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Ashwini D Pillai
Intern (B.P.Th), TMV
Lokmanya Tilak College of
Physiotherapy, affiliated to
MUHS, Kharghar, Navi
Mumbai, Maharashtra, India

Dr. Khushboo Jangid
Assistant Professor,
Department of Community
Physiotherapy, TMV
Lokmanya Tilak College of
Physiotherapy, affiliated to
MUHS, Kharghar, Navi
Mumbai, Maharashtra, India

Dr. Jyoti Parle
HOD, Department of
Community Physiotherapy,
TMV Lokmanya Tilak College
of Physiotherapy, affiliated to
MUHS, Kharghar, Navi
Mumbai, Maharashtra, India

Corresponding Author:
Ashwini D Pillai
Intern (B.P.Th), TMV
Lokmanya Tilak College of
Physiotherapy, affiliated to
MUHS, Kharghar, Navi
Mumbai, Maharashtra, India

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Flexibility assessment of lumbar spine in recreational female Bharatnatyam dancers

Ashwini D Pillai, Khushboo Jangid and Jyoti Parle

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Abstract

Background: Bharatnatyam is an ancient Indian classical dance form where the dancers attain several postures and perform various body movements to the rhythm of the music. Intense training at a very young age could impose an augmented risk of injuries to the joints and muscles of various body parts. Improper postures attained by recreational dancers like Arai-mandi and Muzhu-mandi tends to cause an increase external rotation at hip joint which leads to compensatory increase in the lumbar lordosis this could leads to an imbalance in the flexibility of the lumbopelvic joint. This study aims to assess the flexibility of the lumbar spine among the recreational female Bharatnatyam dancers.

Method: A cross sectional study was conducted among 60 recreational female Bharatanatyam dancers under the age group of 16-25 years. The flexibility of lumbar flexion was done by Modified Schober's test where the privacy of each dancers were maintained while performing the test. According to the test, a pre and post flexion measurement was taken and its difference value was calculated and thus interpreted.

Result: The study revealed that majority of the dancers (40%) showed the difference value whose mean average value obtained is 8.146 ± 1.17 which is greater than the normal value as per the interpretation of Modified Schober's test.

Conclusion: the study concludes that there is an increase in lumbar spine flexibility among the recreational female Bharatnatyam dancers which could make the spine prone to injuries and necessitates the importance of core strengthening program among the dancers.

Keywords: Bharatnatyam, lumbar spine, flexibility, modified schober's test

Introduction

Dance is a masterful movement in a rhythmically coordinated and expressive way. Bharatnatyam is a major form of Indian classical dance that originated in Tamil Nadu. Its meaning is described as bha (Bhava-emotion), ra (Raaga-music), ta (Taal-rhythm) and Natyam means dance. Thus, Bharatnatyam is the dance that encompasses music, rhythm and expression and strictly adheres to Natyashastra (the scripture of classical Indian dance).

There is a high physical and physiological demand on the body due to the artistic body movements displayed in dance in terms of muscular and joint flexibility, muscle strength, balance and coordination, sensory motor integration etc. This dance form demands various fine movements such as transition from one pose to another, quick body sway and turns along with certain hand gestures and rigid foot stomping. The training is conducted and supervised by qualified professional dancer. Arai-mandi is one of the common poses in Bharatnatyam which is similar to the Demi-plie position of ballet dancers. Here the knees are flexed and point in opposite direction where the hips are abducted and externally rotated. Another such pose is Muzhu-mandi where knees are completely bent and body is balanced on toes and heels are raised. Throughout the training period these positions are made to be maintained for longer duration in order to improve their skill in Bharatnatyam. Such rigorous training is initiated at a very young age.

As the dancers need to rely heavily on the muscles and ligaments surrounding the joint, joint stability becomes necessary factor for dancers. At a young age, muscle strength, range of motion, and flexibility are still in developmental phase and intensive and prolonged training during this phase may cause physical and biomechanical changes leading to permanent structural alteration. Flexibility is the ability to move a joint through its complete range of motion and static flexibility is the range of motion available to a joint or series of joint ^[1]. At a young age, muscle strength, range of motion, and flexibility are still in developmental phase

and intensive and prolonged training during this phase may cause physical and biomechanical changes leading to permanent structural alteration [2, 3].

Various studies show that low back pain (38.2%) is more prevalent among the Bharatnatyam dancers followed by knee and ankle. A study revealed the presence of increased lumbar lordosis angle and anterior pelvic tilt as compared to non-dancers [4, 5]. Certain adaptations attained by the Bharatnatyam dancers such as spinal extension movements during the dance performance in order to maintain stability and bring ease to the movements performed can lead to excessive stress on the lumbar spine, reducing the strength of abdominal muscles and shortening of back extensors [5, 6]. Practicing faulty postures make the dancers prone to acute injuries to various joints and causes imbalance to the surrounding musculature. This in turn leads to biomechanical alterations and affecting the flexibility of the joint.

Adequate flexibility is the key to graceful movements without any injury caused to the anatomical structures. While performing various movements of dance, repetitive joint articular movements of the spine associated with strength overload and certain postural adjustments especially the lumbar region supported by abdominal musculature can affect the joint mobility of spine. Lack of flexibility in the adjacent joints around the spine would also result in joint overload and leading to the risk of injuries. Such as the hip joint musculature becomes very important to maintain the stability of the pelvis and torque production and in controlling the lower limb [7]. Any imbalance in the strength and flexibility of these muscles and joint for example: Tight hip flexors or weak abdominals may lead to different type of injuries around the hip and lower back region [6, 7].

Objective of the study

To assess flexibility of lumbar spine among the recreational female Bharatnatyam dancers using Modified Schober's test

Methodology

A sample size of 60 dancers were considered as per convenience sampling from Natanakala academy, Mumbai. The inclusion criteria for each dancers were female Bharatnatyam dancers under the age group of 16-25 yrs with a minimum dance experience of 1 year whereas the exclusion criteria were the dancers with recent injuries of spine and lower limb in last 6 months; those who have undergone any surgery of spine and lower limb in last 6 months; those involved in any sport activities; practicing other dance form and with any neurological deficit.

Procedure

An ethical approval was obtained from the Institutional ethics committee of TMV'S Lokmanya Tilak College of Physiotherapy, Kharghar, Navi Mumbai. A cross sectional study was held and subjects who had met the inclusion criteria were selected to participate in the study. A prior informed consent was obtained from the participants. Information about the procedure to be performed and its need was explained to the subjects. A form regarding demographic details was given which included the data of name, age, BMI, years of experience and duration of practice was told to fill it by the participants which was recorded. Flexibility parameters was measured by Modified Schober's test: This test was performed by asking the subject to expose the part where the privacy was maintained and marking a point midway between the two PSISs by a marker, which is the level of S2; then a point 5 cm below and 10cm above that level were marked. The distance between the three points was measured using a measuring tape and noted indicating the pre-flexion value, the subject was then asked to flex forward and the distance was remeasured as the post flexion value. The difference between the two measurements indicates the amount of flexion occurring in the lumbar spine. Interpretation: The average normal difference value is 6.6cm, if any value calculated is less than 5cm, it indicates the limitation of lumbar flexion. All the measurements were recorded and the data thus obtained was statistically analyzed.

Data analysis and Results

Data analysis was done using MICROSOFT EXCEL, where the mean and standard deviation of the characteristics of 60 participants was calculated and is shown below in tabular format.

Table 1: Mean and standard deviation of each characteristic.

Characteristic	Mean	Standard deviation
Age	17	±2.86
BMI	19.2	±4.26
Experience (years)	10	±4.54
Practice (hours)	2	±0.73
Difference value	8	±1.26

Further frequency and percentage of participants within each characteristic were calculated and graphically presented below.

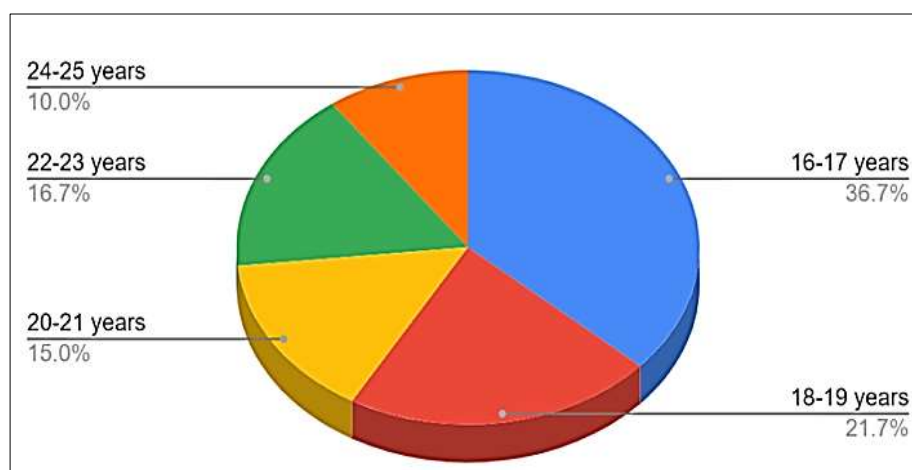


Fig 1: Frequency and Percentage of age of Bharatnatyam dancers

Inference

Among the age group of 16-25, maximum number of dancers were those who belonged to the age of 16-17 years i.e.

22(36.67%). Whereas only minimum number of dancers i.e. 6(10%) were among the age group of 24-25 years. Mean age of the participants were calculated as 19.35 ± 2.86 .

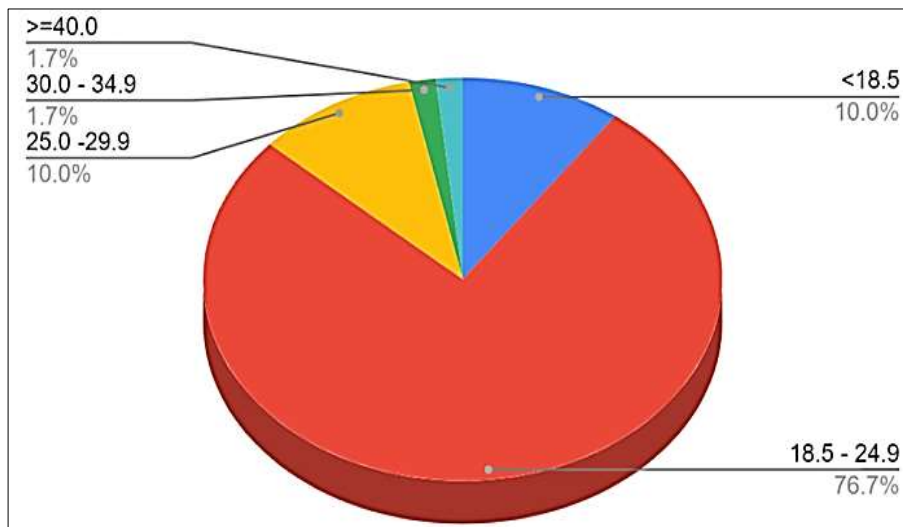


Fig 2: Frequency and Percentage of BMI of Bharatnatyam dancers

Inference: A normal BMI were found among maximum number of dancers i.e., 46(76.67%) whereas only 1(1.67%)

of the dancer were found in both obese class 1 and class 3 each. Mean BMI was calculated as 19.2 ± 4.26 .

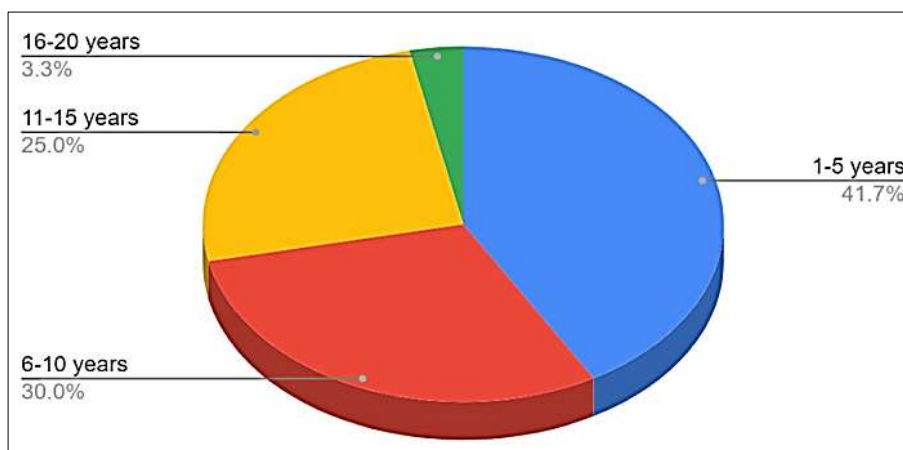


Fig 3: Frequency and Percentage of years of experience of Bharatnatyam dancers.

Inference: Dancers with 1-5 years of experience showed higher number of participations i.e., 25(41.67%) than those with 16-20 years of experience showed the lowest as

2(3.33%). Mean of years of experience were calculated as 7.81 ± 4.58 .

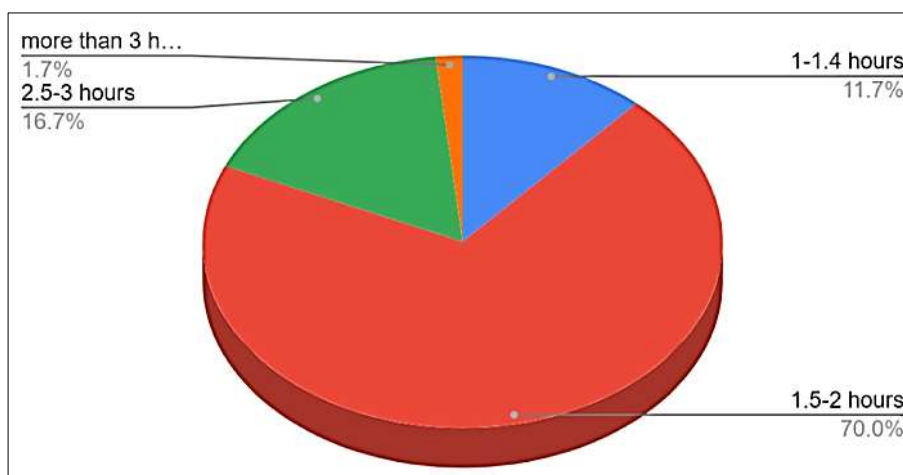


Fig 4: Frequency and Percentage of duration of practice of Bharatnatyam dancers.

Inference: Maximum number of dancers i.e., 41(68.33%) practiced Bharatnatyam for a duration of 1.5-2 hours, whereas there were minimum of 1(1.67%) number of dancers who practiced for more than 3 hours. Mean of duration of practice were found out as 1.97 ± 0.72 .

Table 2: Frequency and percentage of difference value obtained as per Schober's test.

Difference Value	Number of Participants	Percentage
6 cm	6	10.00%
7 cm	10	16.67%
8 cm	24	40.00%
9 cm	14	23.33%
10 cm	2	3.33%
11 cm	3	5.00%
12 cm	1	1.67%

Inference: The difference value calculated using Modified Schober's test has obtained several values where the highest number of dancers i.e., 24(40%) showed the difference value as 8cm and the lowest number 1(1.67%) of the dancer showed a value of 12 cm. Mean average of the difference value is obtained as 8.146 ± 1.17 . According to the Modified Schober's test interpretation, the normal average value of lumbar flexibility is 6.6 cm among the female population and the value obtained by the current study is 8 cm, which suggests that the flexibility of lumbar spine is not affected but is rather excessive among the recreational female Bharatnatyam dancers.

Discussion

Bharatnatyam is an ancient Indian classical dance form which involves rhythmic movements along with exquisite expressions and poses. One of such common poses like Arai mandi is similar to the Demi plie pose in ballet dance, which is described as a position with the trunk being upright and erect, both knees flexed and pointing in opposite direction whereas there is abduction and external rotation at the hip joint. Another such pose called Muzhumandi is a position where the knees are completely bent and body is balanced on toes and heels are raised. These positions are supposed to be sustained throughout the act of dance which demands an adequate range of movement at the targeted joints and optimal muscle strength by the dancers^[9].

Certain studies conducted among the ballet dancers revealed that the dancers were endowed with excessive flexibility of the spine, hips and ankle than the normal due to the demands imposed by the ballet dancing techniques during the training period extending over for many years chiefly established during childhood or adolescence^[10]. Similarly, the current study happens to show results of greater flexibility of the lumbar spine i.e., 8 cm than the average normal value among maximum number of recreational female Bharatnatyam dancers (40%).

A study conducted by Grahame R *et al.* revealed greater incidence of joint hypermobility among the ballet dancers when compared to that student nurses. This was mostly inherited rather than being acquired and that the hypermobile dancers were more prone to the risks of injury^[10]. The term 'Joint hypermobility' is defined as an excessive range of motion^[11]. And even though the dance literature has identified large ranges of movement during forward flexion which is a prerequisite as per the demands of the dancing techniques and for aesthetic purposes, it shouldn't be indicative of generalised joint hypermobility. These range of

movement can also be influenced by prolonged static stretching as a part of training^[10, 11].

Some studies suggested that repetitive joint movements of the spine during dance are associated with strength overload and possible postural adjustments especially the lumbar region supported by abdominal muscle can compromise the lumbar spine flexibility. Flexibility as defined is the ability to move a joint through its complete range of motion, which is considered as an essential element of normal biomechanical functioning of movements^[11]. There are studies which showed results of higher hip ROM at external rotation, abduction and flexion due to the turnout position attained by the ballet dancers where the lower limb is externally rotated and the available range of movement in the hip joint is increased. This range of movement can rely on bone shape, soft tissue laxity and neuromuscular tone. Also, femoral anteversion angle, acetabular version and depth and laxity of anterior iliofemoral ligament have an influence on the external rotation of the hip. The capsular ligament laxity around the hip joint can result in anterior pelvic tilt which leads to an imbalance in muscular attachments that control the lumbar spine and pelvis^[12]. Jyoti S *et al.* conducted a comparative study to compare lower limb flexibility among Bharatnatyam dancers and non-dancers of the age group 18-23 which reported that Bharatnatyam dancers showed higher range of flexion, abduction and ER at hip joint compared to nondancers which can be due to the regular practice of dance poses^[13].

This can be further related to the study conducted by Vrushali P Panhale *et al.* which concluded the presence of increased lumbar lordosis and anterior pelvic tilt among the female Bharatnatyam dancers when compared with 40 age-matched female non-dancers in the age group of 18-30 years^[6]. In order to gain proficiency in Bharatnatyam dance, the dancers are instructed to maintain the common postures such as Arai mandi and Muzhumandi for prolonged duration during the training period in order to improve their strength which begins at a very young age during the adolescent growth spurt, due to which the dancers tend to increase the turnout at the hip joint. This in turn leads to and compensatory increase in the lumbar lordosis which places the hip joint where the capsular ligaments are loosened leading to anterior pelvic tilt which leads to elongation of abdominal musculature. This causes weakening of the core muscles around the lumbar spine which as a result is unable to hold the spine within the range of movement when it undergoes various movements such as swift body turns, changes in posture and stances etc^[6, 12]. Core muscle component involves local stabilization system providing inter segmental motion and global stabilization system providing capability for rapid and powerful torques^[14]. Improper core stability and laxity in the ligaments of the spine can lead to an increase in range of movement thus resulting in increase in flexibility of lumbar spine.

Conclusion

This study findings shows that, there is an increase in flexibility of lumbar spine among the recreational Bharatnatyam dancers. This suggests the importance of core stability exercises among the recreational female Bharatnatyam dancers to prevent injuries of lumbar spine.

Limitations

1. The study was conducted among lesser number of subjects.

2. The study performed was confined only to the female population, thus it creates a bias to generalise the results among the male population as Bharatnatyam dancers consist of both the population.

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