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Unveiling the Dance of Strength: Plyometric Exercise as a Catalyst for Lower Extremity Function in Bharatanatyam

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Abstract

Introduction: Aramandi is the most basic position in Bharatanatyam which is similar to Demiplie position of ballet dancers in which both the legs are were internally rotated. Gaining proficiency in Bharatanatyam requires rigorous training for prolonged periods of time while maintaining specific postures which begin at a very young age during the adolescent growth spurt.The plyometric exercise may strengthen the group muscles.

Aim: To find out the effectiveness of plyometric exercise on lower extremity function among classical Bharatanatyam dancers.

Materials and methods: The subjects were approached via Aurohamsadhwani Art Centre, Auroville, Pondicherry A Pilot study taken with totally 20 classical dancers were selected under the selection criteria. Classical dancers were given plyometric exercise for a duration of 6 weeks each exercise is performed 3 sets for 10 repetitions. Pre and Post assessment was conducted through Lower extremity functional scale (LEFS).

Result: The pre assessment LEFS score was 40.45 and after application of plyometric exercises it improved to 74.10. The obtained data were analyzed by using paired ‘t’ test comparison of pre and post-test value for LEFS questionnaire the ‘p’ value obtained was 0.001.

Conclusion: This study concluded that plyometric exercise has got beneficial effect to shows that there is an improvement on lower extremity function among classical Bharatanatyam dancers.

Keywords: Classical Bharatanatyam Dancers, Plyometric Exercise, LEFS Questionnaire.

1. Introduction

Classical Bharatanatyam dance is a major form of Indian classical dance. It is principally common in the South Indian state of Tamil Nadu and is nearly 2,000 years old form of dance [1.] It has many health benefits that improves flexibility, increases stamina usually the muscle strength, improve balance, and includes postures, poses and movements [2].

Dancers need their lower extremity muscles to be sufficiently flexible in order to keep their balance (stability). There are various positions in Bharatanatyam to attain which dancers need optimal muscle strength and adequate motion at the required joints. Dancers also require balance to maintain position and also while continuously changing postures and positions [4].

This dance style's base is made up of simple steps, repetitive foot stamping, and a variety of clear and significant hand gestures. It involves maintaining a specific position over an extended length of time while using coordinated upper body movements and footwork.

Fig: 1. A: Shows the Bharatanatyam positions of Muzumandi
(Courtesy: Aurohamsadhwani Art Centre)

As dancers perform the poses and steps necessary for their art form, it is important that proper training & injury prevention measure are taken so that dancers do not compromise their health and wellbeing [6.] Dance therapy as exercise is known to increase the neurotransmitters called endorphins which increase a state of wellbeing.

Traditionally many dancers were wary of utilizing resistance training method to improve their performance and enhance stamina as it was often thought that such training would decreased the aesthetic components of dancers & negatively impact of dancers body anthropometry [8.]

Fig: 1. B: Shows the Bharatanatyam position of Nataraja pose

A Bharatanatyam dancer must maintain appropriate posture at all times. Therefore, it is essential to adopt preventative strategies to stop incorrect postural habits that can result in discomfort and injury. Implementation of postural re-education, muscular balance, and flexibility is a prerequisite for these highly trained professionals [5].

Strength & plyometric training have been found to be effective in enhancing sports performance in athletes. Plyometric training is an explosive body weight resistance exercise that stretches and shortening cycle of the muscle fiber to enhance physical capacities such as speed, strength, endurance and power. Plyometric exercise may strengthen the group muscles [8]. Hence, the study aimed to examine the effectiveness of plyometric exercise on lower extremity function among classical Bharatanatyam dancers with the outcome measure lower extremity functional scale (LEFS).

Materials & methodology

This is a pilot study that includes 20 female dancers from the Aurohamsadhwani Art Centre, Auroville, Pondicherry. The participants were included based on the selection criteria. The inclusion criteria of the study were participants in the age group of 25 to 50 years old female classical Bharatanatyam dancers, who are willing to participate in the study and exclusion criteria were any recent lower limb fracture and dislocation, underwent foot surgery within 6 month, sacroiliac joint dysfunction are excluded to participate in the study. In this participant, pre-test and post-test values were collected using lower extremities functional scale. The study was conducted for a period of 6 months and during the study time subjects received plyometric exercise for a period of 6 weeks.

EXERCISES	PROCEDURE	FREQUENCY AND INTENSITY	FIGURES
1. SQUAT JUMP	• Bend your knees and descend to a full squat position. • Engage through the quads, glutes, and hamstrings and propel the body up and off the floor, extending through the legs. With the legs fully extended, the feet will be a few inches (or more) off the floor. • Descend and control your landing by going through your foot (toes, ball, arches, and heel) and descend into the squat again for another explosive jump. • Upon landing immediately repeat the next jump.	3 sets of 10 repetitions of squat jump	 Fig:2.A shows starting position of squat jump exercise  Fig:2.B shows ending position of squat jump exercise
2. JUMPING JACKS	• Stand straight with your feet together and hands by your sides. • Jump up, spread your feet and bring both hands together above your head. • Jump again and return to the starting position.	3 sets of 10 repetition of jumping jacks	

			Fig: 3.A: shows starting position of jumping jacks exercise  Fig: 3.B: shows ending position of jumping jacks exercise
3. TUCK JUMPS	• Stand on flat surface that is cushioned (to lessen the wear on your legs andknees).Feet about hip-width apart. • Begin exercise by getting down into a half squat position and exploding off the ground while bringing your knees as close to your chest as possible. Swing arms upward as you explode off the ground. • Try to land softly on the balls of your feet with a bend in your knees and then immediately explode backup.	3 sets of 10 repetition of tuck jumps	 Fig: 4.A: shows starting position of tuck jump exercise

			 Fig: 4.B: shows ending position of tuck jump exercise
4. REVERSE LUNGE TO KNEE UP JUMP	• Place your right hand on the floor next to your front foot and extend your left arm straight back. • Explosively jump up to bring your right knee up as high as you can, lifting your left arm and dropping your right arm back and down. • Upon landing, move back into the starting lunge position. • Continue for 30 seconds. • Then do the opposite side.	3 sets of 10 repetitions of reverse lung to knee up jump	 Fig:5.A: shows starting position of reverse lung to knee up jump exercise 

			Fig:5.B shows ending position of reverse lung to knee up jump exercise
5. LATERAL BOUNDS	• Explosively jump as high and far to the left as possible. • Land on your left leg in a squat position. • Explosively jump as high and far to the right as possible. • Land back in the starting position.	3 sets of 10 repetitions of lateral bounds	 Fig: 6.A: shows starting position of lateral bounds exercise  Fig: 6.B: Shows side position of lateral bounds exercise

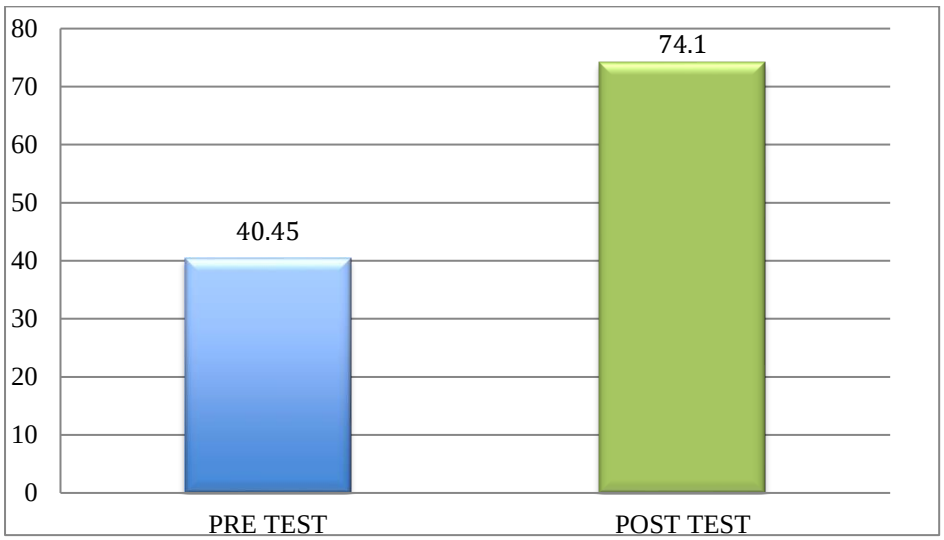
Results

The pre & post difference of LEFS questionnaire within the group analysis of mean & SD were analyzed statistically tested by paired t -test. The result is presented in the below table.

Table -2: Showing the pre and post t- test value of LEFS (paired t-test value)

LEFS	MEAN	SD	SAMPLE SIZE	SEM	T-VALUE	P-VALUE
Pre-test	40.45	4.22	20	0.94	51.767	<0.001
Post-test	74.10	3.35	20	0.75		

It is found that the mean values of LEFS questionnaire score before application of plyometric exercises is **40.45** and after application of plyometric exercises is **74.10**. The p value is **0.001**. since the' p' value is less than 0.05 it is concluded that there is a very significant improvement in LEFS.
The **'t'** value of paired t test for lower extremity functional scale is **51.76**



Graph-1: The group analysis of pre and post- test values of LEFS

Results

In this pilot study paired t -test was used to find out the mean and standard deviation of pre-test and post-test value of LEFS Questionnaire. In the statistical analysis, the calculated mean value for the pre-test and post-test for LEFS Questionnaire is **40.45** and **74.10** and the calculated standard deviation value of the pre and post-test for LEFS questionnaire is ±**4.22** and ±**3.35.**

Hence, the statistical data analysis shows that the paired t-test value of LEFS Questionnaire **t-value = 51.76** is highly significant.

Discussion

The present pilot study conducted to find out the effectiveness of plyometric exercise on lower extremity function among classical Bharatanatyam dancers. This study was selected for the purpose to determine whether there was any clinical benefit of plyometric exercises for lower extremity function among classical Bharatanatyam dancers.

A study conducted to find out the effect of strength and plyometric training on functional dance performance in elite ballet dancers and modern dancers the review concluded that this method generally

have positive effects on functional performance measures such as jump-height or subjective, aesthetic performance in elite ballet and modern dancers. Strength and plyometric regimes from trials in this systematic review did not negatively affect dancer's anthropometric measures[7]. Similar to this review our study also showed the effectiveness of plyometric exercise in lower extremity function among classical Bharatanatyam dancers.

Another study conducted to find out the Joint flexibility in dancers which is essential for correct and efficient execution of the art form. The passive-to-active ROM ratio is an important issue for dancers in terms of performance and joint stability, but it is rarely assessed, with higher values indicating lower joint stability or a deficit in muscular strength[26]. Hence our study evaluated the effectiveness of plyometric exercise in lower extremity function among classical Bharatanatyam dancers

Conclusion

This study concluded that there is an improvement in lower extremity function after 6 weeks of plyometric exercise among classical Bharatanatyam dancers. Hence plyometric exercises can be clinically performed for classical Bharatanatyam dancers. Future studies with larger sample size and randomized control trial can be conducted. A follow-up assessment should be included to provide a more comprehensive analysis. This study examined the effect of plyometrics on a single outcome measure; however, additional relevant outcomes should be explored for a more thorough evaluation.

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