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Original Research Article

A comparative assessment of flexibility of backline and strength of lower limb in bharatnatyam dancers and non-dancers

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ABSTRACT

Background: Bharatnatyam is an Indian classical dance form which have been practiced for a long period of time and is equivalent to any sporting activity. The postures attained during this dance form require good amount of muscle strength and flexibility among the dancers. There is lack of research on flexibility of backline and lower limb strength in bharatnatyam dancers. The overall function of the superficial backline is to support the body in full upright extension and impacts musculoskeletal dynamics. The lumbar lordosis angle and the pelvic inclination angle in bharatnatyam dancers is more than the non-dancers which can affect the backline flexibility. This study analysed if there is any difference, in the lower limb strength and flexibility of backline as compared to participants of same age group.
Methods: 10 bharatnatyam dancers and 10 non-dancers between 15 to 30 years participated in this study. Triple hop distance test for both sides and toe touch test was used to check the strength of lower limb and flexibility of backline respectively.
Results: There was significant difference in the triple hop distance of right lower limb between bharatnataym dancers and non-dancers. There was no significant difference in the triple hop distance of left lower limb between the two groups. There was not quite significant difference in the toe touch test of between the two groups.
Conclusions: There was significant difference in the strength and power of right lower limb of dancers as compared to right lower limb of non-dancers. There was no statistical difference in the left lower limb of both the groups. There was no statistical difference between the flexibility of backline of bharatnatyam dancers and non-dancers.

Keywords: Backline, Bharatnatyam, Flexibility, Strength, Toe touch test, Triple hop distance

INTRODUCTION

Bharatnatyam is an Indian classical dance, almost 2000 years old which was originated in the Tanjor district of Tamil Nadu. It involves nrittha which is rhythmic dance movements, natya which is dance in dramatic aspect and nrithya which is a combination of both.[4] There are various positions in bharatnatyam such as araimandi which is half squatting with heels joined and feet pointing in opposite direction, muzhumandi which is sitting on toes with knee bent, heels joined and hands behind the waist, this demands dancers to achieve various positions which demands great flexibility and tremendeous stress on the musculoskeletal system to attain in which dancers need optimal muscle strength and adequate motion at the required joints.[10] Dancers also require balance to maintain position and also while continuously changing postures and positions. Strength of lower limb is an important fitness component for a dancer. Piriformis, superior gemellus, internal obturator, external obturator are the lateral rotators working to maintain the turnout in aramandi.[11] The 5 main factors affecting this posture are angle of femoral anteversion, orientation of acetabulum, shape of femoral neck, elasticity of Y ligament, flexibility and strength of muscle tendon unit.[12] These soft tissue structures are connected together by fascia, on the

posterior aspect of the spine and lower limb is an important structure known as backline. The superficial backline is one of the myofascial-meridian, extending from the bottom of the foot to top of head in two places-toes to knee and knee to brow like a sheath. It supports and protects the entire posterior surface. It supports the body in full upright extension except at knees where flexion takes place.[10] The fascial system maintains a balance of tension and elasticity which allows for smooth, unrestricted movement of each muscle group while holding everything in place.[2] Flexibility and strength are two important aspects which need to be optimal for the performer, thus any disturbance in flexibility or strength needs to be addressed to prevent any risk of injuries. Thus, this study aimed towards the assessment for strength and flexibility among the dancers and non-dancers.

METHODS

This was an observational study with a duration of 6 months. A total of 20 individuals between the age group of 15-30 years were included in the study. 10 bharatnatyam dancers and non-dancers respectively. The sample size was calculated based on a pilot study with 6 participants in each group, with confidence interval at 95%.

Inclusion criteria

Dancers: (1) practicing bharatnatyam for at least 2 hours weekly (2) experience of minimum 4 years (3) age between 15-30 years. Non-dancers: (1) individuals those who are not involved any type of sports activity and dance (2) age between 15-30 years.

Exclusion criteria

For dancers and non-dancers with (1) recent injuries, (2) undergone any lower limb or any spine surgery.

Institutional review board approval was taken before starting the research. Research was conducted at K. J. Somaiya College of Physiotherapy and in the community.

The procedure was explained to all participants and the parents of those below the age of 18 years. Informed consent taken from all subjects. The demographic data was collected as per the data record sheet.

Toe touch test for flexibility: (1) the participant had to stand erect on a foot stool with shoes removed and feet together. (2) They had to bend forward as far as possible, while maintaining the knees, arms, and fingers fully extended. A measuring tape was stuck on foot stool. (3) The vertical distance between the tip of the middle finger and the reading on the tape was noted, it was positive when the subject did not reach the platform and negative when she could go further. Triple hop distance test for strength: (1) the participant had to perform this test on a level surface. A starting line was marked. (2) The participant had to perform 3 successive hops as far as possible and land on the same leg. (3) The final landing was maintained for a minimum of 2 seconds without losing the balance while the measurement till the heel was recorded. (4) The test was carried out for both legs. The distance was measured.

RESULTS

The results of this study are given in tables below.

Table 1: Comparison of triple hop distance of left limb.

Group	Mean±SD	Test used	P value	Result
Bharatnatyam dancers	234.74±62.297	Unpaired t test	0.1382 (two tailed)	Not significant
Non-dancers	191.58±62.100		0.0691 (one tailed)	Not quite significant

Table 2: Comparison of triple hop distance of right limb.

Group	Mean±SD	Test used	P value	Result
Bharatnatyam dancers	249.62±56.293	Unpaired t test	0.0172 (two tailed)	Significant
Non-dancers	181.27±59.454		0.0083 (one tailed)	Very significant

Table 3: Comparison of toe touch test.

Group	Mean±SD	Test used	P value	Result
Bharatnatyam dancers	-5.855±6.424	Unpaired t test	0.0899 (two tailed)	Not quite significant
Non-dancers	0.7050±9.628		0.0450 (one tailed)	Significant

Therefore from the analysed results it can be said that there is significant difference in the triple hop distance of right lower limb between bharatnatyam dancers and non-dancers. There was no significant difference in the triple hop distance of left lower limb between the two groups. There was not quite significant difference in the toe touch test of between the two groups.

DISCUSSION

Bharatnatyam is an Indian classical dance form almost 2000 years old which is similar to any sport activity. This research compared the flexibility of backline and strength of lower limb in bharatnatyam dancers and non-dancers. Toe touch test was used to check flexibility of backline and triple hop distance test was used to check the strength and power of lower limbs.[1] A study was conducted in 2018 which stated that the dancers reported the back (42.5%) followed by the knee (28.3%) and ankle (18.6%) as the most common sites for pain and past injuries. Stress was the most commonly perceived cause of injury (34.4%), followed by over work (24.7%), tiredness (17.2%), and falls (13.5%).[2] Muscular strength is a very important factor to improve the performance of a dancer and to reduce the risk of injuries. The postures attained as well as the foot strikes performed in this dance form require good amount of lower limb muscle strength because the peak ground reaction force required to perform the foot strikes is 4 to 5 times the body weight.[1] In the current study the strength of lower limb between bharatnatyam dancers and non-dancers was assessed using triple hop distance test. The study concluded there is significant difference in the strength and power of lower limb of right side as compared to left in the bharatnatyam dancers and non-dancers. A study done by Sadauskaitė-Zarembienė, et al compared the difference in muscle strength of the dominant and non-dominant leg of high-performance female athletes. There was statistically significant difference in the muscle strength of the dominant and non-dominant side. Accordingly, the difference in the muscle strength between the sides in the dancers and non-dancers might be due to dominance.[3] These findings are similar with that of study conducted by Jyothi et al, the strength of upper limb and lower limb in female bharatnatyam dancers and non-dancers were compared. In their study hop test and wall sit test were used to assess the lower limb strength and modified push up test was used to assess the upper limb strength. Their results showed that bharatnatyam dancers had more upper and lower limb strength. However, there was no significant difference in the hop time of right and left side.[4] The demi pile posture attained in ballet is similar to the armandi posture in bharatnatyam. In a study by Bennell et al singleton hip muscle strength was assessed in female ballet dancers. Strength of hip external rotators, abductors, and adductors were significantly more in dancers than controls. This result is similar to that of the current study.[5] Doa et al conducted a study on acute effect of self-myofascial release using a foam roller on the plantar fascia on hamstring and lumbar spine superficial back line flexibility. Measurements for the toe touch test and passive straight leg raise (PSLR) test were obtained. The results of this study showed that self-myofascial release on the plantar fascia was immediately effective for improving the flexibility of the superficial backline of the lumbar spine and hamstring, thus the whole body is connected.[6] Study conducted by Pawar et al concluded that the lumbar lordosis angle and the pelvic inclination angle in bharatnatyam dancers is more than the non-dancers which could affect the flexibility of backline.[7] Another study by Schleip et al concluded that active cellular contractility of fascial tissues may be able to impact musculoskeletal dynamics.[8] This would impact the flexibility of backline in these dancers. In the current study there was not quite significant difference in the flexibility of backline between bharatnatyam dancers and non-dancers which was assessed using toe touch test. The difference in the mean was 6.56 cm, dancers having more flexibility than non-dancers. Similar study by Sharma, et al compared lower limb muscle flexibility between amateur and trained female bharatnatyam dancers and non-dancers, their results showed that there were significant differences in lower limb muscle flexibility between trained and amateur bharatnatyam dancers and non-dancers. These differences were attributed to individual dance postures such as araimandi and muzhumandi.[9] Thus, from the current study it can be said that bharatnatyam can be practiced as a recreational activity for improving the strength and flexibility.

CONCLUSION

There was significant difference in the strength and power of right lower limb of dancers as compared to right lower limb of non-dancers. There was no statistical difference in the left lower limb of both the groups. There was no statistical difference between the flexibility of backline of bharatnatyam dancers and non-dancers.

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