

# Explorative Study on Physical Fitness among Adolescent Bharatanatyam Dancers and Sedentary School Children

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**Abstract:** *Physical inactivity is a global issue and a major risk factor for obesity and illness among adolescent group. This study aims to analyze the influence of Bharatanatyam dance on selected health related and motor related fitness parameters in adolescents, compared to those who are not participating in any type of physical training. 25 female Bharatanatyam dancers and 25 female sedentary school children aged from 12 years to 18 years were recruited by convenient sampling. Flexibility (sit and reach test), upper body muscle endurance (push up test), lower body muscle endurance (sit to stand test), hand grip strength (hand held dynamometry) lower limb explosive strength (standing long jump test), balance (stork stand test) and agility (T-test) were measured to evaluate physical fitness parameters. The data was statistically analyzed using unpaired t test using SPSS software and it was found that Bharatanatyam dancers significantly improved their physical fitness parameters when compared with others. It is concluded that regular physical activity improves physical fitness parameters and their health.*

**Keywords:** Flexibility, Agility, Explosive strength, Muscle endurance, Balance, Hand grip strength

## 1. Introduction

Physical fitness is a multidimensional concept with major aspect of prevention of diseases and health promotion. It relates to the ability to perform physical activity.<sup>[1]</sup> It consists of health related components which includes abilities related to daily function and health maintenance and motor fitness components which includes physical abilities that relate to athletic performance.<sup>[2]</sup> Physical activity is thought to be the path to both physical fitness and health. It refers to the amount of exercise that the individual gets engaged in.<sup>[2]</sup> Promotion of physical activity in childhood will promote health and prevent diseases in adulthood.<sup>[3]</sup> There are many literature evidences that supports dance activity improves physical fitness. Physical capacity expected of a dancer can be easily related to those of an athlete and dance critics are describing dancer as athletes.<sup>[4]</sup> Dance helps to extend the limits of human physical ability and it can be a very effective way of establishing a lasting healthy living.<sup>[5]</sup>

Dance is the rhythmic movement of body to music which provides an active, noncompetitive form of exercise which has potential positive effects for physical, mental and emotional well-being in individuals. From the very ancient times, Indian classical dance has a very important role in health of common people.<sup>[6]</sup> Bharatanatyam is one of the most cherished and popular Indian classical dance forms, which was known earlier as Dasiattam, Sadir, or Karnatakam. It has two aspects: nritta, which is confined to footwork, body and hand movements and abhinaya, which is conveyed through gestures and facial expressions.<sup>[7]</sup> In Bharatanatyam, dancer feels the rhythm of music and represents the rhythm through body movements with expressions and emotions. It utilizes many poses, various body movements, stretching posture and explosive movements. Bharatanatyam movement patterns are based

on certain principles and are in organized form. If it taught to children, it may positively help in reorganization of movement pattern and improves their balance against gravity.<sup>[4]</sup> It also improves abilities such as balance, right-left sided coordination, concentration, grasping, expression, muscle tone, audio grasping, visual grasping, memory, sensory skills, posture, etc.<sup>[4]</sup>

Nowadays children and adolescent spend excessive time in electronic gadgets which leads to physical inactivity and is the fourth leading factor of global mortality. This predisposes to morbidity and obesity among adolescence. Available survey data indicate that less than 1 in every 4 adolescents meets the recommended guidelines for physical activity of 60 minutes of moderate to vigorous physical activity, daily. Promoting healthy practices during adolescence and taking steps to protect youth from health risks are critical for the prevention of health problems in adulthood, and for healthy future generation.<sup>[8][9]</sup>

Adolescence is a critical transitional period for any individual, during which he or she enters puberty and starts thinking independently. Promoting regular physical activity during adolescence is not only for the time being, but often their health for years to come. It also focuses the health of future generation, thereby the nation's social infrastructure.<sup>[9]</sup> This study was undertaken to investigate the effect of Bharatanatyam in adolescents on selected health related physical fitness parameters such as flexibility, upper body and lower body endurance, hand grip strength and explosive strength of lower limbs and motor fitness parameters such as balance and agility as compared to the sedentary children of the same age.

## 2. Methodology

Source of data: The sedentary school going students were selected from vocational higher secondary school in Kochi and Bharatanatyam dancers were selected from various dance schools from Kochi and Thrissur.

### Research design

The study was an explorative research and enrolled total 50 participants, 25 Bharatanatyam dancers and 25 sedentary school children (control group) in our study based on the convenient sampling.

### Inclusion criteria

All the participants are from the age group 12years to 18years. The Bharatanatyam dancers were regularly practicing for more than 6 months, at least an hour, 3 to 4 days per week and sedentary school children were not involved in any form of training.

### Exclusion criteria

The subjects with vestibular dysfunction, cardiorespiratory problems, exercise induced asthma or any musculoskeletal and soft tissue injuries within 6 months prior to the study were excluded from the study.

## 3. Tools and Materials

Sit and reach box, hand held dynamometer (KERN MAPversion1.2, 08/2012)with 40kg capacity, chair with straight back without arm rests (seat 17" high), cones, stop watch and measuring tape.

### Procedures

After obtaining approval from institutional ethical committee, consent had taken from the respective authorities and participants. 50 participants who fulfilled the inclusion criteria and willing to participate were enrolled in the study. The purpose of the study and all outcome measures were explained and demonstrated to the participants. Demographic data were collected from the participants and following tests were administered.

Lower body flexibility was assessed using sit and reach test. As per Canadian sit and reach test, subject was asked to long sit with knees extended and soles flat against the box at the 23cm mark with inner edges of the soles placed within 2cm of measuring scale and hands parallel. The subject reached forward with both hands as far as possible, held this position for approximately 2 seconds. The outcome of the assessment is the best distance achieved in two trials from tip of the toe with extended fingers.<sup>[10]</sup>

Upper body endurance was assessed using push-up test. The subject was asked to rest in the modified knee push up position. Then the subject raises the body on elbow and return to down position until chin touches the mat with back straight all the times. The maximal number performed without strain and rest in one minute was counted.<sup>[11]</sup>

Lower body endurance was assessed using sit-to-stand test. The subject sat on a straight back chair without armrest,

with feet shoulder width apart, arms crossed and held close to chest. The score was the number of repetitions the participant could sit down on and stand up from a chair in 30s.<sup>[10]</sup>

Hand grip strength was assessed using hand held dynamometry. The subject holds the dynamometer on the tested hand with arm at right angles and elbow closer to the body. With maximum isometric effort, squeeze the device and maintain it for about 5 seconds. An average of 3 trails is considered with a rest period of 10 seconds between each trial.<sup>[11]</sup>

Lower limb explosive strength was assessed using standing long jump test. The subject was asked to stand behind the take off line with feet shoulder width. To provide forward drive the subject is instructed to bend knees and swing arm and jump as long as possible. The outcome was the best distance achieved from takeoff line to the back of heel in the two trials.<sup>[12]</sup>

Balance was assessed using stork stand test. Subject stands on both feet with their hands on the hips. Then place the sole of the non-supporting leg against the knee of supporting leg and asked to stand on the toes of supporting leg as long as possible. The measurement was the best time achieved in three trials.<sup>[13]</sup>

Agility was assessed using T- test. Four cones were used. Cones A, B and C were kept in a straight line, 5 yards apart in the alphabetical order. Cone D was kept 10 yard away from cone B, perpendicular to the line. As timer starts, the subject sprints from cone D to touch the base of cone B with right hand. Then turn left and sprint to touch the base of cone A with left hand. Again sprint to the right to touch the base of cone C with right hand. Then sprint back to touch base of cone B with left hand and sprint back to cone D. The best out of three successful trials to nearest 0.1 second is selected.<sup>[14]</sup>

## 4. Results

The data was analyzed using SPSS software. An unpaired t test was used to analyze intergroup significance with  $p < 0.05$  was considered significant. The mean age of Bharatanatyam dancers were  $15.08 \pm 1.73$  and controls  $14.04 \pm 1.59$  and BMI values of Bharatanatyam dancers were  $19.22 \pm 2.42$  and controls were  $19.08 \pm 1.8$  respectively.

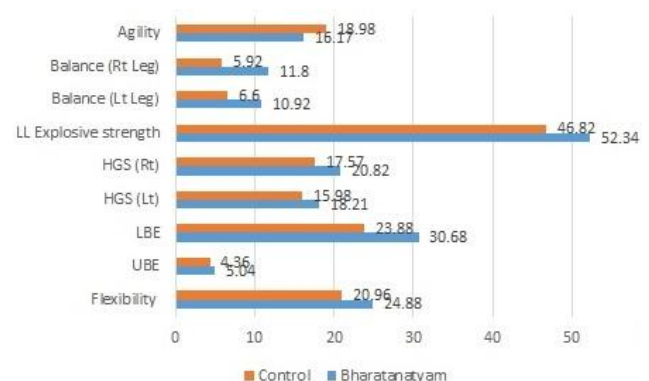


Figure 1: Graphical representation of mean of physical fitness parameters of both groups.

Table 1 results reveals that the Bharatanatyam dancers showed significant improvement in the parameters such as flexibility (p-0.024\*), lower body endurance (p-0.0001\*\*), lower limb explosive strength (p-0.018\*), balance on left (p-0.003\*) and right leg (p-0.0003\*\*), hand grip strength on left (p-0.023\*) and right limb (p-0.007\*) and agility (p-0.0001\*\*) as compared to control group. In contrast, there is no significance difference in the upper body endurance (p-0.514) between both groups. The measured values of both groups are listed in Table 1.

## 5. Discussion

The results revealed that the adolescent Bharatanatyam dancers showed improved flexibility, lower body endurance, lower limb explosive strength, balance, agility and hand grip as compared to controls of same age.

Bharatanatyam training includes various postures called Bhangas which consist of Abhanga in which body is slight bend with one hip raised gracefully and the weight of the body is supported by one leg; Sambhanga, in which the equal bend of equipoise is assigned; Atibhanga, is the great bend with the torso diagonally inclined and the knees are bent; Tribhanga means the triple bend with one hip raised while the torso curved to opposite side and the head is tilted at an angle which results in muscular stretching, there by greater flexibility. [15] Improvement of lower body endurance is due to constant work of lower limbs with feet in different position and with different movements. [4]

The basic stance of Bharatanatyam are Aramandalam (half squat) and Muzhumandalam (full squat) which are similar in fitness training results in static contractions of gluteus, hamstrings, quadriceps and gastrocnemius. The Paadhabedhaahs and Adavu work results in foot work and step work as in plyometric training

**Table 1:** Mean, S.D. and t value to compare physical fitness parameters among Bharatanatyam dancers and control group

Parameters	Group	Mean	Standard Deviation	Difference between mean	t value	Degree of freedom	Significance p-value
Flexibility	B	24.88	4.95	3.92	2.33	48	0.024*
	C	20.96	6.81				
UBE	B	5.04	3.91	0.68	0.66	48	0.514
	C	4.36	3.40				
LBE	B	30.68	4.32	6.80	5.64	48	0.0001**
	C	23.88	4.21				
HGS (Lt)	B	18.21	3.02	2.23	2.35	48	0.023*
	C	15.98	3.67				
HGS (Rt)	B	20.82	3.51	3.25	2.80	48	0.007*
	C	17.57	4.62				
LL Explosive strength	B	52.34	8.80	5.52	2.45	48	0.018*
	C	46.82	7.05				
Balance (Lt leg)	B	10.92	5.27	4.32	3.14	48	0.003*
	C	6.6	4.41				
Balance (Rt leg)	B	11.8	6.14	5.20	3.92	48	0.0003**
	C	5.92	3.53				
Agility	B	16.17	1.29	2.81	5.12	48	0.0001**
	C	18.98	2.42				

B- Bharatanatyam dancers, C- Control (sedentary School children) group, UBE- Upper Body Endurance, LBE- Lower Body Endurance, Rt- Right, Lt- Left, LL- Lower Limb, HGS- Hand Grip Strength, Non Significant-  $p > 0.05$ , \*- Significant  $p < 0.05$ , \*\*- Highly Significant  $p < 0.001$

which results in tremendous efficiency of gastrocnemius and quadriceps and in turn develop explosive strength of lower limbs. [5]

The most common balancing posture is Nataraja pose performed by balancing on single toe in half-squat while the other leg held in front of the balancing leg. [7] Other foot postures are Udghathitha, standing on the toes; Sama, feet placed together; Agratalasanchara, all the toes except the big one are spread out and raise the heel; Anchita, heel is kept on the ground and front part is lifted up; Kunchita, heel is raised and toes are folded into the middle of the foot. In this way Bharatanatyam dancers challenges their balance while performing the dance. [16]

There is a constant and quick change of base of support as the dancer piques from two feet to one foot and even to no foot when airborne which results in improved agility in Bharatanatyam dancers. [17]

Greater grip strength is used as an indicator of total body strength. [18] In dance, various Hastha Mudras (hand gesture) are formed by placing wrist and finger joints in various angles and position as a means of communication and expression. This might be the reason for the gains in grip strength. Further studies are needed to find out the effect of Bharatanatyam dance on hand grip improvement.

## 6. Limitations

Environmental, psychological, and gender factors might have influenced their performance during test, small sample size, only female participants are included and no control over clothing as the study was carried out in different areas.

## 7. Conclusion

The results showed that Bharatanatyam dancers showed significant improvement in the physical fitness parameters

such as lower limb flexibility, agility, lower body endurance, right and left hand grip, lower limb explosive strength and right and left leg balance in contrast to upper body endurance as compared to adolescent sedentary school children. Future studies are needed to establish the importance of different forms of physical activity on different physical fitness parameters. It is evident that regular physical activity improved physical fitness and health among adolescent groups.

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