

Study of Lumbosacral Posture and Pelvic Angle in Odissi Classical Dancers

Tanushree Yalavatti, Shradha Pawar

ABSTRACT

Background: This study was designed to find out the prevalence of backache due to musculoskeletal injuries in Odissi dancers and the influence of lumbar posture and pelvic angle in causing backache. **Methods:** Study design: This was a cross-sectional and observational study; Sample size: 60 numbers were classified into, Group A: 20 - Normal Individuals, Group B: 20 - Beginner Odissi dancers, and Group C: 20 - Advanced Odissi dancers. Inclusion criteria: 1) Normal individuals between 20 and 24 years of age not trained in Indian classical dance, 2) Odissi dancers trained for <2 years- Beginner's group, and 3) Odissi dancers trained for more than 10 years - Advanced group. Exclusion criteria: 1) People trained in other forms of dance, other than Odissi, and 2) recent MSK injuries. Assessment of lumbar posture and the pelvic angle performed using flexicurve and pelvic inclinometer. **Results:** 1) Inter group comparison of mean Pelvic angle (degree): Pelvic angle (degree) was higher in Group 2 in comparison to other two groups and was statistically significant with $P < 0.01$. Pelvic angle (degree) was also observed to be statistically significant between the Groups 1 versus 2 ($P < 0.01$) and 1 versus 3 ($P < 0.05$). 2) Inter group comparison of mean of Lumbar lordosis angle {Theta angle (θ)} using turkey *post hoc* tests: There was no statistical significance between either groups for theta angle. **Conclusion:** This study reveals that pelvic angle in the beginner and advanced group of Odissi dancers was altered in comparison to the non-dancer group, though statistically significant needs further evaluation in larger population of Odissi dancers.

Keywords: Flexicurve, Inclinometer, Lordosis, Lumbosacral, Pelvic angle

Asian Pac. J. Health Sci., (2022); DOI: 10.21276/apjhs.2022.9.3.34

INTRODUCTION

Indian classical dance is one of the most ancient dance forms of art, traced back to the Sanskrit text "*Natya Shastra*." It encompasses eight different dance styles across various parts of India, namely;

- 1) Bharatnatyam from Tamil Nadu
- 2) Kathak from Uttar Pradesh
- 3) Kathakali from Kerala
- 4) Odissi from Orissa
- 5) Sattriya from Assam
- 6) Manipuri from Manipur
- 7) Mohiniattam from Kerala
- 8) Kuchipudi from Andhra Pradesh^[1]

Among these dance forms, the temple dance from Orissa is known for its dramatic expression, rhythmic variations, and lyrical grace.^[2] Its elegance is noted in its costume of silver ornaments used to adorn the body of a dancer with an elevated tiara made of pith flowers, representing the spire of Jagannath temple.^[3] The highlight of this dance is the head, eyes, and neck movements with hand and foot contact techniques. This dance consists of a rich variety of poses or movements of NRITTA and positions of the body found in Hindu sculptures, namely; Samabhanga, Abhanga, Chawk, and Tribhanga.

Samabhanga - Straight standing position with feet together

Abhanga - Asymmetrical position with body weight shifted to one side and the other hip dropped lower

Chawk - Symmetrical position with a deep, low center of gravity, the legs turned out, and bent from the hips as wide as possible.

Tribhanga - Asymmetrical and three dimensional body position.^[2]

The Odissi repertoire consists of 36 types of PADABHEDA (leg movements), seven types of BHRAMARI (spins) and different types of expressions. If practiced consistently, the various forms

Department of Physiotherapy in Community Health, D. Y. Patil University, School of Physiotherapy, Navi Mumbai, Maharashtra, India.

Corresponding Author: Tanushree Yalavatti, Department of Physiotherapy in Community Health, D. Y. Patil University, School of Physiotherapy, Navi Mumbai, Maharashtra, India.

Email: tanu.yalavatti@gmail.com

How to cite this article: Yalavatti T, Pawar S. Study of Lumbosacral Posture and Pelvic Angle in Odissi Classical Dancers. *Asian Pac. J. Health Sci.*, 2022;9(3):168-174.

Source of support: Nil

Conflicts of interest: None.

Received: 19/01/2022 **Revised:** 04/02/2022 **Accepted:** 31/03/2022

of sitting, walking, leaping, and elevations have therapeutic implications leading to good body shape, thin waist, and tender look. Various studies have shown Odissi dancers to have improved lung function and muscular control of waist, hip and thigh.^[4] Since its inception Odissi dance has gone through innumerable changes, from being a temple dance honoring religious traditions to progressing to more secular venues of performance. Despite doing this, it has maintained its spirituality and is still considered as a medium of dialogue with the divine.^[5]

Odissi dance has gone through tremendous change since its inception and has been evolving ever since with improvement in techniques of the dance format. MSK injuries in dancers are of similar severity as compared to other sports and athletic injuries.^[6]

There are several factors contributing to injuries in dancers such as excessive dance training at an early age, extensive and intense rehearsals, insufficient warm-up, fatigue, technical errors, inappropriate or ill-maintained dance floors and dietary habits. Age may also have a role to play in this. Research suggests that adolescent dancers may be more prone to overload injury due to muscle tissue quality and technical skills which are typical to

them at that age. Overuse injuries account for almost 60–76% of all dance injuries, most of them pertaining to the lower extremities and back.^[7]

Although there are some studies available regarding the musculoskeletal injuries in Bharatnatyam and Ballet dancers, there are no elaborate studies regarding the same in Odissi dancers. Hence, this study was designed to study the prevalence of backache due to musculoskeletal injuries in Odissi dancers.

AIMS AND OBJECTIVES

Aims

The aim of the study was to assess the lumbar posture and pelvic angle among various grades of Odissi dancers.

Objectives

The objectives are as follows:

- 1) To assess the lumbar curve and pelvic angle in preliminary Odissi classical dancers.
- 2) To assess the lumbar curve and pelvic angle in advanced Odissi classical dancers.
- 3) To assess the lumbar curve and pelvic angle in normal individuals.
- 4) To correlate the results between the pelvic angle and lumbar lordosis angle (θ) of each group.
- 5) To compare the results of the pelvic angle of each group.
- 6) To compare the lumbar lordosis angle (θ) of each group.

METHODOLOGY

Study Design

This was a cross-sectional study and observational study.

Tools and Materials Used

- 1) Self-made questionnaire and consent form about the participants demographic details.
- 2) Pelvic Inclinator (to assess the position of the pelvis)
- 3) Flexi-curve (to assess the curvature of the lumbar spine)
- 4) A measuring tape
- 5) Clips
- 6) A weighing machine
- 7) A fluorescent tape
- 8) Graph paper
- 9) Pencil
- 10) Pen
- 11) Ruler

Sample Size: 60

Group A: 20 - Normal Individuals

Group B: 20 - Beginner Odissi dancers

Group C: 20 - Advanced Odissi dancers

Inclusion Criteria

The following criteria were included in the study:

- 1) Normal individuals between the ages of 20–24 years, who have not been trained in Indian classical dance.
- 2) Odissi dancers who have been trained for <2 years, to be

included in the beginner's group.

- 3) Odissi dancers who have been trained for more than 10 years, to be included in the advanced group.

Exclusion Criteria

The following criteria were excluded from the study:

- 1) People who have been training in other forms of dance, other than Odissi.
- 2) Recent MSK injuries.

Study Procedure

- 1) Each dancer was provided with a consent form.
- 2) Once the consent was taken, the dancer was required to fill a questionnaire.
- 3) An assessment was performed of the lumbar posture and the pelvic angle using the flexicurve and pelvic inclinometer
- 4) Measurement with pelvic inclinometer:-
 - The pelvic inclination angle is defined as the angle between the horizontal and a line drawn between the Anterior Superior Iliac Spine (ASIS) and the Posterior Superior Iliac Spine (PSIS).
 - The use of a pelvic inclinometer to measure the pelvic inclination is a quick, non-invasive, and user-friendly method.
 - The degree of tilt was measured in the following way:
 - The patient was made to remove footwear and stand relaxed on a flat surface with an erect posture and fix their gaze by looking forward.
 - The therapist determined the location of the ASIS and PSIS by palpating the given surface and marking it with a fluorescent tape.
 - The pelvic inclinometer has two ends, one on each side of the pelvis. One end of the caliper is placed on the ASIS and the other is placed in the PSIS. The deflection of the needle on the dial placed on the other end must be noted which measures the angle of pelvic inclination.
- 5) Measurement with flexicurve:
 - The curve assumed by the lumbar spine is called lumbar lordosis, where the lumbar spine forms an anterior convexity.
 - The subject was made to stand in a relaxed position with the lower back and the upper buttock exposed. The weight has to be distributed on both the legs equally with a distance of 10-15cms. The spinous processes of T12 and S2 were palpated and were marked with fluorescent tape.
 - The spinous process of T12 was palpated down from C7 vertebrae. A fluorescent tape was placed on the spinous process horizontally.
 - Next the spinous process of S2 was palpated, which was assumed to be in the midway between ASIS and PSIS. A fluorescent tape was placed horizontally over the center of the S2 spinous process.
 - The flexicurve was placed over the spinous process shaped to the contours of the low back and the readings were noted. The flexicurve was removed without altering its shape and was traced on the graph paper where T12 and S2 were considered as points A and B, respectively.
 - The length of the line (L) from A to B was measured while the

length of the perpendicular line (H) drawn from the midpoint of (L) to the lumbar curve was measured with a ruler.

- An angle theta was determined using these measurements in the following equation:-

$$\text{Theta} = 4 * (\text{arc tan}[2H/L])$$

Where theta represents the magnitude of the lumbar lordotic curve.^[8]

Statistical Procedures

All data were entered into a computer by giving coding system, proofed for entry errors

- Data obtained were compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States).
- Data were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS v 26.0, IBM).
- Descriptive statistics such as frequencies and percentage for categorical data, Mean and SD for numerical data have been depicted.

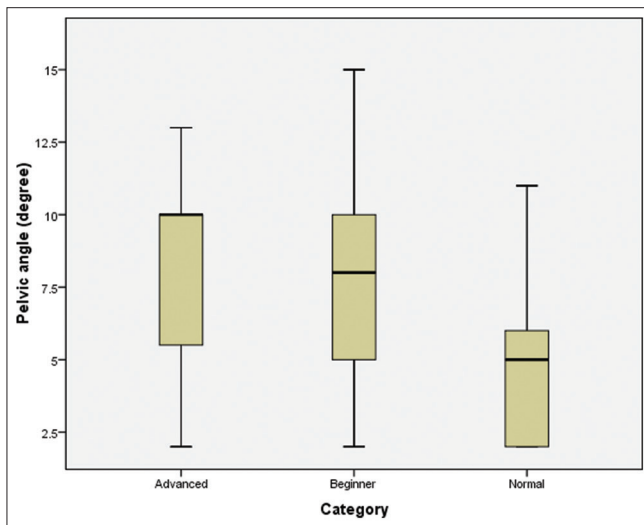


Figure 1: Box plot representation of the above data: For pelvic angle

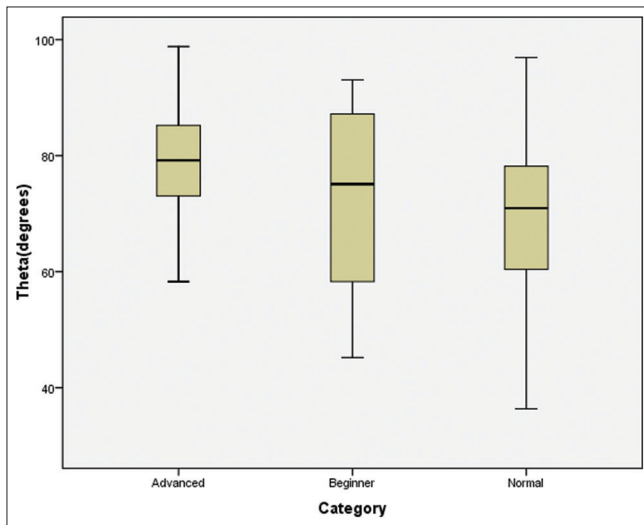


Figure 2: Box plot representation of the above data: For lumbar lordosis angle (θ)

Normality of numerical data was checked using Shapiro–Wilk test and was found that the data for weight, BMI, Waist circum, and Pelvic angle did not follow a normal curve; hence, non-parametric tests have been used for comparisons.

- Inter group comparison (>2 groups) was done using Kruskal–Wallis ANOVA followed by pair wise comparison using Mann–Whitney U test.
- Intra group comparison was done using Wilcoxon Signed-rank test (up to two observations)
- Bivariate correlation between two numerical variables was done using Spearman’s correlation test

Normality of numerical data was checked using Shapiro–Wilk test and was found that the data followed a normal curve; hence, parametric tests have been used for comparisons for rest of the variables.

- Inter group comparison (>2 groups) was done using one-way ANOVA followed by pair wise comparison using *post hoc* test. For all the statistical tests, $P < 0.05$ was considered to be statistically significant, keeping α error at 5%, and β error at 20%, thus giving a power to the study as 80%.

* = statistically significant difference ($P < 0.05$)

** = statistically highly significant difference ($P < 0.01$)

= non-significant difference ($P > 0.05$)

Review of Literature

1. “Dances of India: Odissi” pages 11–12, is a book written by Sharon Lowen which explains about the history and development of Odissi into the modern era. It also explains the right postures and techniques required to perfect the skills in Odissi dance.
2. Subhashree Pattnaik and Sneha Prava Samantaray, did a study, ‘Comparative study on Classical Dances: Odissi and Bharatnatyam’ WWJMRD 2017; 3(12): 147–150, in which they provided an insight about the two classical dances of India. It presents the historical origin, technique, forms, and style of both Odissi and Bharatnatyam dance. It analyses both the dance forms on their style, music, costume, jewellery, gurus, and performances. They concluded that Bharatnatyam is straight and more angular and Odissi has more torso movement which is more visually pleasing; hence, Odissi is preferred over Bharatnatyam.
3. “Musculoskeletal pain and injury in professional dancers: Prevalence, predisposing factors and treatment” Indian Journal of Physical Therapy, Volume 2 Issue 1, a study done by Happiness Anulika Aweto, Oluwapelumi Mariam Awolesi and Rachael Olumayokun Alao investigated the prevalence of musculoskeletal pain and injury among professional dancers. It suggested that dance related musculoskeletal injury and pain causes discomfort results in a limitation, restriction or cessation of participation in dance. Thereby concluding that professional dancers did have a higher prevalence of musculoskeletal injury and pain.
4. Study of lumbar lordosis and pelvic position in Bharatnatyam dancers’ Indian J.Sci.Res. 6(2): 125–130, 2015 done by Shradha Pawar and Unnati Pandit, to understand the implications of wrong adaptation on the spine, especially the lumbar spine. Their study concluded that the lumbar lordosis and pelvic inclination angle in bharatnatyam dancers is more than the non-dancers. They also proved that there was a linear

Table 1: Intergroup comparison of mean age

S. No.	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	F value	P value of one way ANOVA
					Lower Bound	Upper Bound				
1.	20	22.55	0.686	0.153	22.23	22.87	21	24	15.819	0.000**
2.	20	17.25	6.889	1.540	14.03	20.47	13	36		
3.	20	30.35	10.806	2.416	25.29	35.41	18	54		

Interpretation: There was a statistical high significant difference seen for the values between the groups ($p < 0.01$) with higher values in Group 3 and least in Group 2

Table 2: Spearman's rho Correlations between pelvic angle and lumbar lordotic angle in normal

Pelvic angle versus Theta angle	
Correlation coefficient	-0.177
P value	0.454
N	20

Table 3: Spearman's rho correlations between pelvic angle and lumbar lordotic angle in beginners

Pelvic angle versus theta angle	
Correlation coefficient	0.123
P value	0.606
N	20

Table 4: Spearman's rho correlation between pelvic angle and lumbar lordotic angle in advanced dancers

Pelvic angle versus theta angle	
Correlation Coefficient	-0.038
P value	0.873
N	20

Table 5: Intergroup comparison of mean of pelvic angle

Pelvic Angle groups	N	Mean	Std. Deviation	Median	Chi-square value	P value of Kruskal-Wallis test
1	20	4.90	2.654	5		
2	20	8.20	3.928	8	11.426	0.003**
3	20	8.15	2.796	10		

There was a statistically highly significant difference seen for the values between the groups ($P < 0.01$) for pelvic angle (degree) with higher values in Group 2

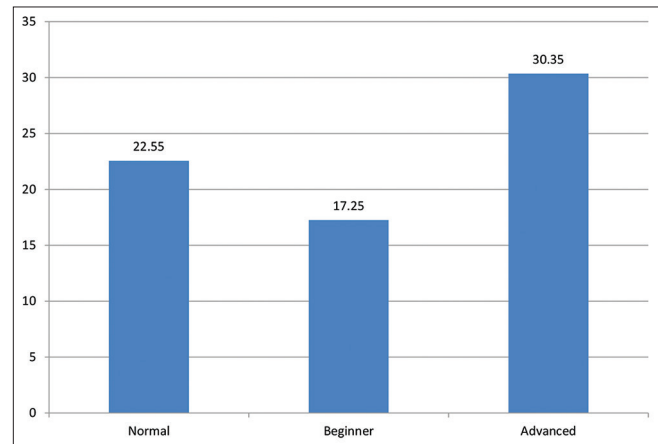
Table 6: Inter group comparison of mean of Pelvic angle

Pelvic angle (Degree)	Group 1	Group 2	Mann-Whitney U value	Z value	P value of Mann-Whitney Test
1	2	102.000	-2.691	0.007**	
1	3	87.000	-3.123	0.002**	
2	3	189.000	-0.305	0.760#	

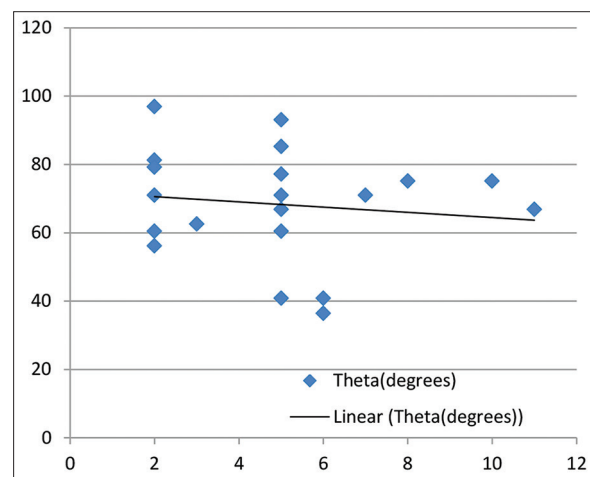
There was a statistically highly significant difference seen for the values between the groups ($P < 0.01, 0.05$) for pelvic angle (degree) between 1 versus 2 and 1 versus 3

correlation between the two measurements which explained the pelvic posture and lumbar spine posture in bharatnatyam dancers.

- "Lumbar lordosis and Pelvic inclination of Asymptomatic adults" Physical Therapy, Volume 76, Issue 10, October 1, 1996, Pages 1066–1081, was a study performed by Youdas *et al.*, which examined the association between pelvic inclination and lumbar lordosis during relaxed standing. They concluded



Graph 1: Intergroup comparison of mean age



Graph 2: Pelvic angle (degree) versus Theta (degrees) in normal

that the abdominal muscle performance was associated with angle of pelvic inclination for women, but not men and lumbar lordosis was associated with abdominal muscle length in women and length of abdominal and one-joint hip flexor muscles and physical activity levels in men. Hence, there was no correlation between the pelvic inclination and the depth of lumbar lordosis in a standing position.

DISCUSSION

Dancers are at a higher risk of developing musculoskeletal injuries. Many factors play a role in causing this such as Poor technique, posture and alignment, longer duration of dance, and no warm-up before practice.^[9]

Table 7: P values of lumbar lordosis angle using the Turkey Post Hoc Tests

Theta angle groups	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum	F value	P value of one way Anova
1	20	68.35	16.282	3.641	36	97	2.791	0.070#
2	20	72.11	15.646	3.499	45	93		
3	20	78.85	9.927	2.220	58	99		

Table 8: Inter group comparison of mean of Lumbar lordosis angle (Θ) using Turkey Post Hoc Tests

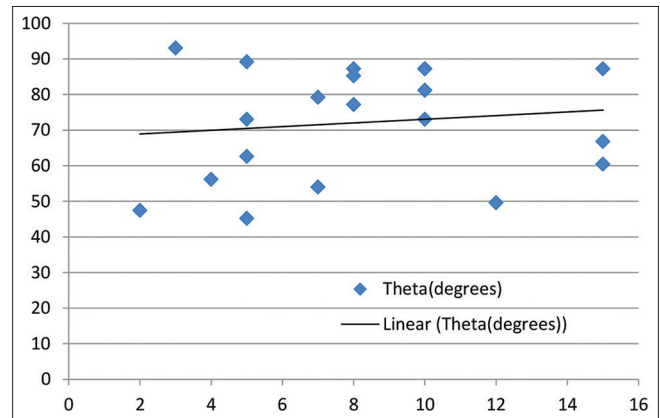
	Group I	Group II	Mean difference	Std. Error	P value0
Theta (degrees)	1	2	-3.760	4.504	0.683#
	1	3	-10.500	4.504	0.059#
	2	3	-6.740	4.504	0.300#

Interpretation: There is no statistical significance between either groups for theta angle

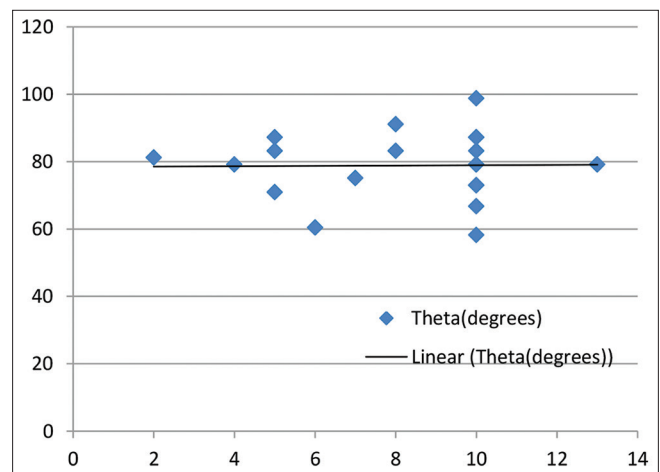
Table 1 training in Odissi classical dance starts at a very early age and takes a rigorous amount of time to perfect the skills to reach the advanced levels.^[10] Although this study has been performed across subjects of various age groups, the statistics prove that it does not alter the end result of the data.^[9] The results presented in the first table suggest the intergroup comparison of the mean age. The mean age in the normal category was 22.55, beginner category was 17.25, and advanced category was 30.35. The varied age groups in each category show significance as the students begin learning this art form at a very early age. To reach the advanced stage there are various factors that play a role such as, the number of years of practice, the number of exams given, and the perception of the Guru. It usually takes 7–8 years to be categorized in the advanced batch.

Tables 2-4 this study also tries to find a correlation between the pelvic angle and the lumbar lordosis angle (theta) using the spearman’s rho correlation. The graphs 3, 4, and 5 depict the correlation between the pelvic angle and the lumbar lordosis in dancers. The P value for normal, beginner and advanced groups were 0.454, 0.606, and 0.873, respectively, which did not depict a high significance. Although the end result did not show any association between the two factors, it still has a major role to play in dancers; hence, it needs to be evaluated further in a larger group of Odissi dancers. Walker *et al.*^[5] observed a weak association between the inclination of the pelvis and the lumbar lordosis in asymptomatic non-dancer subjects, which was unexpected as it was contended that with the increase or decrease of pelvic inclination there is an increase or decrease in the lumbar lordosis as well.^[11]

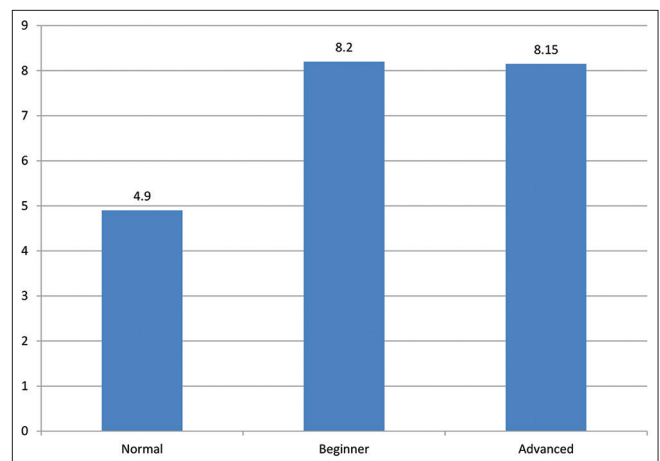
Neutral pelvis, trunk stabilization, and core support are the three pillars for any dancer to achieve proper posture. The muscles that contribute to keeping the pelvis in neutral are lower rectus abdominis, obliques, and the hamstrings. If these muscles become weak, there are chances of the pelvis tilting anteriorly. The hip flexors (rectus femoris and iliopsoas) and lumbar extensors (erector spinae and multifidi) are the muscles that provide stability to position the pelvis in neutral. If these muscles get tight they can cause the pelvis to tilt posteriorly.^[12] Tables 5 and 6 the intergroup comparison of the pelvic inclination suggests that the beginner and advanced groups have pelvic angle more than the normal group. The P value for the comparison between the normal category and beginner group was found to be 0.007 and the P value for the comparison between normal category and advanced group was 0.002. Both these values were significant. This could be due to the wrong techniques



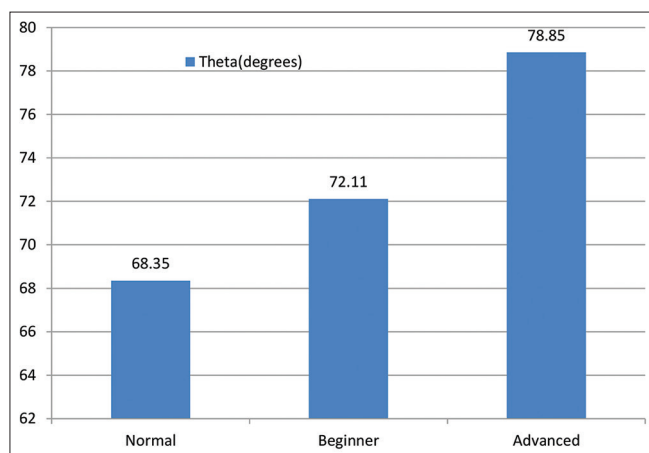
Graph 3: Pelvic angle (degree) versus Theta (degrees) in Beginner



Graph 4: Pelvic angle (degree) versus Theta(degrees) in advanced



Graph 5: Intergroup comparison of mean of pelvic angle (degree)



Graph 6: Intergroup comparison of mean of Theta (degrees)

assumed during practice or long hours of training causing a strain in maintaining those sustained postures. Tables 7 and 8 the intergroup comparison of the lumbar lordosis (theta) angle did not have any significant statistical findings with p values being more than 0.01. Figures 1 and 2 the box plot is a display of distribution of data base on a five number summary which namely minimum, first quartile (Q1), median, third quartile (Q3), and maximum.

Similar to the pelvic inclination, there are several factors that can result in deviation of the lumbar lordosis. The degree of the lordosis is variable among different individuals. When the pelvis tilts anteriorly, the lower lumbar vertebrae are forced anteriorly as the L5 vertebra is connected with the sacrum and the upper lumbar vertebra move posteriorly. This increases the lumbar lordosis. In case of posterior pelvic tilt, there is a decrease in the antero-posterior diameter of the pelvic brim. Hence, as the pelvis moves posteriorly, it also brings the sacrum and consequently the lumbar spine causing the lumbar lordosis to decrease.^[13]

A very essential aspect for any dancer is to control the spine while performing lower limb movements and hence the lumbopelvic region plays a very important role in maintaining the posture. The comparison made between each category to understand the influence of dance on the pelvic angle was found to be significant. Most dance movements involve lower extremities or the trunk and are made possible by dynamic stabilization of the lumbopelvic region, hence movement of the legs in different directions impose tremendous forces on the spine and the pelvis.^[14]

Poor technique, muscle imbalance, and altered motor control have been suggested as possible contributing factors to LBP in dancers; hence, proper alignment of the body is of utmost importance for any dancer as it helps to reduce injuries, enhance dance performance, and biomechanical efficiency.^[15,16]

If wrong postures are not attended to and rectified at the early stage, it might have deleterious effects on the spine, giving rise to low back pain, disc prolapse, radiculopathy, etc., which may lead to the dancers missing out on their practice sessions.

CONCLUSION

Dance is a demanding form of physical activity; it requires a lot of motor control, strength, extensibility, and endurance.

This study reveals that the pelvic angle in the beginner and advanced group of Odissi classical dancers was altered compared to the non-dancer group, which was statistically significant.

The chawk and Tribhangi postures in Odissi have certain effects on the low back of an Odissi classical dancer noted by the change in the pelvic angle.

These group of individuals need to be advised to follow proper technique and posture of dancing, to avoid any episode of low back pain.

This study might act as a guide for further research in larger population, as there is no extensive research done on this aspect of Odissi dancing.

ACKNOWLEDGMENT

I take this opportunity to express my sincere gratitude to those, without whose support and concern this project would not have been a success. I am extremely thankful to my guide Dr. Shradha Pawar, Assistant Professor at School of Physiotherapy, D.Y. Patil University for all the help, guidance and support throughout the study. I am also thankful to Dr. Unnati Pandit, Professor and Director, The School of Physiotherapy, D.Y. Patil University, Nerul, Navi Mumbai who has given me the permission to initiate the project in this Institution and has given her valuable advice and help throughout the project. I also thank all the teaching staff for their guidance and support. I also want to express my gratitude to my family members and colleagues for their kind cooperation. Needless to say, a big thank you to all my study subjects for their time and co-operation in making this study successful.

COPYRIGHT AND PERMISSION STATEMENT

I/We confirm that the materials included in this chapter do not violate copyright laws. Where relevant, appropriate permissions have been obtained from the original copyright holders. All original sources have been appropriately acknowledged and/or referenced.

REFERENCES

1. Deekshitulu PV. Physical and mental health for Indian classical dance. *Am J Hist Cult* 2019;2:9.
2. Lowen S. *Dances of India: Odissi*. United States: Wisdom Tree; 2003. p. 11-2.
3. Pattnaik S, Samantray SP. Comparative study on classical Dances: Odissi and Bharatnatyam. *WWJMRD* 2017;3:147-50.
4. Chatterjee A. The therapeutic value of Indian Classical, Folk and Innovative dance forms. *Rupkatha J Interdiscip Stud Hum* 2013;5:75-83.
5. Axel Michaels and Christoph Wulf. *Images of the body in India. Paragrana*. Vol. 18. United Kingdom: Routledge; 2009. Available from: https://www.books.google.co.in/books?hl=en&lr=&id=Ti6pAgAAQBAJ&oi=fnd&pg=PA180&dq=bodies+filled+with+divine+energy:+The+indian+dance+odissi&ots=hS9trA1Orf&sig=Hv8UAcql-KFtxRjS-sqvGqpchIE&redir_esc=y#v=onepage&q=bodies%20filled%20with%20divine%20energy%3A%20The%20indian%20dance%20odissi&f=false. [Last accessed on 2022 Apr 02].
6. Anbarasi V, Rajan DV, Adalarasu K. Analysis of lower extremity muscle flexibility among Indian classical Bharatnatyam dancers world academy of science. *Eng Technol Int J Med Health Biomed Bioeng Pharm Eng* 2012;6:225-230.
7. Aweto HA, Awolesi OM, Alao RO. Musculoskeletal pain and injury in professional dancers: Prevalence, predisposing factors and treatment. *Indian J Phys Ther* 2014;2:9-13.
8. Rajabi R, Seidi F, Mohamadi F. Which method is accurate when using the flexible ruler to measure the lumbar curvature angle? Deep pint or mid point of Arch? *World Appl Sci J* 2008;4:849-52.
9. Roussel NA, Nijs J, Mottram S, Van Moorsel A, Truijens S, Stassijns G.

- Altered lumbopelvic movement control but not generalized joint hypermobility is associated with increased injury in dancers. A prospective study. *Manual Ther* 2009;14:630-5.
10. Ghadei R. Revival of Odissi form in twentieth century. *J Arts Hum Manage* 2015;9:91.
 11. Youdas JW, Garrett TR, Harmsen S, Suman VJ, Carey JR. Lumbar lordosis and pelvic inclination of asymptomatic adults. *Phys Ther* 1996;76:1066-81.
 12. Krasnow D, Wilmerding V. *A Guide to Neutral Pelvis, Core Support and Trunk Stabilization: A Resource for Dancers and Dance Educators*. Canada: Healthy Dancer Canada - The Dance Health Alliance of Canada, Donna Krasnow, and Virginia Wilmerding; 2017. Available form: <https://www.citraining.com/pdfs/The-Guide-to-Neutral-Pelvis-Core-Support-and-Trunk-Stabilization.pdf>. [Last accessed on 2022 Apr 02].
 13. Pawar S, Pandit U. Study of lumbar Lordosis and pelvic position in Bharatnatyam dancers. *Indian J Sci Res* 2015;6:125-30.
 14. DeMann LE. Sacroiliac dysfunction in dancers with low back pain. *Man Ther* 1997;2:2-10.
 15. Gottschlich LM, Young CC. Spine injuries in dancers. *Curr Sports Med Rep* 2011;10:40-4.
 16. Gamboian N, Chatfield SJ, Woollacott MH, Barr S, Klug GA. Effect of dance technique training and somatic training on Pelvic tilt and Lumbar Lordosis alignment during quiet stance and dynamic dance movement. *J Dance Med Sci* 1999;3:5-14.