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Effectiveness of Plyometric Training Versus Conventional Regular Dance Training on Improving Balance and Lower-Limb Strength Among Classical Bharatanatyam Dancers. A Quasi-Experimental Study."

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Abstract:

Background: Bharatanatyam, a classical Indian dance form, demands a high level of balance, coordination, and lower-limb strength to execute intricate footwork and posture. Traditional dance training enhances these skills.

Objective: To compare the effect of plyometric training versus conventional regular dance training on improving balance and lower-limb strength among Bharatanatyam dancers.

Methodology: A quasi-experimental study was conducted at the Salangai Niruthyalaya Bharatanatyam Kalaikoodam, Avinashi, Tirupur, with 30 Bharatanatyam dancers. It was divided into two groups: Group A underwent plyometric training, and Group B underwent conventional regular dance training. Parameters included the Y–Balance Test for balance and the Vertical Jump Test for lower-limb strength. The outcome measures were recorded at baseline and after 6 months of treatment.

Result: Both groups showed different significant improvements in balance and lower-limb strength post-intervention ($p<0.05$). However, the plyometric training group demonstrated greater progression in dynamic balance and explosive leg strength compared to the conventional training group.

Conclusion: Plyometric training, when incorporated into Bharatanatyam dancers' routine practice, can significantly enhance lower-limb strength and dynamic balance beyond the improvements achieved through conventional regular dance training alone. This suggests that integrating evidence-based conditioning programs into classical dance training may optimize performance and reduce injury risk.

Key words: Plyometric Training, Bharatanatyam, Balance, Lower-limb Strength, Quasi-experimental Study.

INTRODUCTION

Classical Bharatanatyam is a highly demanding Indian classical dance form that requires rhythmic footwork, dynamic postures, prolonged Araimandi, jumps, and single-leg stances [16]. These movements place significant demands on balance, lower-limb strength, and neuromuscular coordination [2, 14, 17, 18]. Although conventional Bharatanatyam training improves technical skills and endurance, it may not adequately develop explosive strength and dynamic balance [1, 3, 4], increasing the risk of fatigue, postural

strain, and lower-limb injuries [13]. Plyometric training enhances muscular power, balance, and neuromuscular performance through rapid stretch-shortening cycle exercises [8, 11, 12, 15, 19]. While its benefits have been established in sports and rehabilitation [15, 19, 20], evidence among Bharatanatyam dancers remains limited. Therefore, this quasi-experimental study aims to evaluate the effect of plyometric training on balance and lower-limb strength in classical Bharatanatyam dancers compared with conventional dance training, providing evidence for improved conditioning and injury prevention.

METHODOLOGY

The study was approved by the institute ethics committee, IEC- RIPT/DT/21/4534. A quasi-experimental study was conducted over a period of six months at the Bharatanatyam class, Salangi Nithruthyalaya Bharatanatyam Kalaikodam. Thirty female Bharatanatyam dancers aged 18–25 years were recruited using purposive sampling and equally allocated (n = 15 each) to improve balance and lower-limb strength. Written informed consent was obtained from all participants before the study. Participants with a Bharatanatyam dancer improved balance and lower-limb strength and prevented further injuries due to the dance were included in this study. Exclusion criteria included a history of lower limb surgery or fracture in the past 12 months, as well as neurological, vestibular, or cardiovascular conditions affecting balance. Currently, participants were not engaged in structured strength or athletic training outside dance, pregnancy within the previous six months. The primary outcome measures were improvements in balance and lower limb strength.

INTERVENTION

GROUP A – Participants received plyometric training, including jump rope, line hops, ankle hops, squat jumps, lateral jumps over cones, split jumps, box jumps, and depth jumps. The single-leg stance treatment session lasted 60 minutes per session, 4 sessions per week; the intervention duration was 6 months. GROUP B – Participants performed conventional regular Bharatanatyam dance training, including adavus, flexibility exercises, postural alignment drills, footwork, and rhythmic patterning. The treatment session lasted 60 minutes per session, 4 sessions per week; the intervention duration was 6 months.

OUTCOME MEASUREMENT

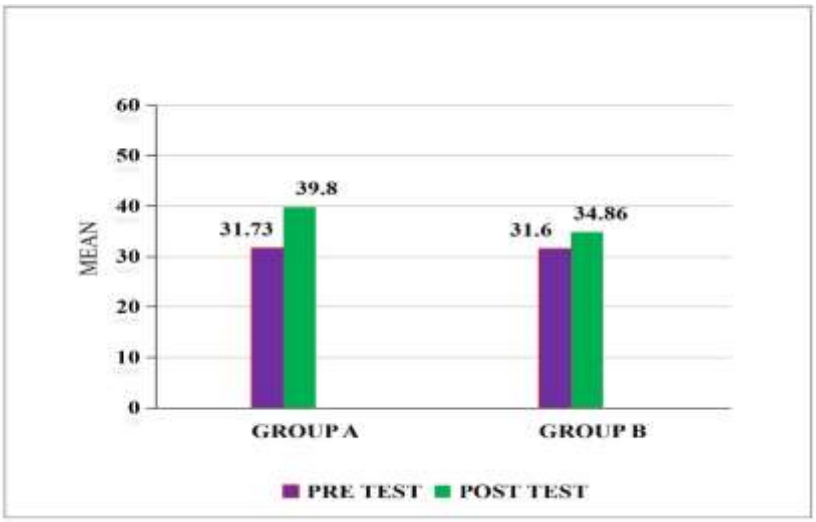
Y - Balance Test (Dynamic Balance Assessment): To evaluate dynamic postural control and lower limb stability, participants stand on one leg and reach in three directions (anterior, posterior, medial, postero-lateral) with the opposite leg. Distance reached is measured in centimeters. Vertical Jump Test (Lower Limb Strength Assessment): To assess explosive power of the lower limbs, participants performed a maximal vertical jump from a standing position. Reach height is measured using a jump mat, vertex, or chalk-mark method.

STATISTICAL ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using the Statistical Package for the Social Sciences (SPSS) version 24, with a significance level of $p < 0.05$ 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 for the dependent variables at $P > 0.05$. Hence, parametric tests were adopted. A paired t-test was adopted to find the statistical difference within the groups, and an independent t-test (Student's t-test) was adopted to find the statistical difference between the groups.

Table 1: Comparison of Vertical Jump Test Scores within Group A and Group B (Pre-Test and Post-Test)

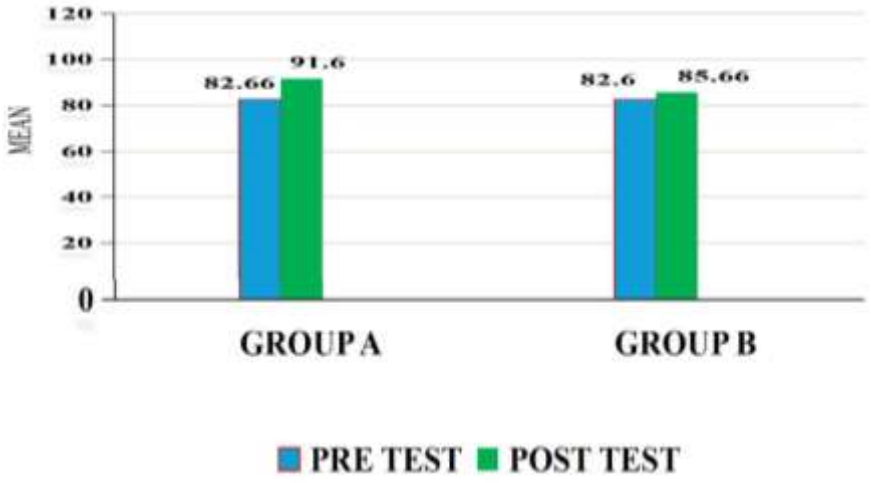
GROUPS	PRE TEST		POST TEST		t – TEST	SIGNIFICANCE
	MEAN	S. D	MEAN	S. D		
GROUP- A	31.73	3.03	39.80	3.07	-18.27	.001**
GROUP- B	31.60	3.15	34.86	2.55	-14.37	.001**



Graph 1: Comparison of Vertical Jump Test Scores within Group A and Group B (Pre-Test and Post-Test)

Table 2: Comparison of Y-Balance Test (Left) Within Group A and Group B (Pre-Test and Post-Test)

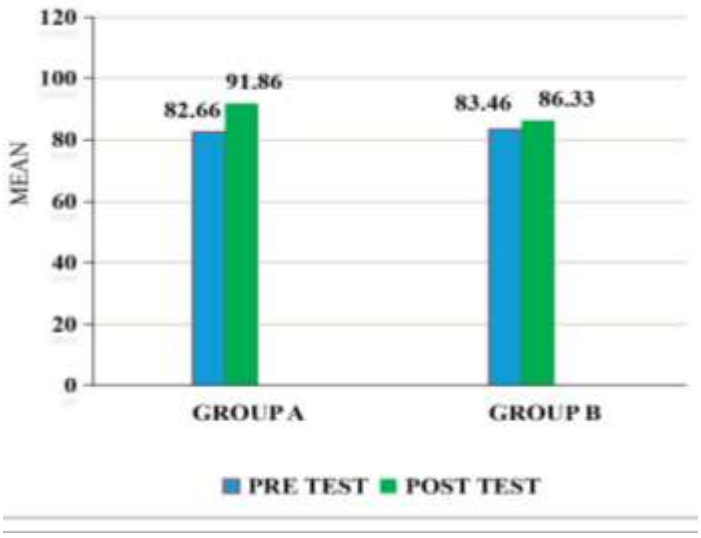
GROUPS	PRE TEST		POST TEST		t – TEST	SIGNIFICANCE
	MEAN	S. D	MEAN	S. D		
GROUP-A	82.66	1.98	91.60	2.22	-25.92	.001**
GROUP-B	82.60	1.80	85.66	1.71	-25.94	.001**



Graph 2: Comparison of Y-Balance Test (Left) Within Group A and Group B (Pre-Test and Post-Test)

Table 3: Comparison of Y-Balance Test (Right) Within Group – A and Group B (Pre-Test and Post-Test).

GROUPS	PRE TEST		POST TEST		t -TEST	SIGNIFICANCE
	MEAN	S. D	MEAN	S. D		
GROUP-A	82.66	1.98	91.86	2.77	-9.71	.001**
GROUP-B	83.46	1.80	86.33	1.79	-21.50	.001**



Graph 3: Comparison of Y-Balance Test (Right) Within Group – Group A and Group B (Pre-Test and Post-Test).

RESULT

Both Group A (plyometric training) and Group B (conventional dance training) demonstrated significant improvements in Vertical Jump Test and Y-Balance Test scores following the intervention ($p \leq 0.05$). However, Group A showed significantly greater improvements than Group B. The post-test Vertical Jump Test score was higher in Group A (39.80 ± 3.07) compared with Group B (34.86 ± 2.55). Similarly, Group A demonstrated superior post-test Y-Balance Test scores for both the right limb (91.60 ± 2.22 vs. 85.66 ± 1.71) and left limb (91.86 ± 2.77 vs. 86.33 ± 1.79). Within-group analysis also revealed significant pre- to post-test improvements in both groups for all outcome measures ($p \leq 0.05$). These findings indicate that plyometric training is more effective than conventional Bharatanatyam training alone in improving lower-limb strength and dynamic balance, leading to the rejection of the null hypothesis.

DISCUSSION

The present quasi-experimental study evaluated the effectiveness of plyometric training compared with conventional Bharatanatyam dance training on balance and lower limb strength in classical Bharatanatyam dancers. Both groups demonstrated significant improvements following the intervention; however, the plyometric training group showed significantly greater gains in Vertical Jump Test and Y-Balance Test scores. These findings suggest that plyometric training is more effective in enhancing lower-limb strength and dynamic balance than conventional dance training alone. The superior outcomes observed in the plyometric group may be attributed to improved neuromuscular coordination, proprioception, and muscle power achieved through stretch–shortening cycle exercises. Although regular Bharatanatyam practice contributes to strength, balance, and endurance, it may not provide sufficient overload to maximize neuromuscular adaptations. Therefore, integrating structured plyometric training into Bharatanatyam practice may improve physical performance, optimize functional capacity, and potentially reduce the risk of lower-limb injuries in dancers.

CONCLUSION

This study shows that the null hypothesis is rejected, and the alternative hypothesis is accepted. The study concludes that plyometric training is significantly more effective than conventional Bharatanatyam dance training in improving lower-limb strength and dynamic balance among classical dancers. Dancers who underwent plyometric exercises demonstrated superior gains in vertical jump height and Y-Balance performance compared to those who followed regular dance training. These findings highlight the importance of incorporating targeted strength and power-based conditioning programs into classical dance training to enhance performance, prevent injuries, and support overall functional stability.

LIMITATIONS AND SUGGESTIONS

Small sample size (n=30), Short duration of intervention, Non-randomized design, Only female dancers were included, Variations in individual training commitment, No long-term follow-up assessments,

External factors (diet, sleep, stress) were not controlled, Age group include between 18 to 25 (females), Integrate plyometric training with Bharatanatyam practice routines, Conduct studies with larger, gender-diverse samples, Include long-term follow-up to examine retention of gains, Incorporate bio mechanical tools for deeper analysis, Standardize training frequency and intensity across participants, Add injury monitoring during training periods, Encourage structured strength and conditioning programs for dancer, Also used in other dance performance.

INFORMED CONSENT

Written informed consent was obtained from all participants before enrolment in the study. Participants were informed about the study objectives, procedures, potential benefits, and their right to withdraw from the study at any time without any consequences.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest regarding the publication of this study.

AUTHORS CONTRIBUTION

Sushiga P: Conceptualization, methodology, participant recruitment, data collection, manuscript preparation, and manuscript revision.

Dr. Darrius B J A C: Study conception and design, supervision, methodology, validation, interpretation of results, critical revision of the manuscript, and final approval of the manuscript.

Dr. P Bright Alwin Victor: Administrative support, overall academic guidance, and final approval of the manuscript.

DATA AVAILABILITY STATEMENT

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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