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Assessing the Validity and Reliability of Bharatanatyam Dance Injury and Pain Questionnaire: A Research Investigation

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doi: [10.33472/AFJBS.6.Si3.2024.0000-0000](https://doi.org/10.33472/AFJBS.6.Si3.2024.0000-0000)**ABSTRACT:**

Background: Bharatanatyam is amongst the most ancient classical dance forms in India. It requires constant adjustments, including the use of one-leg positional holds for poses, quick body twists, rapid movement transitions like jumps and leaps, difficult footwork. Bharatanatyam Dance Injury and Pain Questionnaire (BDIPQ) aims to comprehensively understand the connection between technique-related injuries and their consequences physical aspects of dancers.

Objective: The study aimed to assess the validity and reliability of the BDIPQ in Bharatanatyam Dancers.

Methodology: Study Design – Cross-sectional study design. Subjects were selected on inclusion and exclusion criteria with purposive sampling. Subjects were taken from various dance centres. Content validity was measured with the help of expert reviewers with 10-plus years of experience. Test-retest reliability was conducted within two weeks.

Result: The BDIPQ showed high expert consensus with a Scale-Content Validity Index of 0.91 and Modified Kappa values from 0.76 to 1.00. Test-retest reliability was excellent, evidenced by a Pearson correlation of 0.9702, and internal consistency was strong with a Cronbach's alpha of 0.84.

Conclusion: The BDIPQ showed strong reliability, with a high correlation coefficient and a significant P value (<0.0001). This underscores its dependability for assessing injury and pain in Bharatanatyam dancers.

Keywords: BDIPQ, Bharatanatyam Dancers, Content Validity Index.

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1. Introduction

Bharatanatyam is amongst the most ancient classical dance forms in India. It originated in Tamil Nadu, a state in southern India. ⁽¹⁾ Bharatanatyam is renowned for its beautiful, expressive, and sculpture-like stances, which call for extremely strong physical and mental fortitude when performed. It requires constant, subtle adjustments, including the use of one-leg positional holds for poses, quick body twists (double or single-legged), rapid movement transitions like jumps and leaps, precise, difficult footwork, posture maintenance, and changes in positions and stances. ⁽²⁾ Basic steps, a variety of precise and significant hand gestures and repetitive foot stamping make up the basis of this dance style. One of the most important aspects of this form of dancing is posture, which has three fundamental positions: "standing," "Muzhumandi," or complete sitting, and "Araimandi," or half-sitting. The primary posture held for the longest in this dancing style is Natyaarambham, which is a specific set of arm positions with "Araimandi" posture. ⁽³⁾

Nritta, Nritya, and Natya are the three components that make up Bharatanatyam. Nritta emphasizes rhythm and body movements. Nritya emphasizes body language and dance positions. Poetry and drama are important to Natya. Bharatanatyam is a form of mental and physical cultivation. The beat and rhythm of the song, as well as particular movements and step names, must all be known by the performer. ⁽⁴⁾

Dancers are susceptible to injury due to strong physical demands, including dynamic overload, extreme positions and motions, and excessive use, just like athletes in other sports.⁽⁵⁾ Chronic injuries can limit a dancer's ability to dance for the rest of their lives. Whether or not to impose movement restrictions may depend on the dancer's physical alignment, and if such boundaries are upheld, the dancer may be more vulnerable to injury. The body of a dancer needs to meet specific requirements in terms of muscle strength, cardiovascular endurance, general flexibility, joint stability, multisensory integration, and neuromuscular system coordination as with athletes or artists.⁽⁶⁾ Dancers' physiology and fitness are just as vital as skill development because of the physical demands of today's choreography and performance schedules.⁽⁷⁾

Dance is permanently linked to kinesthetics of the body.⁽⁸⁾ Musculoskeletal injuries are a major global public health concern that significantly raise disability and suffering.⁽⁹⁾ The bulk of musculoskeletal injuries are soft tissue injuries including sprains, strains, and tendinopathies, despite the fact that stress fractures have also received some attention in the literature. Reports of overuse and chronic injuries are common, with the lower body and back being the most commonly injured regions.⁽¹⁰⁾

78% of Maharashtra's professional Bharatanatyam dancers indicate they suffered from musculoskeletal injuries.⁽¹¹⁾ Dancers are prone to injury. Regarding the epidemiology of injuries among dancers, there is, however, conflicting evidence. The majority of current research on dance injuries has centered on ballet, hence there is a dearth of up-to-date information on musculoskeletal injuries in Indian classical [IC] dance. The importance of injury epidemiology studies for improved injury diagnosis, treatment, prevention, and burden reduction is highlighted by the uncertainty surrounding the prevalence of injuries among IC dancers.⁽¹²⁾

The most common injuries were to the ankle (27.2%) and knee (27.2%), then the lower back (13.6%) and hip (9%). Dance is known for its rigorous techniques, demanding requirements and repeated movements, which can lead to foot and ankle injuries.⁽¹³⁾

An exploration of the validity and reliability of the BDIPQ becomes imperative for both the advancement of dance medicine research and the provision of specialized healthcare for Bharatanatyam practitioners. This study addresses a significant gap in the existing literature by introducing the Bharatanatyam Dance Injury and Pain Questionnaire (BDIPQ) as a novel and culturally specific assessment tool. Existing injury assessment tools often lack the cultural relevance necessary to capture the nuanced experiences of Bharatanatyam dancers. The BDIPQ aims to provide a comprehensive understanding of the relationship between technique-related injuries and their repercussions on the physical well-being of practitioners.

The study's novel approach recognizes the cultural context of Bharatanatyam, acknowledging the need for specialized assessment instruments to ensure accurate and meaningful insights into the prevalence and impact of injuries within this dance community. Furthermore, the research contributes to the broader academic discourse by enhancing the cultural sensitivity of injury assessment methodologies, thus facilitating the development of targeted and effective preventive strategies for Bharatanatyam dancers. As dance science continues to evolve, the integration of culturally specific assessment tools, such as the BDIPQ, is vital for fostering a comprehensive understanding of the health dynamics within diverse dance communities, ultimately enriching the broader field of performing arts medicine. The main purpose of the study is to assess the validity of the BDIPQ in accurately capturing the location of and types of pain associated with Bharatanatyam dance techniques and to determine the reliability of the BDIPQ through test-retest measures, ensuring consistent responses over time.

2. Material and methods

The study is observational and cross-sectional, selecting participants through purposive sampling based on specific criteria. It aims to gather data from 103 participants in Aurangabad's dance centres over 6 months. Five expert reviewers were chosen with 10 years of experience in the Musculoskeletal/ Community Physiotherapy. The goal is to explore the characteristics and behaviours of those involved in dance activities, without manipulating variables, using a structured approach to understand relationships within this population. The study's inclusion criteria include Bharatanatyam dancers residing in Aurangabad who are female, aged between 15 to 25 years old, and have at least 3 years of consecutive dance training experience, dedicating 3 to 5 hours per week to dance practice. Exclusion criteria encompass individuals with psychological or cognitive impairments, those unwilling to participate, and those with congenital deformities such as Kyphosis or Lordosis. Additionally, individuals who have experienced recent trauma (e.g., road traffic accidents, fractures) or undergone recent surgeries (e.g., limb or spine surgeries) are excluded from the study.

Procedure:

After obtaining clearance from the ethical committee, Subjects were selected based on inclusion and exclusion criteria by purposive sampling technique. Different dance centres across Aurangabad were included for this study. The study and its importance were explained to the subjects in their own language. Thereafter, informed consent was taken from them. Instructions regarding the study were provided to them. All subjects were approached according to their availability and time. Total 80 subjects were taken for the study.

Administration of the BDIPQ to participants, collecting self-reported data on pain experiences and injuries during Bharatanatyam practice.

Content Validity

- BDIPQ was sent to healthcare professionals across Aurangabad.
- Clinical assessments were conducted by healthcare professionals across Aurangabad to validate and compare the findings from the BDIPQ.
- A Google form-based questionnaire was created and sent to healthcare professionals across Aurangabad.
- Data collected from Google forms was used to help understand the validity of the BDIPQ as described by the healthcare professionals.

Test-retest reliability

- Administration of the BDIPQ to participants for initial assessment.
- Re-administration of the BDIPQ to participants for test-retest reliability assessment after 2 weeks of initial assessment.
- Comparison of data collected after the initial assessment and the assessment conducted two weeks later.

They filled out the information and it was collected on data collection sheets made by Google forms.

Data analysis

The data was analysed by the Modified Kappa Agreement for determining the content validity. The data for test retest reliability was analysed using Pearson's correlation test. The data for internal consistency was analysed by Cronbach's alpha.

3. Result

In total, 105 Bharatanatyam dancers participated in the study. According to the inclusion criteria, all participants were female (100%). Ten individuals were excluded from the study because they were below the specified age group. All participants completed the electronic version of BDIPQ and the Individual Dance Injury Form.

Validity

Content validity was assessed using the Content Validity Index (CVI), which included the Item-Content Validity Index (I-CVI), Scale-Content Validity Index (S-CVI), and Modified Kappa agreement.

Content Validity

The BDIPQ underwent a content validity assessment using the Content Validity Index (CVI). Expert reviews were obtained from five physiotherapists with over 10 years of experience in Sports/ Musculoskeletal/ Community Physiotherapy. Each item received a rating from 1 (strongly disagree) to 5 (strongly agree) on the Item-Level Content Validity Index (I-CVI). Items rated below 3 were assigned a score of "0," while those rated 4 and above received a score of "1." Hence, the value of Item-7 is marked as 5 in the "Agree" column while Item-8 is marked as 4. The I-CVI of the BDIPQ's 11 items ranged from 0.80 to 1.00. The Scale-Content Validity Index for the BDIPQ was 0.91, indicating excellent agreement among experts (ranging from 0.75 to 1.00). The Modified Kappa agreement for each item of the BDIPQ ranged from 0.76 to 1.00, demonstrating excellent agreement, with K values ranging from 0.77 to 0.98.

Table no. 1: Content validity index of Bharatanatyam Dance Injury and Pain questionnaire

	Expert-1	Expert-2	Expert-3	Expert-4	Expert-5	Agree	I-CVI	pc	k*	Interpretation
Item-1	5	5	5	5	5	5	1.00	0.03	1.00	Excellent
Item-2	5	4	5	5	5	5	1.00	0.03	1.00	Excellent
Item-3	5	4	5	3	4	4	0.80	0.16	0.76	Excellent
Item-4	5	4	4	4	4	5	1.00	0.03	1.00	Excellent
Item-5	5	4	4	4	4	5	1.00	0.03	1.00	Excellent
Item-6	5	4	4	4	4	5	1.00	0.03	1.00	Excellent
Item-7	4	4	4	4	4	5	1.00	0.03	1.00	Excellent
Item-8	1	4	4	4	4	4	0.80	0.16	0.76	Excellent
Item-9	5	4	3	4	5	4	0.80	0.16	0.76	Excellent
Item-10	4	4	3	4	4	4	0.80	0.16	0.76	Excellent
Item-11	3	4	4	4	5	4	0.80	0.16	0.76	Excellent
Proportion Relevance	0.82	1.00	0.82	0.91	1.0		0.91			
							S-CVI/Ave			

Reliability

In this study, we employed two widely recognized statistical methods to assess the reliability of the BDIPQ: the Pearson correlation test and Cronbach’s alpha. These methods were used to evaluate two types of reliability: test-retest reliability and internal consistency.

Test-Retest Reliability

The Pearson correlation coefficient was used to compare the scores from two time points. The correlation coefficient, which measures the strength and direction of the linear relationship between two variables, was found to be 0.9702. This value indicates an exceptionally strong positive correlation, suggesting that the scores obtained from the BDIPQ at two different time points are almost perfectly linearly related. The coefficient of determination (r squared) represents the proportion of variance in the dependent variable that is predictable from the independent variable and is 0.9412. The two-tailed P value, which is less than 0.0001, is considered extremely significant. This statistical significance indicates that the probability of observing such a strong correlation by chance is less than 1 in 10,000, providing robust support for the reliability of the BDIPQ.

Internal Consistency

Cronbach’s alpha was calculated based on the responses from Five expert reviews to assess the homogeneity of the BDIPQ items. The Cronbach’s alpha for the BDIPQ was 0.84. An alpha value between 0.80 and 0.89 indicates good internal consistency. The BDIPQ’s alpha value suggests that the items are well-correlated and consistently measure a single construct.

Cronbach’s Alpha	
$\alpha = \frac{K}{K - 1} \left[1 - \frac{\sum s^2_y}{s^2_x} \right]$	
Where	
K	is the number of test item
$\sum s^2_y$	is sum of the item variance
s^2_x	is the variance of total score

Variables	Description	Value
K	No. of Items	11
$\sum S^2Y$	Sum of the item variable	3.38181818
S ² Y	Variance of total score	14.6909091
α	Cronbach's alpha	0.84678218

4. Discussion

The present study aims to assess the validity and reliability of the Bharatanatyam Dance Injury and Pain Questionnaire (BDIPQ). To the best of our knowledge, this is the first outcome measure used for assessing Bharatanatyam dancers' injuries and pain.

The scale offers an organized structure for quantifying and measuring variables, enabling consistent data gathering and examination. It facilitates easier comparison and precise categorization of responses among researchers, leading to a greater understanding of the results. Additionally, by ensuring consistency and accuracy in measurement, scales improve the validity and trustworthiness of research findings.

Experts were approached to provide their opinions on the scale. They were presented with an electronic form displaying the questions and a Likert scale format for responses, ranging from strongly agree (Five) to strongly disagree (One). They could also offer suggestions for any domain/item deemed necessary. Most domains received neutral ratings, with no further suggestions from the experts. However, feedback from 2-3 experts suggested adding a section regarding the mechanism of injury to the scale to further enhance its precision. An "Others" section was also added to the type of pain question (item number three) to provide participants with a wider range of options. No significant suggestions were made for the remaining domains.

Content validity was assessed using the Content Validity Index (CVI), including the Item-Content Validity Index (I-CVI), Scale-Content Validity Index (S-CVI), and Modified Kappa agreement. Five physiotherapists with more than ten years of experience in sports, musculoskeletal, and community physiotherapy were asked to provide expert reviews. Each item on the I-CVI was rated from 1 (strongly disagree) to 5 (strongly agree). The I-CVI for the 11 items in the BDIPQ ranged from 0.80 to 1.00. The average S-CVI value for the BDIPQ, as displayed by the S-CVI/Ave, was 0.91. Experts' agreement on interpretation ranged from 0.75 to 1.00. The adjusted Kappa agreement for each item in the BDIPQ ranged from 0.76 to 1.00, indicating substantial agreement.

The study by Melkamu Asaye M, Gelaye KA, et al., conducted in 2022, Valid and reliable neonatal near-miss assessment scale in Ethiopia: a psychometric validation, involved 19 experts and 32 items, resulting in an S-CVI/Ave value of 0.96, calculated using both the S-CVI/Ave and S-CVI/UA methods.⁽¹⁴⁾ Similarly, the study by Naye F., Décarý S., et al., from 2022, Development and content validity of a rating scale for the pain and disability drivers' management model, included 42 experts and 51 items, which also achieved an S-CVI/Ave value of 0.96, but was calculated using only the S-CVI/Ave method.⁽¹⁵⁾

A 2-week interval separated two consecutive implementations of the BDIPQ administered to 105 Bharatanatyam dancers. Scores from the two-time points were compared using the Pearson correlation coefficient, which revealed a correlation coefficient (r) of 0.9702. This high value indicates a strong positive correlation between scores at separate time intervals. The coefficient of determination (r squared) was 0.9412, indicating that a significant percentage of the dependent variable's variation can be predicted based on the independent variable. The two-tailed P value, less than 0.0001, is considered highly significant.

In a study conducted by Madu Ghanashyam Prasad, Atiya Nasreen, et al. Novel Animated Visual Facial Anxiety/Pain Rating Scale-Its reliability and validity in assessing dental pain/anxiety in children, (2021), the Pearson's correlation was found to be $P < 0.01$.⁽¹⁶⁾ Another study by Amit Khatri, Namita Kalra, et al., Evaluation of pain in children using animated emoji scale: A novel self-reporting pain assessment tool, (2021) reported a Pearson's correlation of $P < 0.001$.⁽¹⁷⁾

Five Expert Reviewers were approached and then the Cronbach's alpha for the BDIPQ was 0.84, indicating high internal consistency, as an alpha value greater than 0.70 is widely accepted

as indicating high internal consistency. Based on the BDIPQ's alpha score, the items demonstrate a strong correlation and reliably measure a single construct.

In a study conducted by Sharma, Sonia BDS, et al., Graded Chronic Pain Scale: Validation of 1-month reference frame, in 2022, the Cronbach's alpha value was reported to be between $\alpha=0.87$ and $\alpha=0.94$.⁽¹⁸⁾ Another study by Silvia Navarro-Prado, María Angustias Sánchez-Ojeda, et al., Development and Validation of a Rating Scale of Pain Expression during Childbirth (ESVADOPA), in 2020, found the Cronbach's alpha value to be $\alpha=0.78$.⁽¹⁹⁾

This scale consists of 11 items/domains, with the first one being a compulsory question determining whether the participant can proceed further. The subsequent component includes an illustration of a body chart, aiding participants in selecting the area of injury or pain occurring before, during, or after dancing. Participants then proceed to a table listing types of pain experienced while performing. Subsequent questions inquire about the ability and pain experienced while performing specific Bharatanatyam techniques such as Sampada, Aramandi, Muzhumandi, Dragging, Bharmari, Jumping, and Leaping. Participants respond with a yes or no to each component, and scoring is based on this, with 0 indicating yes and 1 indicating no. Professional dancers are particularly vulnerable to overuse injuries due to the repetitive performance of moves requiring tremendous flexibility, strength, and endurance. These injuries could significantly negatively impact the long-term health of dancers, many of whom begin training at the age of 5 or 6.

The Bharatanatyam study revealed that the most common sources of pain were the knees (50%), followed by the lower back (16.7%), hips/thighs and ankle/feet (9.3%), neck and shoulder (5.6%), upper back and wrists/hands (1.9%), and elbows (0%). Thus, our scale focuses on understanding the location of injury/pain along with the technique that caused said injury and/or pain.

5. Conclusion

This study demonstrated that the Bharatanatyam Dance Injury and Pain Questionnaire (BDIPQ) is a highly reliable and valid tool for assessing injury and pain in Bharatanatyam dancers. The Scale-Content Validity Index of 0.91 and Modified Kappa values ranging from 0.76 to 1.00 indicate excellent agreement among experts. The Pearson correlation coefficient of 0.9702 and Cronbach's alpha of 0.84 further confirm the BDIPQ's robustness, ensuring consistent and dependable measurements over time. These findings support the BDIPQ's use in both clinical and research settings for accurately evaluating dance-related injuries and pain.

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ANNEXURE-1

Bharatanatyam Dance Injury and Pain Questionnaire (BDIPQ)

Copyright registration number: L-143520/2024

Overview

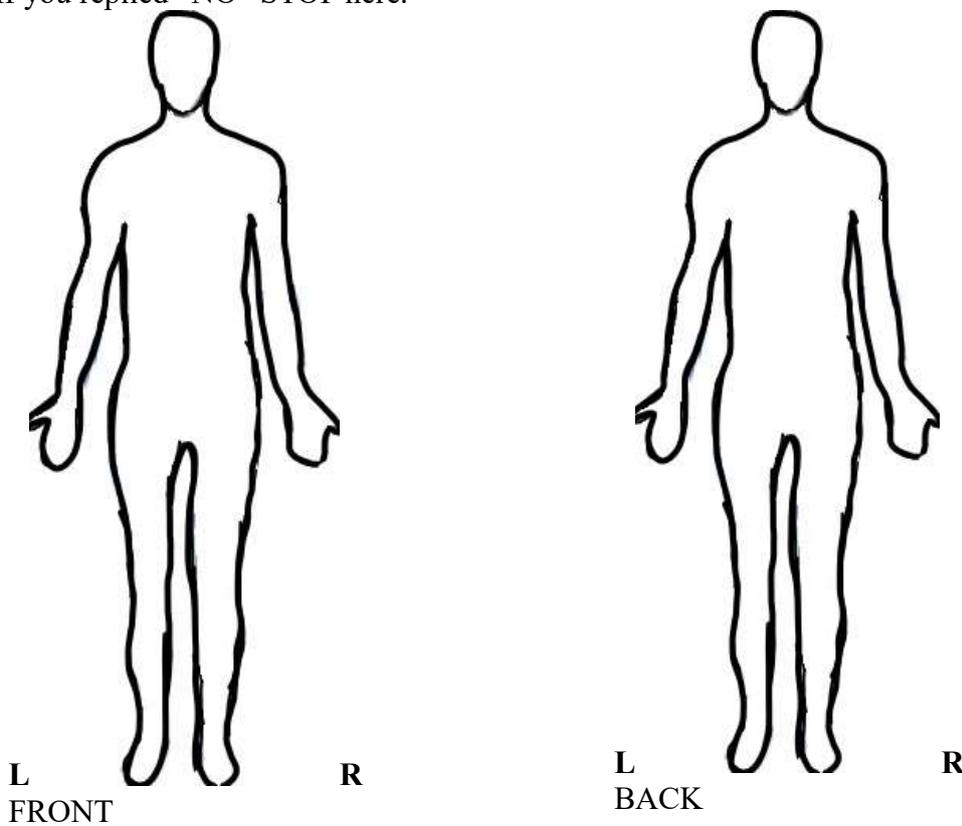
Bharatanatyam, an ancient dance form, is renowned for its magnificent, expressive, and sculptural poses that require high levels of physical and psychological power to execute(1). This requires subtle, continuous changes with a combination of single-legged stances (for poses), rapid body rotations (single or double-leg), quick, dynamic transitions of movement strict specific footwork, changing position and posture as well as maintaining posture(2).

The Bharatanatyam Dance Injury and Pain Questionnaire (BDIPQ) is an assessment tool designed to inquire about pain experiences and the influence of injuries during the practice of Bharatanatyam techniques. It aims to highlight the connection between technique-related injuries and its consequences on the dancer's overall performance and well-being.

Compulsory Question	Response	
I experience pain before/during/after performing vigorous dance and exercise. Occasionally it limits performance ability.	Yes	No

If you replied “YES” Continue ahead.

If you replied “NO” STOP here.



Circle around the area you experience pain

According to you, explain the type of pain you experience (Tick inside box)

Sr. No.	Type of pain	Response (Tick inside box)
1.	Dull aching pain	
2.	Tingling pain	
3.	Sharp shooting pain	
4.	Numbness pain	
5.	Burning pain	

Sr. No.	Questions	Response (Tick \checkmark in the box for "YES" and "NO")	
		Yes	No
1.	Sampada (Standing) Are you able to fully perform Sampada with ease without any excessive stress, feeling weak or giving way of joints on body while maintaining position?		
2. a	Aramandi (Half-sitting) Are you able to fully perform Aramandi including postures like Natyaarambham and stamping of feet flatly on floor while maintaining the position?		
2.b	Are you experiencing pain in knees?		
3.a	Muzhumandi (Full sitting) Are you able to fully perform Muzhumandi including jumping in Muzhumandi while maintaining the position?		
3.b	Are you experiencing pain in knees? Are you experiencing pain in ankles? Or both?		
4.	Dragging (A movement performed in Sampada by placing feet at the side/forward and dragging of feet from inner edge of foot/on toes) Are you able to fully perform dragging movement sideways and forward without limitations while maintaining Sampada position and losing balance?		
5.	Bharmari (Circular motion or turning around a singular locus - could be repetitive in nature) Are you able to fully perform unlimited turns on both legs or a single leg without feeling dizzy or losing balance?		
6.	Jumping Are you able to fully perform everything (big and small jumping) combinations, including beats? Is take-off power within the normal range, unrestricted and can maintain balance when landing after a jump or hop?		
7.	Leaping (A movement wherein the dancer leaps across the floor in a graceful manner; includes change of direction, pivots, quick stops and starts, or run) Are you able to fully perform all leaping combinations (change of direction, pivots, quick stops and starts, or run) at maximum speed without losing balance whilst moving from one position to another?		

Interpretation

If you answered "YES" you get 0 point

If you answered "NO" you get 1 point

0-1: Minimum disability during dance performance

2-4: Mild disability during dance performance

5-7: Moderate disability during dance performance

8-9: Severe disability during dance performance

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