



ASSESSMENT OF STATIC BALANCE AND FLEXIBILITY OF LOWER EXTREMITY IN TEENAGED HIP-HOP AND BHARATNATYAM DANCERS.

AN OBSERVATIONAL STUDY

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Abstract: Dancing is a physical activity as well as a form of expression and communication since it engages the body, emotions, and mind. Dancers need sufficient flexibility in their lower extremity muscles to maintain balance (stability). A dancer needs to maintain a strong balance in moving their body. Flexibility tests are used to determine the capacity of skeletal muscle and tendons to lengthen. Flexibility can be both static and dynamic Hip-hop dance encompasses a variety of dance forms, including breakdancing (or "breaking"), house dancing, popping, and locking, funk, street dancing krumping, Memphis jookin', and voguing. Bharatnatyam is the most well-known of the Indian classical dance forms in South India and the oldest of all the Indian classical dance forms, which are all based on Natya Shastra. Bharatnatyam first originated in Tamil Nadu temples.

Purpose of Study:

The purpose of the study was to assess static balance and flexibility of lower extremities in teenage hip-hop and Bharatnatyam dancers.

Material And Methodology:

For this purpose, a total of 66 teenage dancers were selected male and female dancers between 15-18yrs of age. Among them, thirty-three were Hip-hop dancers (N=33) and thirty-three were Bharatnatyam dancers (N=33). Subject practicing for more than 3 years. Static balance and flexibility were considered as the criterion measure for the present study. Stock stand test and goniometer were used to measure the parameters of static balance and flexibility respectively. Mean and standard deviation were used as descriptive statistics and the significance of the difference between group mean was analyzed by using an independent sample test.

Results:

The result revealed that Hip-hop dancers had higher levels of static balance (Mn =478.64 & SD=18.55) and flexibility (Mn=478.33 & SD=18.48) than the Bharatnatyam dancers (Mn=417.70 & SD=56.06 and Mn=417.73 & SD=51.92) difference between mean for flexibility (t=6.16) and mean for static balance (t=6.27) between two groups is significant.

Conclusion:

From the finding, it was concluded that teenage dancers who practiced Hip-hop on regular basis had a significantly higher level of flexibility than the dancers who practiced Bharatnatyam dance occasionally.

Keywords: Static balance, Flexibility, Bharatnatyam dancers, Hip-hop dancers.

I. INTRODUCTION

DANCING is a physical activity as well as a form of expression and communication since it engages the body, emotions, and mind.¹ A specific area of sports medicine is now known as dance medicine.² In terms of muscular and joint flexibility, stability, muscle strength, coordination, sensory integrity, and motor integrity, the artistic body movements used in dance exert a tremendous physical and physiological demand on the body. As a result, dancers can be thought of as both athletes and artists.³ Dance is a deliberate attempt to create a visual design in space by moving the bodies in a series of poses and pattern training. The movement must also be symmetrical and have a specific rhythm.¹

Dancers need sufficient flexibility in their lower extremity muscles to maintain balance (stability).⁴ Flexibility tests are used to determine the capacity of skeletal muscle and tendon to lengthen. Flexibility can be both static and dynamic. The range of motion (ROM) accessible to a joint or group of joints is referred to as static flexibility. The ease of movement within the available range of motion is referred to as dynamic flexibility. Lack of flexibility could cause early onset of muscle fatigue or change typical movement biomechanics, increasing the risk of injury.¹

The vestibular, visual, auditory and higher-level premotor systems work together to maintain balance.⁵ A dancer needs to maintain strong balance while moving their body, neuromuscular coordination, proprioception awareness, and endurance in order to perform for an extended period of time and produce fatigue-free expression, exact rhythm, and a perfect, positive response to music.⁶ The balancing systems' functional aims are:

- Maintaining a precise posture, such as sitting or standing, is important.
- Facilitation of voluntary movements, such as between-posture transitions, and
- External perturbations such as a trip, slip, or push cause reactions to restore balance.⁵

Dancers must constantly work on their balance in order to improve their stability while performing choreographed movements.⁷

HIP-HOP DANCERS have grown in popularity around the world.⁸ Hip-hop originated on the streets in the 1970s.⁹ Hip-hop dance encompasses a variety of dance forms, including breakdancing (or "breaking"), house dancing, popping and locking, funk, street dancing, krumping, Memphis jookin', and vogueing.⁸ The dancers are trained and presented in a variety of settings, including contests (referred to as "battles"), and can contain a significant amount of improvisation. The locations for training and performances vary greatly and frequently take place outside of conventional dance studios. Even though some dancers might have access to studio space, they frequently perform, practice, and compete on floors made of concrete.¹⁰ Rapping, turntablism, graffiti, and breaking are the other four pillars of hip-hop culture. Breaking is the original hip-hop dance form.⁹ Hip-hop is characterized by body-bouncing movements, knee bending, hopping, turning, twisting, isolated extremities movements, and a very active torso.¹¹ Breaking consists of four basic dancers

- TOP ROCK consists of footwork-oriented steps performed while standing.
- DOWN ROCK consists of footwork performed with both hands and feet on the floor.
- FREEZES consists of stylish poses performed on the hands.
- POWER MOVES which consist of complex and impressive acrobatic moves.⁹

Indian classical dance known as "BHARATNATYAM" first appeared in Tamil Nadu's temples.¹² It is the most well-known of the Indian classical dance forms in South India and the oldest of all the Indian classical dance forms, which are all based on Natya Shastra, the classical Indian dance form's holy book.¹ Even though it has been practiced for centuries, the Indian classical dance system has changed significantly over time. It consists of two basic stances or postures known as Araimandi (half-squatting position) that have a more pronounced turnout of the lower extremities.¹³ Grace, elegance, purity, compassion, expression, and sculptural stances are all hallmarks of Bharatanatyam.¹² Bharatanatyam is divided into three categories: Nirutham, Niruthiyam, and Natyam. Without any feelings, expressions, or Sahityam, Nirutham is a pure dance. It involves the use of Adavus, which are coordinated movements of the hands, feet, head, and eyes. Niruthiyam includes a Sahityam (meaningful statement). The hastas exhibit emotions, expressions, and meaning. All four forms of Abinayam are involved in Nirutham. When a Niruthiyam is mixed and music is played in the background, it is known as Natyam. There are four types of abhinaya in dance. They are as follows:

- Anghika – physical or body gestures.
- Vachika – the song being played, poetry.
- Aaharya – Character/dancer ornamentation such as jewelry, clothing, and so on.
- Satvika – Involuntary motions such as trembling, loss of voice, and tears.¹²

Professional dancers have a greater risk of lower extremity injury, according to recent studies. They suffer from different types of dancing injuries during their carrier. In the lower extremities, the injuries affect the knee, ankle, and foot region. The most common site of injury among these dancers was a knee injury. The most common causes of dance injuries are biomechanical irregularities, agonist-antagonist muscular strength imbalances, a lack of lower limb flexibility, and so on. Lack of flexibility can result in early muscle Fatigue or incorrect biomechanical movement of the lower limb, which can lead to injuries. According to several research, proper muscular flexibility is essential in dance performance, and a lack of flexibility contributes to injuries among dancers. Dancers who are unable to achieve a proper dancing position may develop compensatory measures, which can lead to a variety of musculoskeletal injuries.¹³

Performing Hip-Hop and Bharatnatyam involves various kinds of movements and postures which affect the fitness and health of the performers. Hence the objective of the study is to compare the two fitness components namely static balance and flexibility of lower extremity muscles between teenage Hip-Hop and Bharatnatyam dancers.

II.MATERIALS AND METHODOLOGY

An observational study was conducted in the Miraj-Sangli community. The study was approved by the Institutional Ethical Research Committee of Miraj Medical Center, College of Physiotherapy, Wanless Hospital, Miraj.

III.PARTICIPANTS

Subjects who completed the inclusion and exclusion criteria were included in the study. The inclusion criteria were Hip-hop and Bharatnatyam dancers, Male and female of age group between 15 to 18 years, subject practicing for more than 3 years. The exclusion criteria were soft tissue injury (sprain, strain, plantar fasciitis, bursitis, tendonitis), Recent lower limb fractures, Dislocation of the hip, Deformities of the lower limb, History of musculoskeletal disorders of the lower limb. Written Informed consent was obtained from the participant.

IV.PROCEDURE

1. Stock stand test

The reliability of the stock stand test is 0.71 and the validity is 0.67.

The performer is asked to stand on the foot of the dominant leg and place the ball of the other foot on the inside of the supporting knee.

The subject is instructed to place the hands on the respective side of the waist.

The subject is informed to stand on the ball of the foot by raising the heel from the floor on the signal 'start'.

On the signal 'start', the subject raises the heel from the floor to maintain the balance as long as possible without moving the ball of the foot from its initial position, and the tester starts the stopwatch.

As soon as the subject loses balance either by touching the heel to the floor or by the movement of the foot's initial position, the tester stops the stopwatch.¹⁴



FIG NO. 1

Interpretation of stock-stand test.

Rating	Score (seconds)
Excellent	> 50
Good	40 – 50
Average	25- 39
Fair	10 – 24
Poor	< 10

2. Goniometer (for flexibility)¹⁵

The Reliability for measuring the lower extremity Range of motion with a goniometer is ICC= 0.74-0.89 and validity is 0.74-0.94.

- *Hip Flexion*

Position: Measurement was done in the supine position with the hip in 0° of abduction, adduction, and rotation.

Axis Location: Femoral greater trochanter.

Stationary arm: Parallel to the trunk.

Movement arm: Parallel with the longitudinal axis of the femur in line with the lateral femoral condyle.

Range: 0-120°



FIG NO. 2

- *Hip Extension*

Position: The subject was in the prone position, and the knee was extended to avoid tension from the rectus femoris muscle.

Axis Location: Greater trochanter

Stationary Arm: Parallel to the trunk.

Movement arm: Parallel to the longitudinal axis of the femur in line with lateral femoral condyle.

Range: 0-30°

**FIG NO. 3**

- *Hip abduction*

Position: The subject was in a supine position with an extended knee.

Axis location: ASIS on the measured side.

Stationary arm: Directed to opposite ASIS.

Movement arm: Parallel to femur directed to the center of the patella.

Range: 0- 40°

**FIG NO. 4**

- *Hip Adduction*

Position: The subject was in a supine position with an extended knee.

Axis location: ASIS on the measured side.

Stationary arm: Directed towards the opposite ASIS.

Movement arm: Parallel to the femur at the center of the patella.

Range: Adduction: 0-30°



FIG NO. 5

- *Hip Internal rotation*

Position: The subject was in a sitting position at the edge of the table with a towel roll beneath the distal femur.

Axis location: Mid patella.

Stationary arm: Perpendicular to the floor.

Movement arm: Patella to the long axis of the tibia.

Range: 0-45°



FIG NO. 6

- *Hip External Rotation:*

Position: The subject was in a sitting position at the edge of the table with a towel beneath the distal femur.

Axis location: Mid patella.

Stationary Arm: Perpendicular to the floor.

Movement Arm: Parallel to the long axis of the tibia.

Range: External Rotation: 0- 45°



FIG NO. 7

- *Knee flexion:*

Patient is prone with test-side ankle off plinth and leg in extension.

Axis location: lateral epicondyle of the femur.

Stationary Arm: along the femur to the greater trochanter.

Movement Arm: along the fibula to lateral malleolus.

Range: 0-135°



FIG NO. 8

- *Knee Extension*

Position: Patient is prone with test-side ankle off the plinth.

Axis location: lateral epicondyle of the femur.

Stationary Arm: along the femur to the greater trochanter.

Movement Arm: along the fibula to the lateral malleolus.

Range: 0-15°



FIG NO. 9

- *Ankle Plantar Flexion*

Position: Patient is prone or supine with the test-side knee in slight flexion. The therapist stabilized the leg.

Axis location: lateral malleolus.

Stationary Arm: parallel to fibula.

Movement Arm: parallel with 5th metatarsal.

Range: 30-50°



FIG NO. 10

- *Ankle Dorsiflexion*

Position: the patient is prone with the test-side ankle the off-plinth and leg in extension. The therapist stabilized the tibia.

Axis location: lateral malleolus.

Stationary Arm: parallel to fibular.

Movement Arm: parallel with 5th metatarsal.

Range: with knee extension is 0-10°

With knee flexion is 0-20°

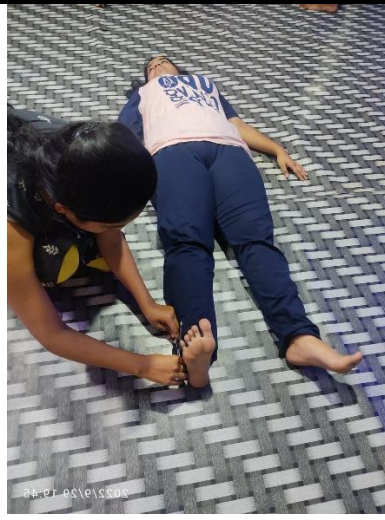


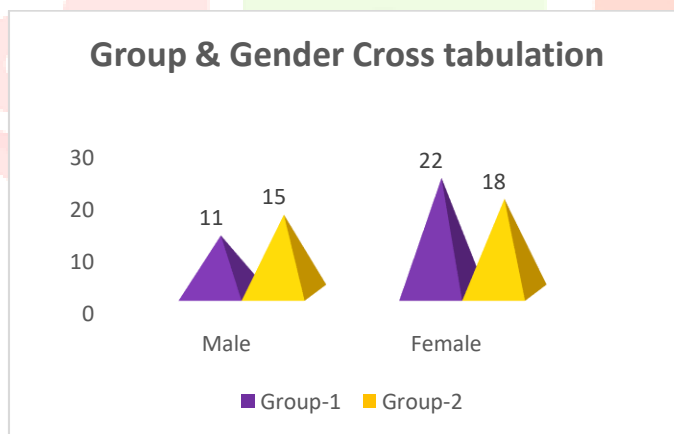
FIG NO. 11

V. RESULT

In total, 66 participants have evaluated from which 22 participants were male and 40 participants were female.

Particular	GENDER		Total
	Male	Female	
Group-1	11	22	33
Group-2	15	18	33
Total	26	40	66

Table 1: Gender wise distribution of participants.

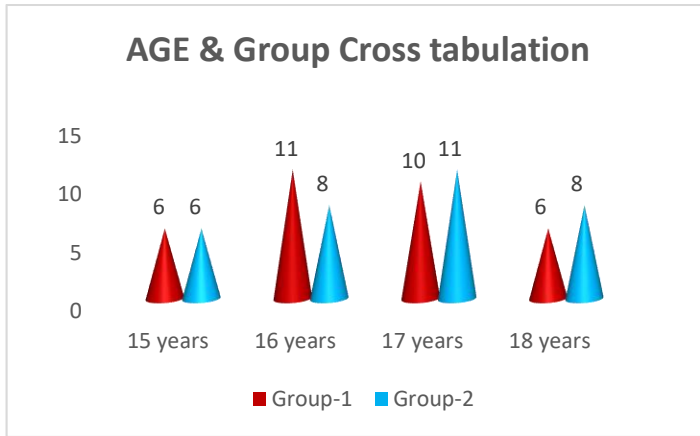


Graph 1: gender distribution.

The average age of participants was 15-18 years. The Age wise distribution shows 12 dancers were in 15 years, 19 dancers were in 16 years, 21 dancers were in 17 years, and 14 dancers were in 18 years.

Particular		Group		Total
		Group-1	Group-2	
AGE	15 years	6	6	12
	16 years	11	8	19
	17 years	10	11	21
	18 years	6	8	14
Total		33	33	66

Table 2: Age-wise distribution



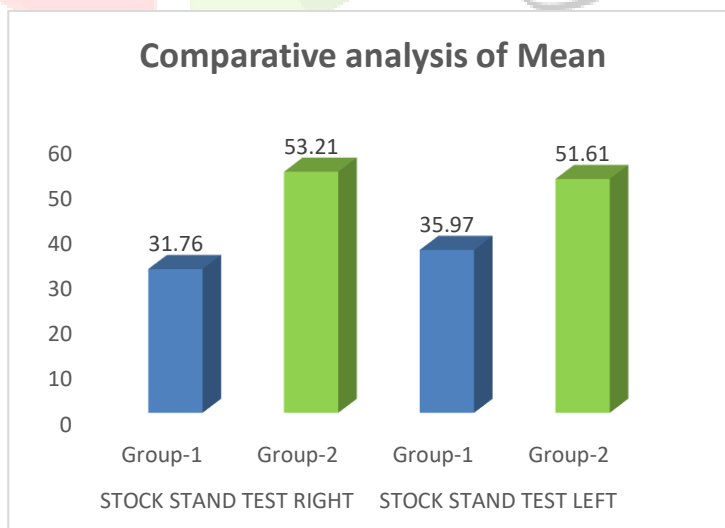
Graph 2: Age wise distribution

Group		Mean	SD	t-value	p-value
STOCK STAND TEST RIGHT	Group-1	31.76	14.47	7.144	0.001*
	Group-2	53.21	9.39		
STOCK STAND TEST LEFT	Group-1	35.97	16.15	4.809	0.001*
	Group-2	51.61	9.37		

Table 3: comparative analysis for stock stand test (Balance)

From the above table, it is observed that between groups analysis is significant for STOCK STAND TEST RIGHT at 5% level significance. Group 2 with a higher value is better than Group 1

From the above table, it is observed that between-groups analysis is significant for STOCK STAND TEST LEFT at 5% level significance. Group 2 with a higher value is better than Group 1



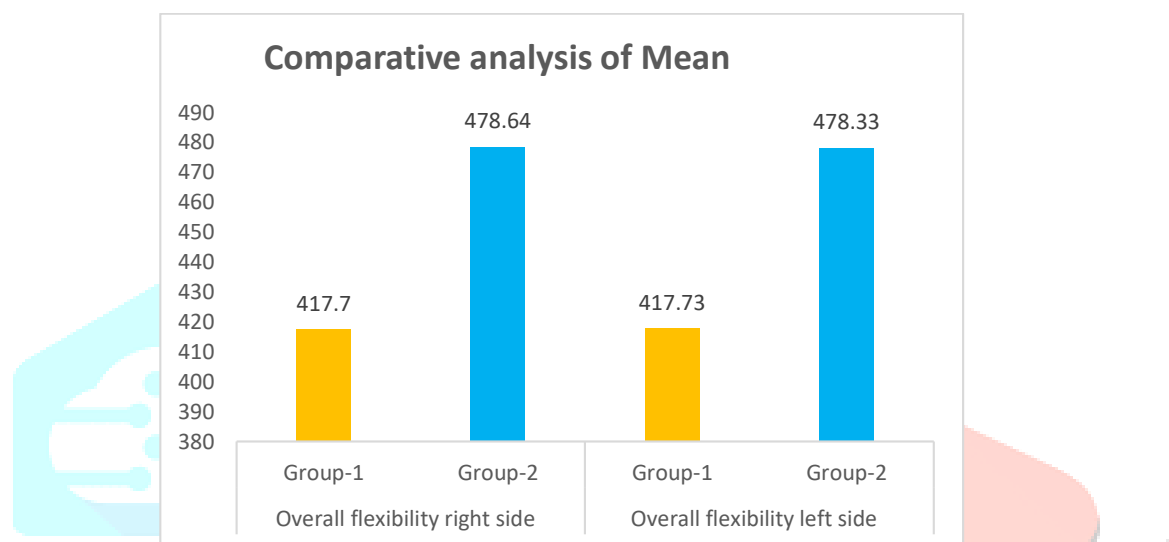
Graph 3: Comparative analysis of stock stand test (Balance)

Group		Mean	SD	t-value	p-value
Overall flexibility right side	Group-1	41.70	56.06	5.929	0.001*
	Group-2	47.64	18.55		
Overall flexibility left side	Group-1	41.73	51.92	6.317	0.001*
	Group-2	47.33	18.48		

Table 4: Comparative analysis for flexibility

From the above table it is observed that between groups analysis is significant for Overall flexibility right side at 5% level significance. Group 2 with a higher value is better than the Group 1 with a lower value

From the above table it is observed that between groups analysis is significant for Overall flexibility left side at 5% level significance. Group 2 with a higher value is better than the Group 1 with a lower

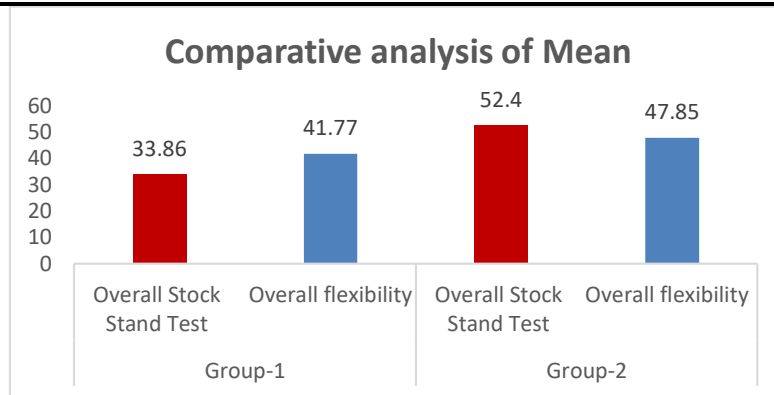


Graph 4: Comparative analysis for flexibility

Group	Variable	Mean	SD	t-value	p-value
Group-1	Overall Stock Stand Test	33.86	14.59	2.923	0.005*
	Overall flexibility	41.77	5.36		
Group-2	Overall Stock Stand Test	52.40	8.67	2.949	0.004*
	Overall flexibility	47.85	1.84		

Table 5: comparative analysis of both flexibility and balance

From the above table it is observed that between groups analysis is significant for Stock Stand Test and Overall flexibility at 5% level significance for both the groups. Group 2 is better with stronger significant value as compared to the group 1



Graph 5: Comparative analysis of both flexibility and balance

VI.DISSION

This study was intended to assess and compare static balance and flexibility of lower extremities in teenage Hip-hop and Bharatnatyam dancers. Sixty-six dancers were divided into 2 groups thirty-three dancers in each group. In this study, there was an inclusion of both male and female dancers their assessment of static balance and flexibility was done by (1) the Stock stand test (Balance), and (2) the Universal Goniometer (flexibility). The stork test is used to monitor the development of the individual's ability to maintain a state of equilibrium (balance) in a static position.¹⁶ Goniometry has been used for years by physical therapists in an attempt to quantify the joint range of motion.¹⁷

Balance is an important aspect that helps to maintain a stable posture for performing daily activities while counteracting external or internal conflicts. In terms of biomechanics, balance is the process that maintains the center of gravity (COG) or center of mass (COM) within the body's base of support. When the body is at rest it is called static balance, and when the body is in steady state motion then it is called dynamic balance.¹⁶

Flexibility tests are used to determine the capacity of skeletal muscle and tendons to lengthen. Flexibility can be both static and dynamic. The range of motion (ROM) accessible to a joint or group of joints is referred to as static flexibility. The ease of movement within the available range of motion is referred to as dynamic flexibility. Dancers need sufficient flexibility in their lower extremity muscles to maintain balance (stability). Lack of flexibility could cause early onset of muscle fatigue or change typical movement biomechanics, increasing the risk of injury.¹⁴

Pintu Sil (2016) conducted a study to find the static balance and flexibility in teenage yoga students and Bharatnatyam dancers wherein the average age of the yoga students was 16.47 years and Bharatnatyam dancers were 15.59 years in groups A and B respectively. For this purpose, a total of thirty-five teenage female students were selected among them 18 were yoga students and 17 were Bharatnatyam dancers. The stock stand test (balance) and modified sit and reach test (flexibility) were used to assess Balance and flexibility which was higher in yoga students than in the Bharatnatyam dancers. Yoga students performed yoga on a regular basis whereas the dancers were not performed the dance on regular basis. They just practice dance for more duration before the stage show performance. As a result, flexibility and balance were low in Bharatnatyam dancers.

Aiyegbusi Ayoola Ibifubara (2018) et al. compared the association between the flexibility of the lower limb muscles and injury risk and pattern among three different types of professional dances in Lagos, Nigeria. Eighty-two (82) participants who were all professional dancers between the ages of 18-35 years were selected. Twenty-eight participants performed one of the indigenous African dances, while twenty-six were professional ballet dancers and twenty-eight professional hip hop dancers. The goniometer (flexibility) and questionnaire (injury risk) were done. Findings from this study showed a significant association between the type of dance and injury occurrence as it was found that ballet participants experienced the highest number of injuries. Hip-hop and ballet dancers exhibit increased flexibility. The three dance genres involved in this study have peculiar flexibility risks associated with injury occurrence. To proactively minimize injury, dancers need to take part in regulated fitness training that is targeted at increasing the flexibility of the muscle groups involved in injury occurrence in the different genres.

The present study was to assess static balance and flexibility of lower extremities in teenaged hip-hop and Bharatnatyam dancers. It was done with 66 male and female dancers, 33 Bharatnatyam, and 33 hip-hop dancers. Higher flexibility and balance were found in Hip-hop dancers in the present study, which might be due to that the hip-hop dancers practice and performed dance regularly whereas the Bharatnatyam dancers were not practicing and performed dance regularly. In this study, the Bharatnatyam dancers performed the dance occasionally and not on a regular basis they practiced the dance for more duration before the stage show performance. As a result, their flexibility, as well as balance, was lower than the Hip-hop dancers.

VII.CONCLUSION

On the basis of the above finding and within the limitations of the present study following conclusion was drawn:

- ❖ The teenage male and female dancers performing Hip-hop on regular basis had significant higher level of flexibility than the dancers who performed the Bharatnatyam dance occasionally.

VIII. LIMITATIONS AND SUGGESTIONS

LIMITATIONS- The research couldn't include the adult dancers.

SUGGESTIONS- Further research can focus on assessing Flexibility and balance above the age group of 18 years. Also, it can be carried out in various dance forms.

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