



EFFECT OF 6 WEEKS INTEGRAL TRAINING ON DYNAMIC BALANCE AND AGILITY IN AMATEUR BHARATNATYAM DANCERS – RANDOMISED CONTROLLED TRIAL

¹Swati Mendhe, ²Dr Chetali Paliwal, ³Dr Sucheta Golhar

¹Intern, ² Assistant Professor PES Modern College Of Physiotherapy, ³Principal PES Modern College Of Physiotherapy

¹PES Modern College Of Physiotherapy, Pune, India

Abstract:

Background: Sudarshan Kriya Yoga (SKY) is a unique rhythmic breathing process advocated by Art of Living, Bangalore, India SKY is not practiced as a single technique but is integrated with asanas, pranayamas, meditations and attitude training. It has four distinct components.

- 1) Ujjayi” or “Victorious
- 2) Bhastrika or “Bellows Breath”
- 3) Om chanting
- 4) Sudarshan Kriya (Soham kriya)

According to recent study done in 2021, prevalence of stress in undergraduate physiotherapy students is 94.4% Stress is associated with SNS (Sympathetic Nervous System) overactivity and PNS (Parasympathetic Nervous System) underactivity.

Objective: Aims to find the effectiveness of Sudarshan Kriya Yoga (SKY) on stress in undergraduate physiotherapy students using Perceived Stress Scale (PSS10) after 4 weeks.

Method: Study begun with the presentation of synopsis to the ethical committee in PES MCOP. An approval was granted from the ethical committee .73 subjects were selected on the basis of inclusion and exclusion criteria. Pre PSS10 scores were taken. SKY technique was performed for 4 weeks. Post PSS10 scores were taken. Data entered and analyzed.

Results: There was significant effect of SKY technique on stress in undergraduate students ($p < 0.0001$)

Conclusion: This study concluded that there was significant effect of SKY technique on stress in undergraduate physiotherapy students after 4 weeks.

Keywords: Sudarshan kriya yoga (SKY) ,undergraduate physiotherapy students , stress , PSS10 score

INTRODUCTION

BHARATANATYAM-an ancient Indian classical dance form, originated in Tamil Nadu, a region of southern India. This form is an amalgamation of music, rhythm, expression, and poses that demand high levels of physical and psychological power during a performance. The foundation of this dance form consists of basic steps along with rhythmic stamping of the feet and a multitude of crisp and meaningful hand gestures. Posture is one of the vital components of this dance form which comprises three basic positions namely “*Araimandi*” (half-sitting position), “*Muzhumandi*” (full sitting position), and “standing”.^[1]

Natyarambham—a particular combination of arm positions with “*Araimandi*” posture is the main position maintained for the longest duration in the dance style. Gaining proficiency in this dance form requires rigorous training for prolonged periods of time while maintaining specific postures.^[1]



ARAIMANDI



MUZHUMANDI

BALANCE

-Balance is the ability to maintain the centre of gravity of the body while minimizing the postural sway. Balance is achieved through the coordination of multiple body systems- motor and sensory (visual, vestibular and somatosensory), cognition, task, environment, and other extrinsic factors. Maintaining balance isn't a matter of staying rigid or in one place, but by making small shifts and adjustments continually.^[2]

BHARATNATYAM AND BALANCE –

The basic posture of Bharatanatyam is called 'Araimandi' which involves the dancer to assume a position of half-squat with hips externally rotated and knees flexed. This helps lower the body and Bharatanatyam makes use of this principle to provide the dancer with increased stability.^[2]

Bharatanatyam dance adds limb movements by outstretching of the arms forward, upward, backward, etc. In some cases when the leg is outstretched as well, in different directions, the base of support also changes. Dance requires these subtle continual changes to ensure the dancer makes quick but smooth, complete moves. Bharatanatyam dance incorporates a lot of one leg positional holds (for poses), spins (single-legged or double), quick movement transitions, changes in positions and stances ('araimandi', 'mandi', 'samam', lunge positions, full sit, side sits etc.). Balance is dynamic and affected by a variety of factors. Bharatanatyam dancers constantly change bodily stances, thus challenging balance^[2].

INTEGRAL TRAINING-

Integrated training refers to a training program that incorporates, or integrates multiple types of exercise together into a single program.

So here we will be using plyometric exercise, proprioception training and core strengthening exercise.

PLYOMETRIC EXERCISES-

Plyometric training aims to teach proper jumping techniques to the subjects so as to correct the lower extremity alignment, to decrease landing forces and to increase the joint stability during their activities.

Plyometric training involves a series of stretch-shortening cycle (SSC) movements designed to induce the repeated lengthening and shortening of various muscle-tendon complexes, and it also includes various types of body-weight jumping exercises, including drop-jumps, countermovement jumps, squat jumps, leg bouncing, and hopping. Plyometric focusing on knee joint or shoulder joint will enhance corresponding joint proprioception by facilitating neural adaptation.^[3]

CORE STRENGTHENING- Strengthening exercises activate superficial trunk muscles that provide shock absorption of loads and are appropriate for patients with acute and chronic pain.

These exercises aim to increase strength and control of the global trunk muscles to improve general spinal stability.^[4]

NEED OF STUDY

- In Bharatanatyam there are various different foot work or postures like standing on toes with knee flexed and hip externally rotated etc will deflect the centre of gravity away from navel also the repeated jumping movement while dancing requires better balance and proprioception to land properly which explain there need of balance to maintain the posture.
- Agility is ability to move quickly which is very important for any type of dancers according to the beats of their dance.
- The Bharatanatyam dance training itself help to improve their balance so adding an extra training might help to improve balance and agility even better

- There is fewer study on balance and agility in Bharatnatyam dancer .

So giving integral training may help to improve balance and agility in Bharatanatyam dancers then people only taking Bharatnatyam dance training.

Hence there is need to study the effect of integral training on balance. and agility in Bharatanatyam.

AIM

To study the effect of 6 weeks integral training on balance and agility in Amateur Bharatanatyam dancers.

OBJECTIVE

- To study the effect of integral training on balance in amateur Bharatanatyam dancers using y balance test after 6 weeks.
- To study the effect of integral training on agility in amateur Bharatanatyam dancers using agility t test after 6 weeks.

HYPOTHESIS

Null Hypothesis (H₀): There is no significant effect of 6week integral training on balance and agility in amateur Bharatanatyam dancers.

Alternative Hypothesis: H1-There is significant effect of integral training on dynamic balance in Bharatanatyam dancers.

H2- There is significant effect of integral training on agility in Bharatanatyam dancers

METHODOLOGY

- Sample size -64
- Study design – randomized controlled trial
- Sampling method – convenient sampling
- Sample population –amateur bharatanatyam dancers
- Intervention duration- 6 weeks
- Study duration-6 months
- Study setting –Bharatanatyam institutes in and around pune

MATERIALS

CONES

MEASURING TAPE

TAPE

PEN

PAPER

YOGA MAT

STEPPER

CRITERIA**INCLUSION CRITERIA:**

- Bharatnatyam dancer with less than 1 year of training (amateur dancers)
- Age-14 to 17year
- Y balance test score <90% of limb length.
- Agility t test score less than 11.5 sec for male and less 12.5 sec for females.
- BMI -normal (18-24.9)

EXCLUSION CRITERIA:

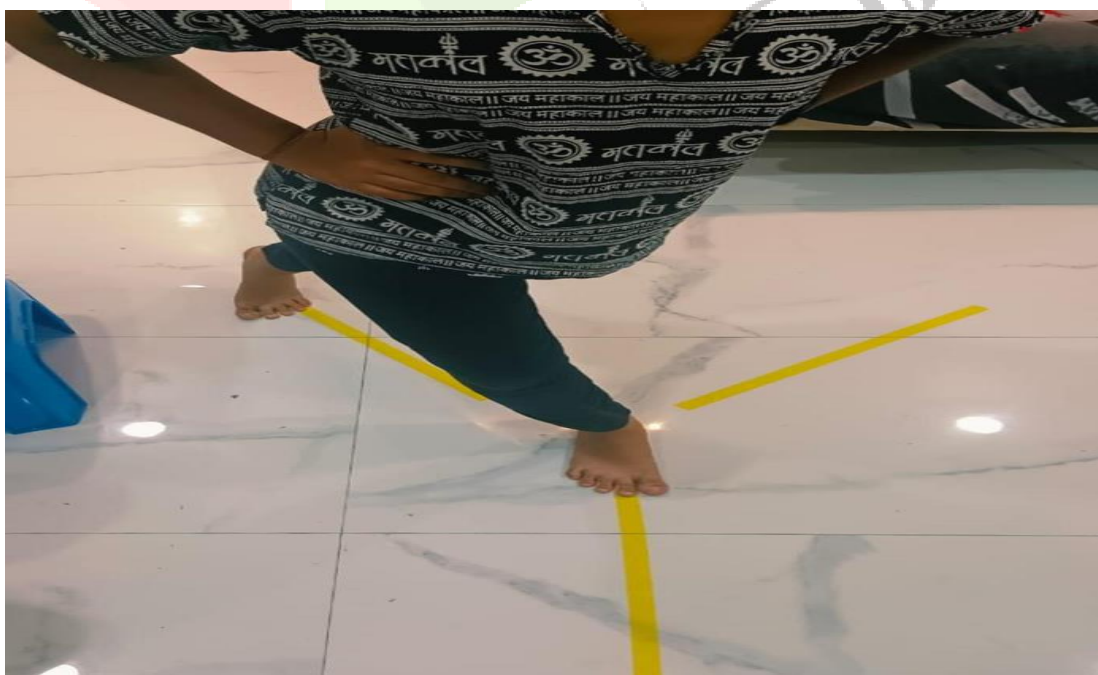
- Dancers with any vestibular dysfunction.
- Dancer with any foot deformities or any other Lower limb musculoskeletal problems.
- Dancer taking any other physical therapy treatment protocol.
- Dancer with any recent lower limb injury.

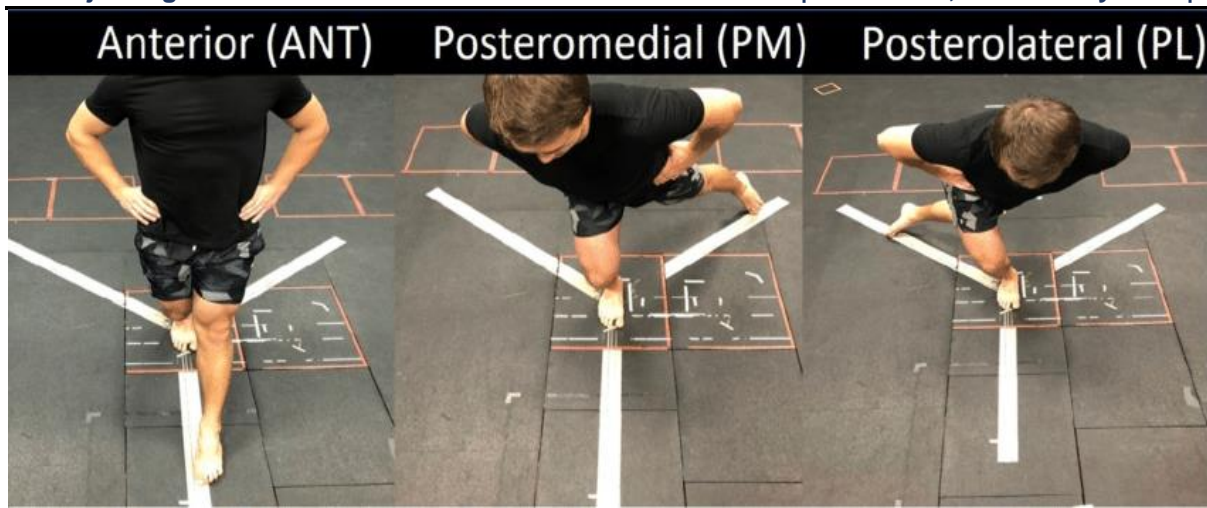
OUTCOME MEASURE**Y BALANCE TEST-**

- The Y balance is a simple yet reliable test used to measure dynamic balance.
- The YBT requires the person to balance on one leg simultaneously reaching as far as possible with the other leg in three direction that are anterior, posterolateral and posteromedial with both left and right limb.



- Then YBT score is calculated by summing the result and is compared with the limblength





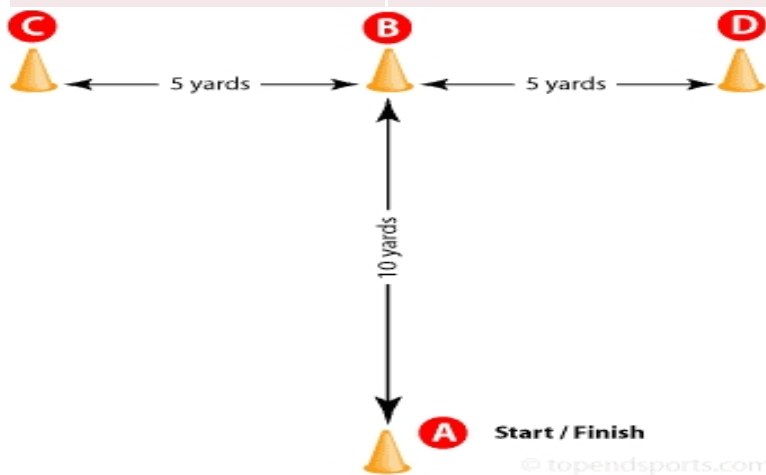
SCORING SYSTEM

- with the complete and all performance recorded, the test administrator can calculate the score
- **Absolute reach distance (cm)** = (Reach 1 + Reach 2 + Reach 3) / 3
- **Relative (normalised) reach distance (%)** = Absolute reach distance / limb length * 100

AGILITY T TEST –

- **Purpose:** the T-Test is a test of agility, and includes forward, lateral, and backwards running.
- **Pre-test:** Explain the test procedures to the subject. Perform screening of health risks and obtain informed consent. Prepare forms and record basic information such as age, height, body weight, gender, test conditions. Measure and mark out test area. Perform an appropriate warm-up.
- **Test setup:** Set out four cones as illustrated in the diagram above (5 yards = 4.57 m, 10 yards = 9.14 m).
- **Procedure:** The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touches its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. They then shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A

	Males(seconds)	Females(seconds)
Excellent	< 9.5	< 10.5
Good	9.5 to 10.5	10.5 to 11.5
Average	10.5 to 11.5	11.5 to 12.5
Poor	> 11.5	> 12.5



- **Scoring:** The trial will not be counted if the subject crosses one foot in front of the other while shuffling, fails to touch the base of the cones, or fails to face forward throughout the test. Take the best time of three successful trials to the nearest 0.1 seconds.

PROCEDURE

The study began with presentation to the ethical committee

- The participants were selected according to the inclusion and exclusion criteria.
- The Purpose of the study was explained to the participants and written consent was taken.
- The selected participants were divided into two group in which one continued with their Bharatanatyam training and the other group continued with their bharatanatyam training along with integral training for 6 weeks.
- In selected participants, the Y balance test and agility t test was performed before starting the protocol & at the end of 6th week after the protocol.
- Integral training was given for 1 hr /day 3 times a week for 6 week(10 min warmup, 40 min protocol & 10 min cool down).

PROTOCOL FOR WEEK 1

1. Proprioception training –

Participant were made to stand on a foam mat for 10 min.

2. Plyometric training –

A. Line jump – Participants jumps in a straight line forward backward and side to side .5 times in forward direction, 5 times in backward direction and 5 times on each side (20*2).

3. Core exercises

A. Bridging – bridging with 1 leg on floor and other on the soft foammat. 2 sets of 10 repetition.

B. Swiss ball bounce- participants sits on the swiss ball and bounce on that first 10 repetition with both foot resting on the ground next 10 with only heel supported on the ground and last with toe touching the ground.

PROTOCOL FOR 2ND WEEK

1. Proprioception training –

A. Participant has to stand on one leg for 10 min 2 sets.

B. Participants has to stand wobble board with both feet.

2. plyometric training –

A. Two-legged jump from mat to 10-cm stage with firm surface each directions i.e side to side forward and backward

3. Core exercises

A. Bridging exercise – Bridging with each foot on soft foam 2 sets of 10 Repetition.

B. Swiss-ball exercise- swiss ball is kept over the foam mat and the

participants were asked to bounce with front side foot tap 30 repetition.

PROTOCOL FOR 3RD WEEK

1. Proprioception training-

- A. One-leg-standing on foam with free-leg with sand bag tied to it .
- B. Two-leg-standing on wobble board.

2. Plyometric Training –

- A. Two-leg jump from mat to 15-cm stage with firm surface in all the directions.
- B. Ankle jumps

3. Core exercises –

- A. Bridging exercise with crossed-leg on the foam mat.
- B. Swiss-ball exercise -leg march on ball with each bounce.

PROTOCOL FOR 4TH WEEK

1. Proprioception training-same as 3rd week.

2. Plyometric Training-

- A. Two-leg jumping from mat to 15-cm stage with mat surface.
- B. Ankle jumps – ask the participants to jump on their heels. 1 set of 20 repetition.

C. Scissor jumps -stand with the feet hip-width. Jump up with Forward and the other one backward. Bend the knees to squat down while landing.

PROTOCOL FOR 5&6 WEEK

1. Proprioception training-

- A. One-leg-standing with eyes-closed on foam -ask the participant to stand on foam on one leg with closed eyes for 10 sec with 6 repetitions.
- B. Stand on the foam mat & catch sandbag while standing. 1 set of 30 Repetitions.

2. Plyometric training-

- A. One-leg jumping from firm surface to 10-cm stage .1set of 10 repetitions.
- B. One-leg continuous jump in S-shape.

C.Squat-tuckjump.10repetition

D. Cone jump with 3 cones forward and side to side 2 sets of 5 repetitions in each direction.

3.Core exercise

A. Planks – ask the participant to lie on elbow with back support .

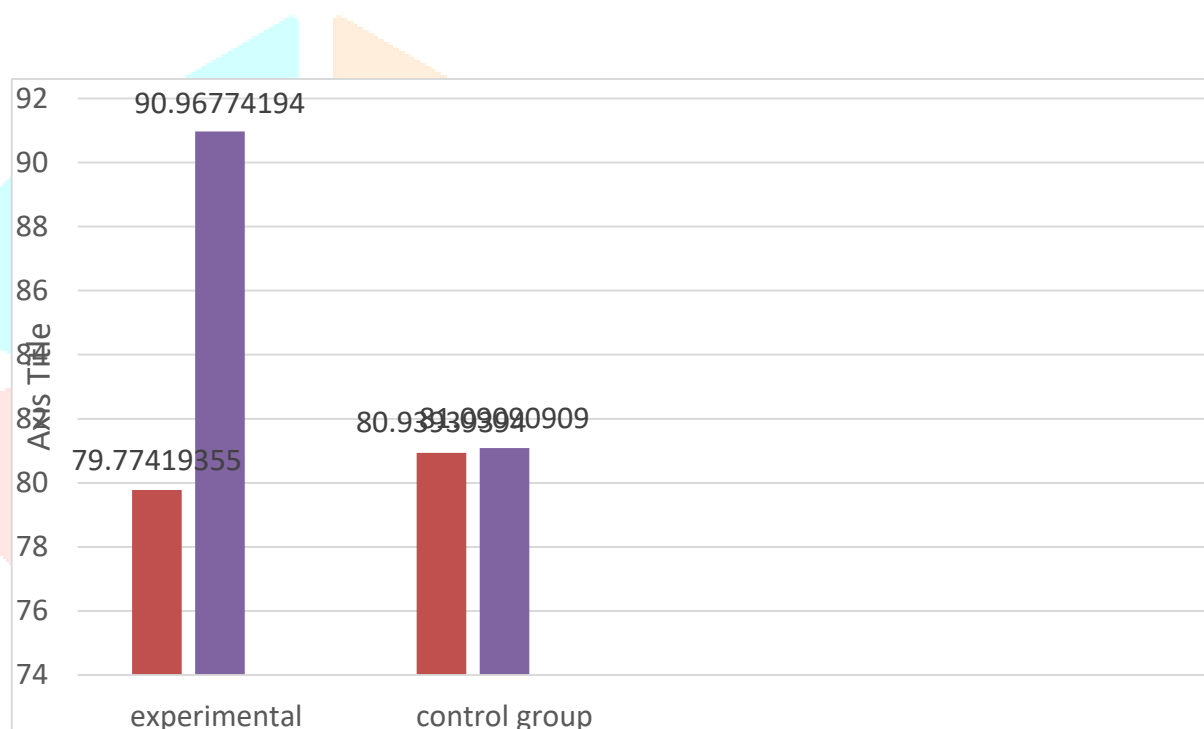
B. Jumping jacks



DATA ANALYSIS AND INTERPRETATION

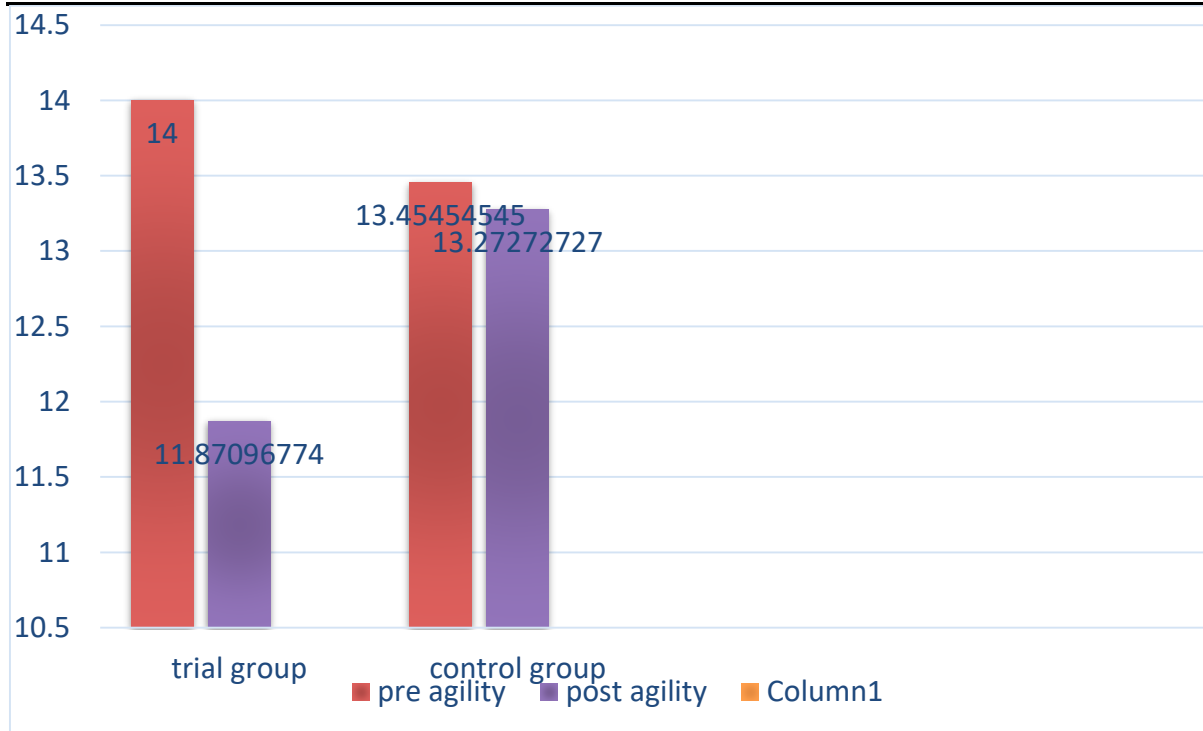
The data collected was statistically analyse using Microsoft excel sheet and GraphPad.com

- Effect of integral training on balance and agility was analysed using appropriate parametric test.
- Paired t test was used to obtain the difference between Pre-treatment and Post-treatment values of experimental and control group.
- Unpaired t test was used to obtain difference between post treatment values of balance and agility of both experimental and control groups.
- The various statistical measures such as Mean, Standard Deviation (SD) and the test of significance were utilized to analyse the data.
- The difference of post treatment balance of experimental and control group is $p < 0.0001$ which is considered to be statistically extremely significant.
- The difference of post treatment agility of experimental and control group is $p = 0.0004$ which is considered to be statistically significant.



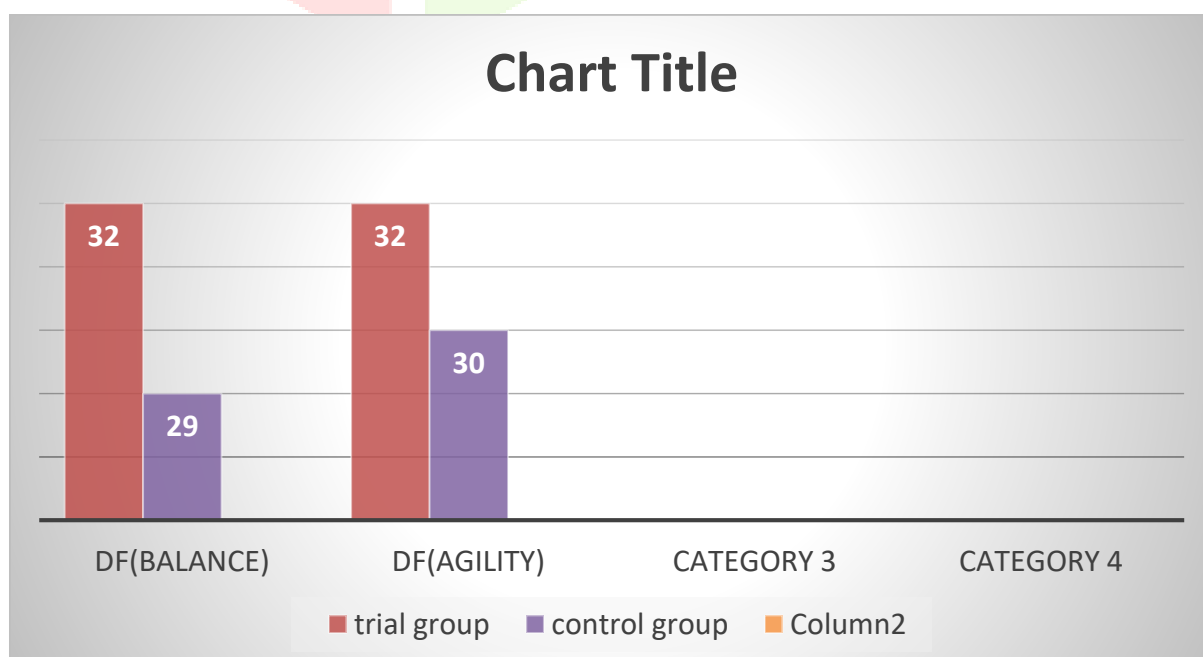
The graph shows pre and post values of balance of two groups i.e the experimental group and the control group.

	Pre balance	Post balance	N		
Control group	80.93939394_+4.37	81.09090909+ 4.41	33		
Experimental group	79.7741_+3.69	90.96774194- _+3.19	30		



The graphs shows the difference between the pre and post values of agility of two group i.e the experimental and the control group

Group	Pre agility	Post agility
control	13.45454545	13.27272727
experimental	14	11.87096774



DISCUSSION

- The aim of this randomized controlled trial is to test the effect of 6-week integral training on dynamic balance and agility in Bharatnatyam dancer. The study was conducted on 64 Bharatnatyam dancers within the age group 14 to 17 years, with those less than 1 year of experience.
- The participants were then divided in two groups a) experimental and b) controlled group, with each group having 32 dancers in it then the participants were tested for balance and agility using Y balance test and t agility test and the pre-score and post-score of the individuals were taken.
- The results reveal that the trial group have better dynamic balance and agility as compared to the control group.
- Balance and agility are the main components required in the Bharatnatyam dance form and as per the results shown in the study they can be improved using integral training. As this training consists of three components, proprioception training, plyometric training and core strengthening. Plyometric training which contains certain sets of movements which are beneficial to improve the dynamic control of the body by improving the joint proprioception and stimulating the golgi tendon organs and improve lower body stability by strengthening the lower limbs, also core strengthening results in smaller displacement in centre of pressure and centre of mass.

Therefore, the motion at level of the trunk and hip is properly controlled resulting in a better dynamic balance which is beneficial for Bharatnatyam dancers, addition of this training with the regular training program in Bharatnatyam dancers is beneficial for the dancers to achieve a proper dynamic balance and agility.

- Plyometric training helps to improve the dynamic control of centre of mass, which ultimately develops neuromuscular adaptability by activating the nervous system and muscular system⁹.
 - Plyometric helps to improve lower body stability by increasing the muscle activation and by stimulating GTO firing, which indirectly improves agility⁹.
 - In thus we can say that there is improved balance and agility after plyometric training.
 - Plyometric improves proprioception of individual as it involves fast ballistic movements which stimulates the mechanoreceptors in and around the joint which indirectly improves the balance and agility of an individual⁹.
 - Similar to the present study,
 - Myer and FORD in 2006 performed a 7 weeks of plyometric training which showed improved dynamic balance after the training¹².
- ❖ The core strengthening results in smaller displacement of mediolateral centre of pressure and centre of mass which leads controlled motion at the trunk and hip which causes significant improvement in balance¹³.
 - ❖ For example – a study conducted by Amer Al Saif studied the effect of core muscle strengthening for pain balance in pfps have shown similar effect¹³.
 - ❖ Thus, adding integral training along with Bharatnatyam training will help dancers to improve their dynamic balance and agility faster.

RESULT-

The integral training has shown significant improvement in dynamic balance and agility when given along with the Bharatnatyam training.

CONCLUSION

There is a significant effect of integral training on dynamic balance and agility after 6-week in Bharatnatyam dancers.

LIMITATIONS

- Study was done on small population.
- The main limitation was to find bharatnatyam dancers with less 1 year of experience.

FUTURE SCOPE

- Study can be done on larger population.
- Study population can be changed.
- Study can be performed for postural correction in school going children or in adults.

REFERENCES

1. Analysis of Postural Risk and Pain Assessment in Bharatanatyam Dancers
Vrushali P Panhale, Prachita P Walankar, and [Aishwarya Sridhar](#).
2. Balance in Bharatanatyam dancers and non-dancers: A comparative study Leora Penkar^{1,*}, Aparna Sadhale
3. Effects of Plyometric and Balance Training on Neuromuscular Control of Recreational Athletes with Functional Ankle Instability: A Randomized Controlled Laboratory [Pi-Yin Huang](#),¹ [Amornthep Jankaew](#),² and [Cheng-Feng Lin](#)^{1,2}
4. Effects of core stabilization exercise and strengthening exercise on proprioception, balance, muscle thickness and pain related outcomes in patients with subacute nonspecific low back pain: a randomized controlled trial. [Su Hlaing Rungthip Puntumetakul](#),^{2,3} [Ei Ei Khine](#),⁴ and [boucat](#)
5. Comparison of lower extremity muscle flexibility in amateur and trained bharatanatyam dancers and nondancers.
6. Evaluation of Standing Balance Performance in Indian Classical Dancers
Juhi K. Bharnuke, Rajani P. Mullerpatan, and Claire Hiller.
7. Age-Related Changes in Agility Time in Children and Adolescents
Erika Zemková¹.
8. The reliability of STAR EXCURSION TEST AND LOWER EXTREMITY Y-BALANCE TEST in healthy individual. Cameron J Powden .
9. Current concept of plyometric
George davis , Bryan Riemann , and Robert manske,
10. Assessment of body balance in Bharatnatyam female dancers.
11. Comparison of three agility tests with male servicemembers: Edgren Side Step Test, T-Test, and Illinois Agility Test
Michael A Ryan

12. The effects of plyometric vs. dynamic stabilization and balance training on

power, balance, and landing force in female athletes. Gregory D myer, Kevin R ford .

13. Effectiveness of core muscle strengthening for improving pain and dynamic balance among female patients with patellofemoral pain syndrome. Mohammad Faizal chevdikunnan, Almer al saif

