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Original Research Article

Assessment of Foot In Female Kathak Dancers

Pranita Bhalerao *[1], Gaurai Gharote[2].

[*1] Intern, Physiotherapy Department, TMV's Indutai Tilak College of physiotherapy, Pune, Maharashtra, India.

[2] Professor, Physiotherapy Department, TMV's Indutai Tilak College of Physiotherapy Pune, Maharashtra, India.

ABSTRACT

Background: Kathak is the art of storytelling and conveying it to the audience in a different way. Now a days kathak is spreading worldwide, and people are learning and chasing the challenges at top level for this the kathak dancers are focusing more and more over the riyaz followed by intense practice. Tatkar is an important component of this dance form which is performed by foot of dancer, commonly called as footwork. The population increasingly demand the repetitive rhythmic movements at ankle joint and to maintain the ankle stability there is requirement of heavy muscle work. This study examines postural deviations in the foot of female kathak dancers.

Methods: The design was quantitative descriptive study utilizing Self Made Questionnaire developed specially for the research and foot posture index scale with the navicular drop test. The questionnaire contained questions related years of practice and frequency of practice with the pain associated to lower limb.

Results: Percentage of people with normal and supinated conditions for both right and left feet across the different variables. It's notable that the categories for Pronated, Highly Pronated, and Highly Supinated feet were not observed in the datasets.

Conclusion: In the present study it is found out that about 80% of total population have no postural changes found out in the foot the reason behind that can be the regular warm up cool down sessions, stretching and much more postural awareness. To avoid the foot problems and postural deviation now a days institutes are taking great warm up and cool down sessions with stretching for at least 1 hour and then startup with the forceful riyaz. Further research is warranted to make standardized warm up and cool down protocols for kathak dancers.

KEYWORDS: Tatkar, kathak, Riyaz, Postural changes, footwork.

Address for correspondence: Ms. Pranita Bhalerao, Intern, Physiotherapy Department, TMV's Indutai Tilak College of Physiotherapy, Pune, Maharashtra, India.
E-Mail: pranitabhalerao99@gmail.com

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INTRODUCTION

'Kathaka' is the art of storytelling and conveying it to the audience vividly and entertainingly. 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 (chakras) 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. In a nutshell, Kathak is a stimulus that affects the body in its entirety [1].

While enacting the Kathak dance, the dancers also need to execute various swirling movements at the body at warp speed. Over time, routine execution of these movements for inexhaustible hours may lead to exposure of the foot to a substantial amount of stress abundant enough to make the foot prone to significant biomechanical changes [1,2].

The normal stance position of Kathak dancers during the performance consists of overly turning out the feet. The forefeet is turned out even further than the foot axis, putting an additional strain on the inner side of the foot. This can result in the functional and postural changes in the foot. Even outside the studio, dancers tend to maintain this disadvantageous position thus encouraging the twisting of the foot.

Kathak dancers are exposed to enormous stresses at foot which can likely affect their performance. Many studies have been performed on dancers of different Western dance forms like ballet, hip-hop, jazz, and many other Indian classical forms such as Bharatanatyam, etc. Numerous studies have been done on athletes and sports persons. But to date, no satisfactory literature is present about Kathak dance form. Their highly complex dance forms may predispose them to abound lower extremity injuries. Therefore, there is a need for a detailed assessment of the kathak dancers to perceive the effect of dancing on their feet and to scale down its complications.

Likewise, the repetitive pounding of the foot over the floor makes the medial arch depress permanently as the medial arch is extremely resilient. Tapping makes use of Flexor Hallucis Longus and Flexor Digitorum Longus muscles which help in the formation of the medial longitudinal arch at the foot while providing support to it. These muscles are also liable for other foot movements required for the dance performance such as flexion of the big toe, push of power of jumps, etc. Repetitive overuse of these may further give rise to inflammatory conditions such as tendinitis in addition to depression of the medial arch. Furthermore, the impact produced by the ground reaction force over the foot during tapping is enhanced due to performance over hard cemented floors [1].

Another important factor is 'Ankle bells', which can be called gungaroos. The presence of The ankle bells on the ankle while performing the dance form, especially footwork; we call it a *tatker* in classical terms. These bells vary from 50 grams to 1.5 Kg in each leg. This creates excessive stress on the ligaments and connective tissue of the leg. Ankle bells may overload connective tissue of the legs and can lead to overextension, tendon strain, and other connective tissue have to work harder to lift the feet when weights are present during riyaz to which muscle imbalance between the agonist and antagonist occurs at a faster rate.

Indian classical dance is being exposed to newer concepts and styles every day. To achieve a great position in the world, dancers are taking challenges, working hard, and intensely training, with the focus of bringing perfection and clarity to the performance.

Possible foot deviations in kathak dancers' feet are Flat feet, Hyperpronated feet, Planterfascsiitis, and many more, depending on the profession and lifestyle of the individual performing kathak.

Flat foot: Flat feet are most commonly seen in kathak dancers due to repetitive high-speed tapping of the foot on hard surfaces for a long time.

Flat foot occurs when the normal arch is lost and is often associated with ankles that are angled outward.

Plantar fascia: Plantar fasciitis refers to inflammation of the plantar fascia. The inflammation is the result of some injury to the plantar fascia. Typically, plantar fascitis results from repeated trauma to the tissue where it attaches to the calcaneum.

This study will help in having a clearer insight into their foot problems so that in the future, more innovations can be brought into their treatment, which may be appropriate to their profession and lifestyle [3-11].

METHODOLOGY

Research design Participants: The research questionnaire was hand-delivered to participants. The informed consent form requested the dancer's participation and explained the purpose and procedure of the study. The benefits of the study, confidentiality, and remuneration were addressed. The participants were included according to inclusive and exclusive criteria. A population of 70 female Kathak dancers was targeted, and all willingly participated in the assessment, fulfilling the inclusive criteria.

Research tool: The questionnaire was Self-made and used along with the Foot Posture Index and Navicular Drop Test. The questionnaire was made to get access to information regarding years of experience and frequency of practice of dancers, and the questionnaire was validated by the ethical committee of TMV's Indutai College of Physiotherapy.

Ethics, Consent, and Permissions: Participants in this study were given a consent form that contained information regarding the research project by including the title of the study, the aims of the study, and the confidentiality of the information and demographic data given by each participant.

Data collection: Every participant was given the Self-Made Study Questionnaire, data collection was completed between October 2023 and March 2023. The questionnaire included demographic data and generalized data regarding the years of experience of participants with the credentials of the assessment test.

Data analysis: Data was analyzed using the tool named "Jupyter Notebook" (version 7.1), from which libraries like numpy were used to deal with numerical data, and Matplotlib was used to convert this numerical data into graphical form. The language used to conclude was Python. Excel (6.2.14 Excel 2019, Excel 2021) was used for data cleaning and storing the data. Descriptive statistics was performed to assess the mean and standard deviation of the respective groups. All the data drawn after descriptive statistics was presented in the form of bar graphs and pie charts for better understanding and simplification.

RESULTS

A total of 70 female kathak dancers were taken from the institutes located in Pune city according to inclusive criteria. Descriptive statistics was performed to assess the mean and standard deviation of the respective groups. All the data drawn after descriptive statistics was presented in the form of bar graphs and pie charts for better understanding and simplification.

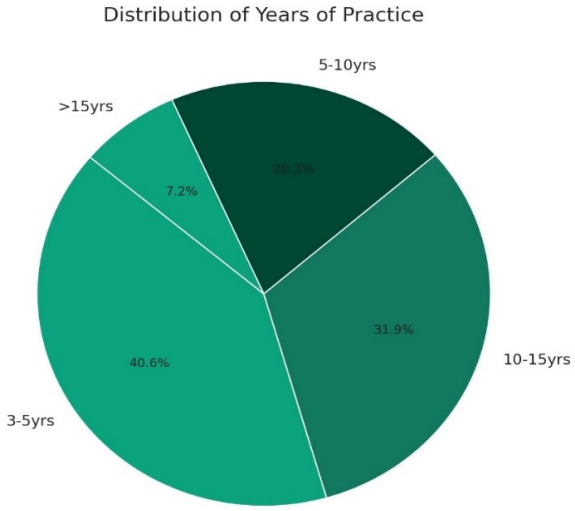


Chart 1: shows the distribution of samples within the no. of years of experience.

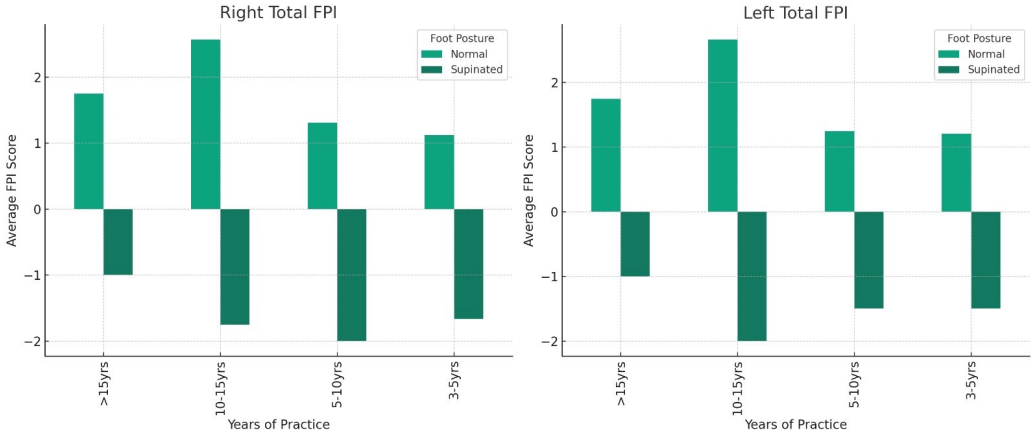
Interpretation: This distribution highlights that the majority of the entries fall within the "3-5yrs" category that of 28 observations, followed by "10-15yrs" that of 23 observations, "5-10yrs" that of 14 years of observations, and the least number of observations in the ">15yrs" that are 5 observations category.

Table 1: Table shows the categorised data with the total score of FPI of right foot of samples distributed according to no. of years of experience.

S.No	Side	Years of Practice	Foot Posture	Observations	Average Score
1	Left	>15yrs	Normal	4	1.75
2	Left	>15yrs	Supinated	1	-1
3	Left	10-15yrs	Normal	15	2.67
4	Left	10-15yrs	Pronated	1	6
5	Left	10-15yrs	Supinated	7	-2
6	Left	5-10yrs	Normal	12	1.25
7	Left	5-10yrs	Supinated	2	-1.5
8	Left	3-5yrs	Normal	24	1.21
9	Left	3-5yrs	Supinated	4	-1.5

Table 2: Table shows the categorised data with the total score of FPI of left foot of samples distributed according to no. of years of experience.

S.No	Side	Years of Practice	Foot Posture	Observations	Average Score
1	Right	>15yrs	Normal	4	1.75
2	Right	>15yrs	Supinated	1	-1
3	Right	10-15yrs	Normal	14	2.57
4	Right	10-15yrs	Pronated	1	6
5	Right	10-15yrs	Supinated	8	-1.75
6	Right	5-10yrs	Normal	13	1.31
7	Right	5-10yrs	Supinated	1	-2
8	Right	3-5yrs	Normal	25	1.12
9	Right	3-5yrs	Supinated	3	-1.67



Graph 1: Showins that the distribution of observations for Right and Left TOTAL FPI scores by years of practice, categorized by foot posture

Right TOTAL FPI:

LEFT TOTAL FPI:

Right Navicular Drop Analysis

Table 3: This table shows the categorised data, with the total score of the navicular drop of the right foot of samples distributed according to the number of years of experience.

Years of Practice	Condition	Observations	Average Score
>15yrs	Normal	3	5.33
>15yrs	Supinated	2	3
10-15yrs	Normal	13	5.77
10-15yrs	Supinated	9	4
5-10yrs	Normal	7	5.86
5-10yrs	Pronated	1	10
5-10yrs	Supinated	6	3.5
3-5yrs	Normal	25	6.11
3-5yrs	Supinated	3	3.5

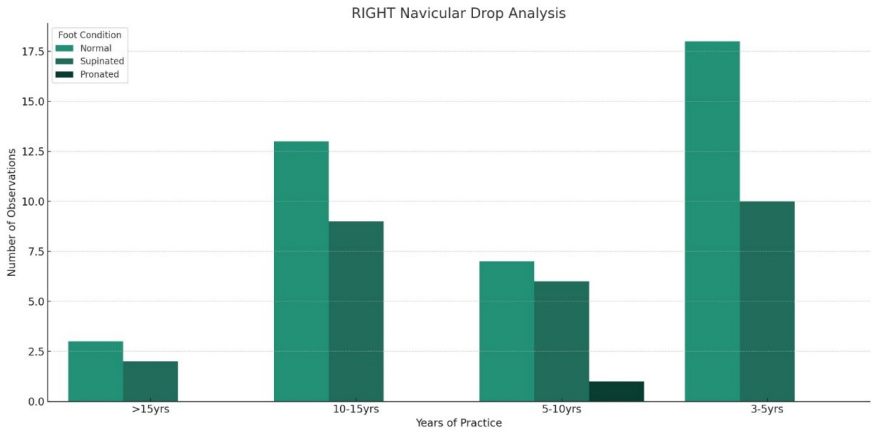
Each bar represents the number of observations for a specific category of foot posture within a given practice year range. These visualizations help identify trends and comparisons across different categories and years of practice easily.

These summaries offer detailed insights into the distribution of navicular drops among different years of practice categories. They showcase the prevalence of normal feet, with fewer observations of pronated and supinated feet within the given dataset.

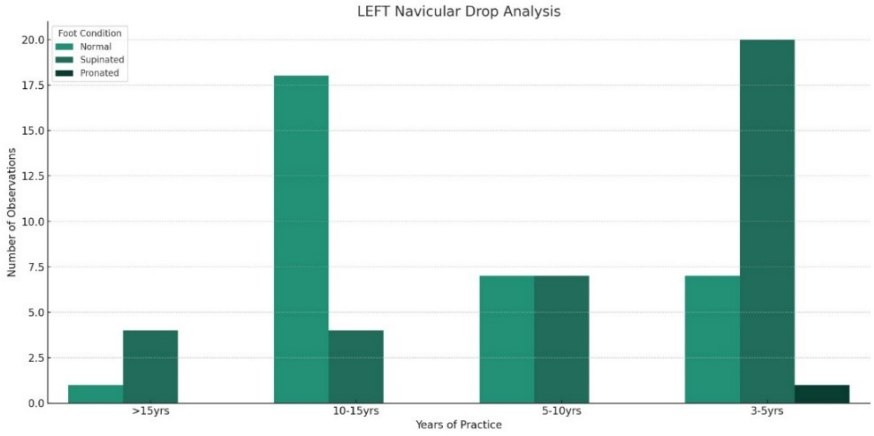
Left Navicular Drop Analysis:

Table 4: the table shows the categorized data with the total score of a navicular drop of the left foot of samples distributed according to no. of years of experience.

Years of Practice	Condition	Observations	Average Score
>15yrs	Normal	1	5
>15yrs	Supinated	4	3.5
10-15yrs	Normal	18	6.44
10-15yrs	Supinated	4	4
5-10yrs	Normal	7	6.43
5-10yrs	Supinated	7	3.86
3-5yrs	Normal	24	5.71
3-5yrs	Supinated	4	3.65



Graph 3: Shows the score of right navicular drop in relation no. of years of experience.



Graph 4: Shows the score of left navicular drop in relation with no. of years of experience.

These visualizations facilitate easy identification of trends and comparisons across different categories and years of practice, illustrating the prevalence and distribution of navicular drops among the participants.

DISCUSSION

The study conducted is observational in nature by taking clear assessment to gain insight into changes in the feet of female kathak dancers who have practiced for at least 3 years in a traditional dance form. The present study tells about the prevalence of foot postural changes by using the Foot postural index and Navicular drop test. In recent times, as we see around people are moving towards the classical performing arts to catch their soothing breath, and also they are taking it as a profession. Because of turning more people in the field, there is a high level of progressive competition faced by the people to row your leg in the crowd. Now kathak is taking place worldwide, and to chase the opportunities, the people are providing, intensify focus to the hard work. This is, of course, possible by increasing practice hours and increasing the frequency of weekly practice. Hard and intense practice ultimately gets a requirement of strong muscles in the lower limb and, specifically, the foot. The assessment-based study provides information regarding the daily sessions currently happening in the institutes, that involve stretching and warm-up tutorials prior to the practice and cool-down sessions after the practice. This will surely create a great impact on the overall posture of the kathak dancer and primarily avoid major deviations and the probability of injuries to the joints and muscles.

The overuse of the foot muscles will definitely lead to a structural and functional deformity in the foot, which includes flat feet, pronation, hyperpronation, and inflammation of plantar fascia. These deformities can be unilateral and bilateral in presence. Most preferentially, females are found out with right dominant; hence, while performing the footwork, the use of the right leg is more than the left; therefore, the probability of presence of postural deviations in the right leg is more than the left [12].

As the assessment is taken with foot posture index and navicular drop it prominently

determined the hyperpronation, pronation, supination and hypersupination of the foot. The both the scales are having reliability of ~0.99 and ~0.98 respectively. The foot posture index checks the 6 gradients of the foot which involves Talar head palpation, supra and infra malleolar curves, calcaneal frontal plane, talonavicular congruence, medial longitudinal arch height, forefoot abduction and adduction. This six components defines the actual posture person is having at there foot the ranges of every component is in between -2 to +2 . Every component's normal or not deviated range is 0. The more negative value move towards the supination and more positive value move towards the pronation. According to this the reference of foot posture index is normal range lie between 0 to +5, Pronated lie between +6 to +9, hyperpronated is in between => +10 that of supinated lie between -1 to -4 , highly supinated -5 to -12 respectively [7].

Navicular drop test counts the distance between the navicular tuberosity and ground in unilateral and bilateral stance. As the distance between the navicular tuberosity and ground increases from the normal range the foot is said to be pronated and if the same distance decreases from the normal range the foot is said to be supinated. The reference value for navicular drop test is neutral foot ranges from 5-9 mm, pronated foot is > 9mm, supinated foot is <5mm. navicular drop test rechecks the identification done by the foot posture index to avoid the error in the readings and determination process [7].

By taking an assessment with all these reference values and referred scales the data analyzed, showed that among the 70 females who were taken for the study with consent, 80% of the female we got have normal feet and 20% of the female kathak dancers have supinated feet. The data shows same readings with both navicular drop and foot posture index data analyzation methods. The data is described in graphical manner of both normal and supinated feet of the whole population. In the present study after analyzing the percentile score of each variable of foot posture index it has been found that the percentage of people with normal and supinated conditions for both right and left feet across the different variables. Notably, the categories for Pronated, Highly Pronated, and Highly Supinated feet were not observed in these datasets [8-11].

It has been seen that the 20% of the subjects with supinated foot the most prominently contributing factor is supra and infra malleoli curvature followed by prominence of the talonavicular joint, talar head, and then medial longitudinal arch for both right and left feet. Percentage of people with normal, supinated, and pronated feet. The categories for Highly Pronated and Highly Supinated feet were not observed in the dataset for both the right and left foot. At current status, the institutes are much aware of the foot problems and foot conditions then can create problems in their daily Riyaz [12-18]. Those females are known for the conditions like plantar fascitis, calcaneus spur, and flatfeet and retrocalcaneal bursitis to avoid foot problems and postural deviation nowadays institutes are taking great warm-up and cool-down sessions with stretching for at least 1 hour and then starting the forceful riyaz. Further research is warranted to make standardized warm-up and cool-down protocols for kathak dancers.

Table 5: Shows percentile involvement of each variable included in the FPI assessment of every sample.

Variable	Normal Right (%)	Supinated Right (%)	Normal Left (%)	Supinated Left (%)
TALAR HEAD	78.57%	21.43%	77.14%	22.86%
SUPRA-INFRA MALLEOLLI CURVATURE	31.43%	68.57%	30.00%	70.00%
CALCANEAL PLANE	97.14%	2.86%	97.14%	2.86%
PROMINENCE OF TNJ	41.43%	58.57%	45.71%	54.29%
MEDIAL LONGI. ARCH	88.57%	11.43%	88.57%	11.43%
ABD/ADD OF FOOT	98.57%	1.43%	98.57%	1.43%

Limitation:

The study may be limited by sampling bias means the more number of population is in the 3-5 years of experience criteria. The sampling does not include all types of experience category equally. There is limited access of data as the data does not included male population. Hence data can be considered as biased because of inclusion of female population only.

In case of assessment of those subjects who are under performing arts there is need to consider the BMI that is body mass index of individual.

CONCLUSION

From the observation, the study concluded that 80% of total subjects have normal right foot and 18.57 % have supinated foot. As 78.57% of total subjects have normal left foot but 20% of subjects have supinated foot.

Therefore the study tells that about 80% of the total population have no postural changes found in the foot the reason behind that can be the regular warm-up cool-down sessions, stretching, and much more postural awareness.

ABBREVATIONS

FPI- Foot Posture Index
Yrs- years

Conflicts of interest: None

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