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# To Determine the Relationship between Foot Pronation and Dynamic Balance in Female Kathak Dancers - An Observational Study

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**Abstract:** ***Background: The normal stance position of Kathak dancers during the performance consists of overly turning out the feet, putting an additional strain on the inner side of the foot. 90% of kathak dancers exhibit a functional hyperpronated foot as a result. Dynamic balance is necessary for dancers to perform. The dancer's balance may change if their feet pronate. Purpose And Context: This study sought to determine the relationship between female kathak dancers' foot pronation and dynamic balance. Methodology: 116 female kathak dancers of age 18-35 years practicing kathak since the last 5 years or more were taken as per inclusion and exclusion criteria. Foot pronation was taken according to the foot posture index. Dynamic balance was taken by the Y-Balance test. A correlation between both the variables was found. Result: Pearson's correlation test was used to interpret the data. The study shows a moderate negative correlation between foot posture index and Y-balance test of dominant leg with r value of -0.636 at 0.001 level significance and for non-dominant leg with r value of -0.629 at 0.01 level significance. Conclusion: The study accepts alternative hypotheses and proves that there is a moderate negative correlation between foot posture index and dynamic balance.***

**Keywords:** dynamic balance, foot pronation, kathak dancers

## 1. Introduction

One of the traditional dance styles in India is Kathak. [1] During the performance, Kathak dancers typically stand with their feet turned out excessively. The inner side of the foot is further strained because the forefeet are turned out even farther than the foot axis. This results in the typical, functional hyper pronated foot. [2] Among the kathak dancers, 90% individuals presented with foot pronation. [3] Since the foot is the farthest segment in the lower extremity chain and serves as a comparatively modest base of support for the body's balance, it makes sense that even slight biomechanical changes to the support surface could have an impact on postural-control techniques. [4] Foot pronation can influence posture and balance, which in turn can affect the total performance of a dancer. [5] The foot posture can be identified by Foot Posture Index which is an observational scoring system consisting of six validated, criterion-based observations of the back foot and the forefoot when standing in a relaxed position. [6] The lower quarter Y-balance test has demonstrated high reliability over time and between raters to measure dynamic balance. [7]

## 2. Method

### Study Design

The Kathak dancers were the subjects of this study that aimed to evaluate dynamic balance using the Lower Quarter Y-balance test, analyze various foot postural aberrations among the dancers using the foot posture index, and examine the relationship between the two. Screening of 116 Female Kathak Dancers was done for the study from various dance academies in and around Rajkot city on the basis of inclusion criteria. Female Kathak dancers from the age group of 18-25 years, practicing Kathak since the last 5 years or more regularly thrice a week were taken for the study. Subjects with a history of any recent surgery at lower limbs, any neurological deficit, or any congenital deformity which may affect the functionality of the lower limbs were excluded. Dancers who were professionally inculcated in outdoor sports were excluded from the study in order to restrain the results of the study from any error.

### Procedure

Subjects were explained about the procedure and purpose of this study and consent was taken.

### A) Foot posture index

For determining the scores of Foot Posture Index, the subjects were required to stand still while keeping their lower limbs in the relaxed stance position on the floor. They were asked not to swivel to see what is happening for them, as this may significantly affect their foot posture. After positioning and instructing the patient, all the 6 components of the Foot Posture Index (Talar Head palpation, Supra and Infra lateral malleolar curvature, Calcaneal frontal position, Prominence in the region of Talonavicular joint, Congruence of the Medial Longitudinal Arch and Abduction/ Adduction of the Forefoot on the Rearfoot) were assessed according to the predefined criterion. Each of the observations/components were graded as 0 for neutral, -1or -2 for clear signs of supination and +1 or +2 for signs of pronation according to severity of condition. The final score was a whole number between -12 to +12. Inter-tester reliability for this index ranges from 0.62 to 0.91 and Intra-tester reliability ranges

from 0.81 to 0.91.

**B) Y balance test**

For the Y balance test, the subject's barefoot was in the center of the foot plate with toes just behind the starting line.While maintaining a single leg stance, the subject practiced by reaching in each of the three directions - anterior, posteromedial, and posterolateral - with her free leg and then return to the starting position.When the practice trials were completed, the subject started with her right foot in the center of the foot place and performed 3 trials of the direction being tested. The test was performed with the subject's left foot in the center of the foot plate.

The testing order was:
1) Right anterior
2) Left anterior
3) Right posteromedial
4) Left posteromedial
5) Right posterolateral
6) Left posterolateral

The average of maximal reach for each leg in each direction was for 3 trials. The composite score was calculated by taking the sum of 3 reach directions divided by 3 times the limb length then, multiplied by 100.Subject could not touch down during the test or place her foot on top of the reach indicator. Any loss of balance resulted in a failed attempt.

## 3. Result

| | Mean | SD |
|---|---|---|
| FPI Dominant | 6.94 | 1.03 |
| FPI Non dominant | 6.94 | 1.03 |
| Y Balance Dominant | 80.1 | 8.9 |
| Y Balance Non dominant | 79.7 | 9.2 |

| Foot posture index dominant leg | Y - balance test dominant leg |
|---|---|
| r- value | -0.636 |
| p-value | 0.001 |
| Foot posture index non dominant leg | Y - balance test non dominant leg |
| r- value | -0.629 |
| p-value | 0.001 |

## 4. Discussion

'Kathak' is the art of storytelling and conveying it to the audience in a vivid and entertaining manner. It has all the classical elements such as nritta (pure dance), nritya (expressive), and natya. It is a highly spirited dance form in which the dancers make use of ghungroos (dance bells) for maintaining body balance while performing spinning movements (chakkars) and giving rhythm to their performance, facial muscles for expressing their emotions (abhinaya) and arms and feet for the formation of statuesque poses called mudras.(9) Routinely execution of these movements for inexhaustible hours may lead to exposure of foot to substantial amount of stress abundant enough to make foot prone to significant biomechanical changes.(3)The normal stance position of Kathak dancers during the performance consists of overly turning out the feet. This results in the typical, functional hyperpronated foot. (2) Repetitive pounding of the foot over the floor makes the medial arch to depress permanently as the medial arch is extremely resilient. (10) Foot pronation at the subtalar joint plays a crucial role in functional activities related to shock absorption and propulsion of the body during the dynamic phases of gait [1, 2]. Severe hyper-pronation of the foot is related to high risk of injury, probably because of larger lower extremity torques and increased internal tibial rotation. (11,12)

Thus, there was a need to find a correlation between foot pronation and dynamic balance in kathak dancers. The foot posture was identified by Foot Posture index and dynamic balance by lower quarter Y-balance test. Screening of 116 Female Kathak Dancers was done for the study from various dance academies in and around Rajkot city on the basis of inclusion criteria. The data followed normality and thus, Pearson's correlation test was used to interpret the data. The study shows a moderate negative correlation between foot posture index and Y-balance test of dominant leg with r value of -0.636 at 0.001 level significance and for non-dominant leg with r value of -0.629 at 0.01 level significance. Hence, the study accepts alternative hypotheses and proves that there is a moderate negative correlation between foot posture index and dynamic balance.

## 5. Conclusion

On accepting the alternative hypotheses, it can be proved that there is a moderate negative correlation between foot posture index and dynamic balance. Hence, dancers should be well educated about the importance of proper posture and body alignment. Precautions like proper rests in between practice sessions, proper exercising, muscle stretching, strengthening, footwear modification, type of practice floor, proper landing, dancing with correct techniques, etc should always be taken care of. If these precautions are considered, then it would not only help in reducing the chances of unwanted injuries, but also drastically improve the longevity and the quality of performance.

## References

[1] ***Chatterjee A.*** *The therapeutic value of Indian classical, folk, and innovative dance forms. Rupkatha J Interdiscip Studies in Humanities. 2018;10(4):13–26.*
[2] ***Simmel L.*** *Dance medicine in practice. J Dance Med Sci. 2009;13(1):4-11.*
[3] ***Roopika Sabharwal.*** *Foot postural deviations in female kathak dancers. Indian J Phys Ther. 2017;2(1):34–40. 4.* ***Karen P. Cote.*** *Ef ects of pronated and supinated foot postures on static and dynamic postural stability. J Orthop Sports Phys Ther. 2016;46(6):450–459.*
[4] ***Deepak Kumar Pradhan.*** *Correlation of foot posture with balance and pelvic tilt in healthy runners. Int J Sports Sci. 2019;10(1):49–55.*
[5] ***Gonul Babayigit Irez.*** *The relationship with balance, foot posture, and foot size in students of Physical Education and Sports. J Educ Sci. 2020;8(2):12–18.*
[6] ***Phillip Plisky.*** *Systematic review and meta-analysis of the Y-balance test lower quarter: reliability, discriminant validity, and predictive validity. J Strength*

*Cond Res. 2013;27(12):3403–3413.*

[7] ***Ali H Alnahdi.*** *Reference values for the Y Balance Test and the lower extremity functional scale in young healthy adults. J Sport Rehabil. 2015;24(4):467–474.*

[8] ***Hetsroni I, Finestone A, Milgrom C, Sira DB, Nyska M, Radeva-Petrova D, et al.*** *A prospective biomechanical study of the association between foot pronation and the incidence of anterior knee pain among military recruits. J Bone Joint Surg Am. 2007;89(7):1439–1446.*

[9] ***Lippert LS.*** *Clinical kinesiology and anatomy. 4th ed. Philadelphia: F.A. Davis Company; 2011. 11.* ***Dr Shefali Milind.*** *Proportion of low back pain in kathak dancers in Pune. Indian J Dance Med. 2021;5(2):52–59. 12.* ***Pohl MB, Buckley JG.*** *Changes in foot and shank coupling due to alterations in foot strike pattern during running. Clin Biomech (Bristol, Avon). 2010;25(7):721–726.*