeks	10.938 ±6.744	19.498±3.509	2.969	0.003 **
ODI	pre	9.400±3.273	9.600±3.098	0.000	1 NS
	6 weeks	6.600±4.006	9.000±1.944	1.477	0.14 NS
	8 weeks	2.800±3.676	7.400±2.119	2.601	0.009**
DFOS	pre	10.114±3.493	9.670± 3.357	0.115	0.908 NS
	6 weeks	5.338±3.944	9.670±3.357	2.103	0.035 *
	8 weeks	3.558±3.136	8.003±3.426	2.576	0.01 **

Table 3: Between-Groups Comparison (non-Parametric) of IIQ, ODI and DFOS
**highly significant, * significant, NS-not significant

		IIQ	ODI	DFOS
EXP (A)	Pre	26.636±5.117	9.4400±3.273	10.114±3.493
	Post 6 weeks	17.597±5.038	6.600±4.006	5.338±3.944
	Post 8 weeks	10.938 ±6.744	2.800±3.676	3.558±3.136
H value		18.299	10.882	13.105
P value		p<0.001 ***	p=0.004 **	p<0.001 ***
CONTROL(B)	Pre	24.733±6.265	9.600±3.098	9.670± 3.357
	Post 6 weeks	23.305±5.697	9.000±1.944	9.670±3.357
	Post 8 weeks	19.498±3.509	7.400±2.119	8.003±3.426
H value		4.566	2.907	2.757
P value		p=0.102 NS	p=0.234 NS	p=0.252 NS



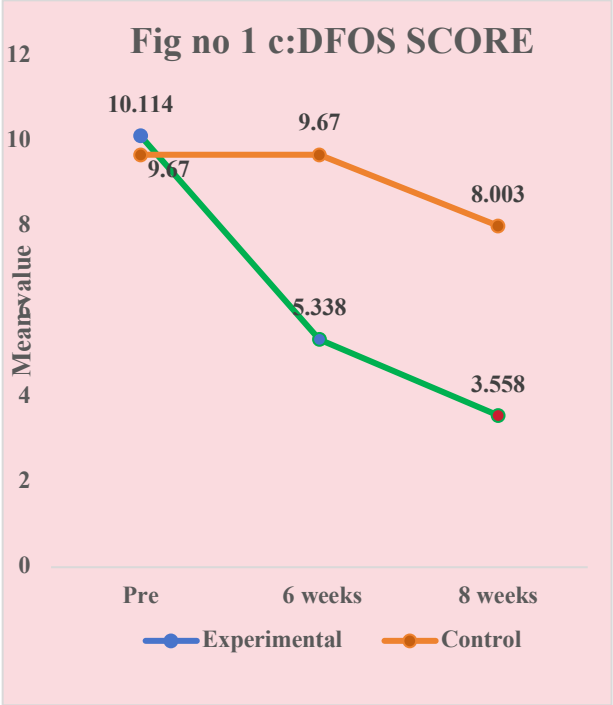


Figure 1: a. IIQ score, b ODI score, c DFOS score

Kruskal Wallis Test score- Within group A and B comparison and Mann Whitney U test score-Between group A and B comparison

4. Discussion

The current study revealed a notable distinction in the application of the core stability exercises, pelvic floor exercises and hamstring stretching, between the two groups of bharatanatyam dancers with back pain and SUI with a $p < 0.05$. This pilot study demonstrated the feasibility for recruitment, treatment compliance with supervised sessions, safety, acceptability and potential effects of treatment on clinical outcomes like IIQ, ODI and DFOS.

Initially, there was no significant distinction between the two groups at the pre-level, but notable differences emerged over time. At 6 weeks, both groups experienced a decrease in mean IIQ and DFOS scores, with the experimental group showing a more pronounced reduction and were statistically significant. This trend continued at 8 weeks, where the experimental group consistently exhibited greater reductions in IIQ, ODI and DFOS scores compared to the control group, and highly significant differences observed. It consistently reveals significant differences between the experimental and control groups, further validating the superiority of the intervention group. This is in line with previous research findings, reinforcing the intervention's impact across different conditions and populations. Murugavel K (2018)showed effects of 16 weeks core muscle strengthening exercises and

physiotherapeutic techniques on stress urinary incontinence and performance over female athletes aged between 17and 25 years .Thus it is more beneficial in athletes [20] Mahalakshmi (2013) 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 all the components of stress urinary incontinence (modified oxford grading score) and athletic performance (sprint and jump) variables when compared to the control group.[21] Roshni Prakash (2015-2016), highlighted the increased adherence of Bharatanatyam and ballet dancers who recognized the benefits of the intervention program.[22] Balakrishnan PS et al showed core stability exercises with hamstring stretching for 6 weeks and 8 weeks is effective in treating nonspecific acute low back pain in Bharatanatyam dancers with improvement in disability status and better quality of life.[23] Balakrishnan PS et al proves core stability exercises are effective in Bharatanatyam dancers which is significant to reduce stress urinary incontinence in them.[24] There is a dearth of literature to combine pelvic floor exercises with core stability exercises and hamstring stretching in Bharatanatyam dancers with nonspecific low back pain and stress urinary incontinence.

The strengths of this pilot study aside from the feasibility assessments include randomized assignment, blinding of outcome assessors and evaluation of important clinical outcomes (i.e. incontinence impact by IIQ, back pain disability by ODI and quality of life by DFOS). Additionally, the lack of prior studies on this topic in Bharatanatyam dancers has limited direct comparisons of our results with other studies. Nevertheless, this pilot study demonstrates important preliminary findings for conducting a full-scale trial of CSE and PFE and assessing quality of life in dancers with DFOS in this part of the world. In response to this study, only a few modifications were made to the full-scale trial protocol. We involved more Bharatanatyam dancers with back pain and stress urinary incontinence. We will facilitate compliance with home programs and follow-ups for 6 months as much as possible by a frequent reminder through phone calls to the participants.

5. Conclusion

Findings of this pilot study suggest that the interventions are promising and conducting a full-scale randomized clinical trial in the future is feasible to confirm the effectiveness of the interventions –core stability exercises and pelvic floor exercises with non-specific acute low back pain and stress urinary incontinence in Bharatanatyam dancers, taking into account the possible arrears of improvements.

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Conflict of Interest Statement
The authors declare no conflicts of interest.

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