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**Sohana Khandekar**  
BPTTh Student, Modern college  
of Physiotherapy, Pune,  
Maharashtra, India

**Dr. Shrikant Mhase**  
Associate Professor, Modern  
college of Physiotherapy,  
Pune, Maharashtra, India

**Correspondence**  
**Sohana Khandekar**  
BPTTh Student, Modern college  
of Physiotherapy, Pune,  
Maharashtra, India

## To study the effect of pilates exercises on low back pain in female Bharatnatyam dancers undergoing training

**Sohana Khandekar and Dr. Shrikant Mhase**

### **Abstract**

**Background and Objectives:** Bharatnatyam dance form involves aesthetic yet challenging movements. Their training requires strength, stamina, flexibility, grace, passion, and emotion. It has been found that there is prevalence of 34.7% of back injuries in Bharatnatyam dancers. Bharatnatyam dancers utilize two movements: a half-sitting pose and a full-sitting pose, both requiring external rotation of the legs and bending at the knee joints, anterior tilting of pelvis, increase in lumbar lordosis and stress is placed on the back muscles to maintain the position. It has been concluded in a previous study that probably when iliacus and psoas major are shortened during repeated hip flexion movements as in half sitting position, it causes anterior pelvic tilt and increased lumbar lordosis which in turn causes imbalances in trunk flexors and extensors and could be the probable cause for low back pain<sup>4</sup>. Core stability, strength and flexibility are emphasised in pilates exercises, as in control of movement, posture and breathing. All these aspects of pilates exercise may benefit people with low back pain as exercise with similar features have been successful in reducing pain and improving functional ability. Thus this study is determined to study the effects of pilates exercises for low back pain in female Bharatnatyam dancers undergoing training.

**Study Design:** Quasi experimental study

**Study Setting:** Bharatnatyam dance institutes in Pune

**Outcome Measures:** Numerical pain rating scale (NPRS) and Oswestry low back pain questionnaire (OSWDQ)

**Method:** 50 subjects were selected on the basis of inclusion and exclusion criteria. After taking informed consent they were taught selected set of pilates exercises which were performed under supervision in groups of 5. The exercises were performed thrice a week for three weeks.

**Result:** The study showed significant reduction in pain and increase in functional abilities of dancers. The comparison of pre and post scores of NPRS and OSWDQ scales shows significant difference.

**Keywords:** Bharatnatyam, low back pain, pilates exercises, Oswestry questionnaire, numerical pain rating scale

### **1. Introduction**

Bharatnatyam is often used to tell religious stories, so the technique of the steps and postures representative of Hindu deities are based on a half-squatting position (Aramandi) or a full-squatting position (Muzumandi) along with rhythmic stamping of the feet and a multitude of crisp and meaningful hand gestures.

In order to correctly execute Aramandi, the dancer has to sit as deeply as she can while still keeping her back straight, feet together in a V-formation, heels on the floor, legs rotated outwards, and knees spread apart. In Muzumandi, the same posture is maintained, but the heels come off the floor as the dancer fully squats.

Bharatnatyam dance form involves aesthetic yet challenging movements. Their training requires strength, stamina, flexibility, grace, passion, and emotion. It has been found that there is prevalence of 34.7% of back injuries in Bharatnatyam dancers<sup>[1]</sup>.

Bharatnatyam dancers utilize two movements—a half-sitting pose and a full-sitting pose, both requiring external rotation of the legs and bending at the knee joints, increase in lordosis of lumbar region and stress is placed on the back muscles to maintain the position. It has been concluded in a previous study that probably when iliacus and psoas major are shortened during repeated hip flexion movements as in Aramandi position, it causes anterior

pelvic tilt and increased lumbar lordosis which in turn causes imbalances in trunk flexors and extensors and could be the probable cause for low back pain [4] Pilates exercises is named after its founder Joseph Pilates, who developed a series of exercises in the 1920's to encourage physical and mental conditioning.

Core stability, strength and flexibility are emphasized in Pilates exercises, as in control of movement, posture and breathing. All these aspects of Pilates exercise may benefit people with low back pain as exercise with similar features have been successful in reducing pain and improving functional ability.

## 2. Objectives

To study the effectiveness of Pilates exercises on low back pain in female Bharatnatyam dancers.

## 3. Hypothesis

**Null hypothesis (H0):** There will be no effect of Pilates exercises on low back pain in Bharatnatyam dancers.

**Alternate hypothesis (H1):** There will be an effect of Pilates exercises on low back pain in Bharatnatyam dancers.

## 4. Review of Literature

1. A study was conducted on "Dance related injuries among Bharatnatyam dancers" by Paul, Joyce K and Satwanti Kapoor in 1998. The aim of the study was to investigate the occurrence of dance related injuries among Bharatnatyam dancers. 80 subjects were taken to participate in the study and each group was studied for the occurrence of dance injuries. The study shows prevalence of 34.37% of back injuries in Bharatnatyam dancers.<sup>1</sup>
2. A study was conducted on "The relation of backpain with increased lumbar lordosis and pelvic inclination angle in Bharatnatyam dancers" by Shraddha Pawar *et al* in 2015. The aim of the study was to assess the lumbar curvature and pelvic inclinations in Bharatnatyam dancers. 80 subjects were taken out of which 40 belonged to experimental group (training for at least 3 yrs) and other 40 were non dancers. The study concluded that lumbar lordosis and pelvic inclination angle in Bharatnatyam dancers is increased as compared to normal individuals leading to low back pain in Bharatnatyam dancers [4].
3. A study was conducted on "The effect of modified Pilates for active individuals with chronic non-specific low back pain" [2] by Valerie Gladwell, Samantha Head, Martin Haggard and Ralph Beneke in 1998. The aim of the study was to see the effect of Pilates program over chronic nonspecific LBP. The study included 49 individuals with chronic low back pain were randomly allocated to control (n = 24) or Pilates group (n = 25). Thirty-four individuals completed the study (14 and 20 individuals for control and Pilates group, respectively). The study concluded that Pilates used as a specific core stability exercise incorporating functional movements can improve non-specific chronic low back pain in an active population compared to no intervention. Additionally, Pilates can improve general health, pain level, sports functioning, flexibility, and proprioception in individuals with chronic low back pain [2].

4. A study was conducted on "Effects of Pilates Exercise Programs in People With Chronic Low Back Pain" [9] by Antonino Patti, Giuseppe Messina, Maria Alessandra Montalto in January 2015. Subjects were selected presenting low back pain complaints, the pain was evaluated before and after intervention, using scale measures for pain that were validated for the measurement and the comparison. The study concluded that Pilates method is more effective than minimal physical exercise intervention in reducing pain and disability in the short-term period [9].

## 5. Methodology

Study design - Quasi experimental study

Sample size - 50 subjects [9].

Sampling design - Convenient sampling

Study population - Young female Bharatnatyam dancers between 18 to 30 yrs age

Study setting - Bharatnatyam dance institutes in Pune

Duration of study - 6 months

Intervention period - 3 weeks

## 6. Inclusion and exclusion criteria

### Inclusion criteria

1. Female Bharatnatyam dancers undergoing training between ages 18- 30 years.
2. With minimum experience of 3 years [4].
3. Regular training of at least 5 days a week and at least 1 hour a day
4. Dancers complaining of low back pain.
5. NPRS rating of at least 3 on 10

### Exclusion criteria

1. Dancers with history of surgery in past were excluded.
2. History of recent trauma, pathological conditions of spine i.e. fracture, cancer and inflammatory disease, degenerative changes of spine, congenital abnormalities of spine, nerve root compression.
3. Any neurological and cardiac condition contraindicating the exercise protocol.
4. Patient already involved in regular Pilates classes.

## 7. Materials

1. Pen
2. Paper
3. Oswestry low back pain assessment scale
4. Consent letter
5. Pilates mat

## 8. Outcome measures

1. Numerical pain rating scale. [Reliability-0.877 and Validity- 0.71]
2. Oswestry scale for low back pain disability questionnaire assessment. [Reliability-0.96 and Validity-0.95]

## 9. Procedure

Subjects were selected for the study based on the inclusion and exclusion criteria. Procedure was explained to them. Pain-Numerical pain rating scale scores and Oswestry low back pain disability questionnaire scores were recorded before commencing the Pilates exercise program.

Subjects were thoroughly explained about the exercise programme and taught the exercises. Subjects were asked to perform the exercises 3 times per week for 3 weeks under supervision. After three weeks subjects were evaluated for pain NPRS and Oswestry low back pain assessment scale scores were recorded.

**Pilates protocol**

5 key elements to be taught to the subjects before commencing the pilates protocol.

- Neutral spine
- Centering
- Shoulder blade placement
- Rib cage placement
- Head and neck placement

**Pilates protocol**

**1. Pilates pelvic tilt:** Inhale. Exhale: press back on the floor and pull the belly button in. Inhale to release back to the floor, or go on to pelvic curl. Press down through your feet all owing the tailbone to begin to curl up toward the ceiling. The hips raise, then the lower spine, and, finally, the middle spine. Exhale: As you let your breath go, use abdominal control to roll your spine back down to the floor. Repeat this exercise 3 to 5 times

**2. Swan preps:** Swan prep strengthens the back extensors, the muscles that hold us upright. These muscles are often weak and over-stretched in bharatnatyam dancers. Begin Pilates Swan Prep: Lie on the mat face down. Keep your arms close to your body as you bend your elbows to bring your hands under your shoulders. Shoulders should be away from the ears. Engage your abdominal muscles, lifting your belly button up away from the mat. The abdominals remain lifted throughout the exercise. Inhale: Lengthen your spine. Exhale: Keep your abdominals lifted as you release the arc, lengthening your spine as your torso returns to the mat in a sequential way: low-belly, mid-belly, low-ribs and so on. Repeat 3 to 5 times

**3. One leg circle:** This is one of the best exercises for core strengthening as abdominal muscles must work hard to keep pelvis and shoulders stable. Start with rest position. Level 1) Inhale to prepare. Exhale, float the left leg into tabletop position, inhale and hold the table top position. Exhale and circle outwards and downwards in clockwise direction in a small and controlled ROM. Inhale complete the circle on this leg by circling inward and upward to finish were the circle started [ exhales as leg circles away from body and inhale as leg circles towards the body]repeat 8-10 times. Level2) Inhale to prepare. Exhale, float the left leg into tabletop position and continue extending the left knee. A minimum 70degrees hip flexion with an extended knee should be achieved. f this is not achievable then allow slight knee flexion. Repeat level 1 flex the leg in table top position then lower this leg onto the mat repeat on right leg.

**4. Kneeling arm and leg reach:** Begin Pilates Kneeling Arm and Leg Reach: Your hands are directly under your shoulders and your knees are directly under your hips. Make your legs and feet parallel and hip distance apart. Your back is in a neutral spine position. Don't let your back sag or arch up. Extend your right arm straight in front of you and your left leg straight behind you at the

same time. Your arm and leg will be parallel to the floor. Balance. Hold one to three breaths. Exhale: Return to hands and knees. Inhale: Extend your left arm straight in front of you and your right leg straight behind you at the same time. Repeat this exercise 3 to 5 times

**5. Side kick:** This side lying stability exercise is very useful for strengthening of hip, thighs and abdominal muscles. Side lying. Underneath arm outstretched in alignment with trunk with head resting on arm, hips bent slightly knees bent upto 90degrees, other top hand resting on the mat in front of the waist. Level 1) Inhale to prepare. Exhale and lift top leg to hip height then glide thid top leg forward from the hip joint. Keeping knee bent and other leg at height. Inhale and glide thid leg back into alignment with trunk. Repeat 8-10 times on each side. Level 2) extend both legs and flex your ankles. Inhale to prepare. exhale and lift top leg, glide the leg forward from the hip joint. Inhale and glide this leg back into alignment with trunk. Repeat 8-10 times

**10. Data and statistical analysis**

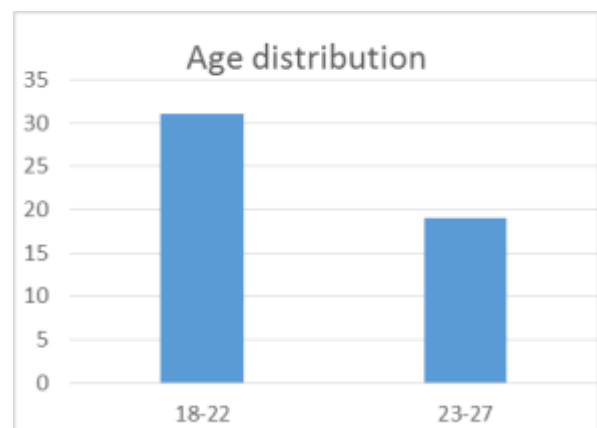
Statistical analysis was conducted using INSTAT™ for Windows. The difference in pre and post treatment values of NPRS and Oswestry low back pain disability questionnaire (OSWDQ) was compared by using paired t test.

**1. Demographic Data**

Age distribution

**Table 1:** Age distribution.

18 to 22 years	23 to 27 years
31	19



**Fig 1:** Age distribution.

**2. NPRS**

The comparison of pre and post treatment values of NPRS scores shows a significant difference.

**Table 2:** Pre and Post comparison of NPRS scores.

	Pre treatment	Post treatment
Mean	4.740	1.180
Standard deviation	0.8033	0.4819
T value	41.169	
P value	0.0001	
significance	Highly significant	

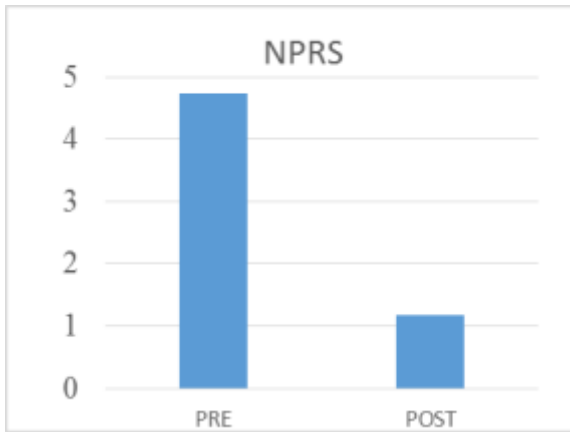


Fig 2: Pre and Post comparison of NPRS scores.

**3. Oswestry low back pain disability questionnaire**

The comparison of pre and post treatment values of Oswestry low back pain disability questionnaire scores shows significant

Table 3: Pre and Post comparison of Oswestry scale scores.

	Pre treatment	Post treatment
	6.860	1.760
Standard deviation	1.927	0.6869
P value	0.0001	
T value	25.968	
significance	Highly significant	

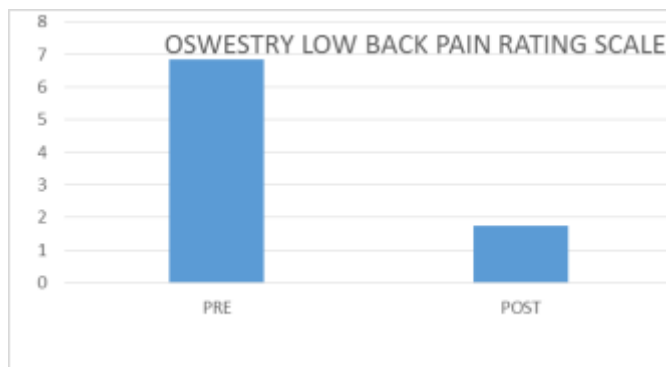


Fig 3: Pre and Post comparison of Oswestry scale scores

**11. Result**

Comparison of NPRS and Oswestry low back pain disability questionnaire pre and post treatment mean values.

Table 4: Comparison of difference in pre and post NPRS and Oswestry scale scores, t value and p value.

Variable	Pre	Post	T value	P value
NPRS	4.740	1.180	41.169	0.0001
Oswestry LBP Scale	6.860	1.760	25.968	0.0001

50 subjects were selected based on the inclusion and exclusion criteria. The study group were explained about the pilates exercises. The exercises were performed under supervision in groups for 3 days in a week for three weeks. The values of NPRS and OSWDQ scales were recorded before and after commencing the pilates protocol. The pre and post analysis using paired t test revealed a statistically significant ( $p < 0.0001$ ) difference among the group between pre test and post test scores The mean values obtained by the pre and post treatment NPRS scores(4.740 pre and 1.180

post which is lesser than pre treatment sore) shows a significant difference. The mean values obtained by the pre and post treatment OSWDQ scores (6.860 pre and 1.760 post which is lesser than the pre treatment score) shows a significant difference. Thus indicating improvement post treatment.

**12. Discussion**

This study was intended to see the effectiveness of pilates exercises on low back pain in bharatnatyam dancers. The results show that the exercises were effective in reducing lower back pain in these dancers.

A study was conducted by Shraddha pawar *et all* on lumbar lordosis and pelvic inclination angle in bharatnatyam dancers. 80 subjects were assessed for lumbar lordosis and pelvic inclination angle. The study concluded that thelumbar lordosis angle and the pelvic inclination angle in bharatnatyam dancers is more than the non-dancers. They also proved that there is linear correlation between the two measurements which explains the pelvic posture and the lumbar spine posture in bharatanatyam dancers. The theoretical findings that deviations in the lumbar lordosis are contributing factor to low back pain Back pain in bharatnatyam dancers has been associated with the increased lumbar lordosis and anterior tilting of pelvis<sup>4</sup>. Both these alterations in alignment are corrected through pilates exercises. The deeper abdominal muscles, including the m. transversus abdominis (TA), m. multifidus (MF), pelvic floor muscles, and the diaphragm muscle are the core muscles involved in core activity. Pilates techniques aim to specifically train all the above mentioned “core muscles” submaximally to increase the tone and strength of these muscles, to lengthen and stretch the lumbar spine thus decreasing compression of the joints, and cause an alteration in the tilt of the pelvis. A study was conducted by Joyee K Paul and Satwanti Kapoor on dance related injuries among bharatnatyam dancers which showed prevalence of 34.37% of back pain in bharatnatyam dancers<sup>1</sup>. In this study pilates exercises are proved to be effective in reducing low back pain in bharatnatyam dancers.

**13. Limitations**

Subjects could not be followed up after study duration.

**Future Scope**

It can be further studied on a larger population. There can be a control group to compare the effect. There can be comparison between a conventional protocol and pilates protocol. The study can include other age groups.

**14. Conclusion**

PILATES was proved to be effective in treating low back pain in female bharatnatyam dancers undergoing training.

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