Original Article

Analysis of Flexibility and Body Composition among Female Students of Punjabi University Patiala

Reena Rai[1]*, Arman Malik[2],

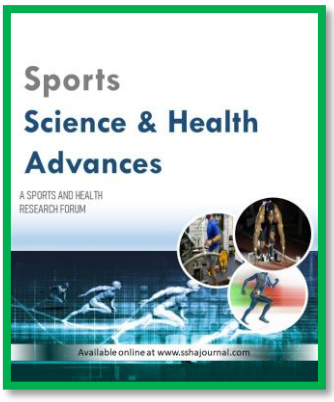
[1, 2] Student, Master of Physical Education, Department of Physical Education, Punjabi University, Patiala, Punjab

***Correspondence**: raireena827@gmail.com

Abstract

This study aims to analyze the flexibility, Body Mass Index (BMI), and body fat percentage of female students at Punjabi University, Patiala. The sample consisted of 30 female students 15 each from the Department of Physical Education and the Department of Dance. Flexibility was assessed using the V-Sit and Reach Test, while BMI and body fat percentage were measured using a BMI analyzer. The results revealed a significant difference in flexibility, with female Physical Education students exhibiting greater flexibility than their counterparts from the Dance Department. Conversely, Dance students had a higher BMI, but a lower body fat percentage compared to Physical Education students. These findings highlight the influence of specific physical training regimens on flexibility and body composition. While a significant difference was observed in flexibility between the two groups, no statistically significant differences were found in body composition variables.

Keywords: Flexibility, BMI, Body Fat Percentage, Physical Education, Dance, V-Sit and Reach Test.



Peer-Reviewed
Refereed
Indexed

How to cite: Rai, R., Malik, A. (2025). Analysis of Flexibility and Body Composition among Female Students of Punjabi University Patiala. *Sports Science & Health Advances*. 3(1), 440-446. https://doi.org/10.60081/SSHA.3.1(Spl).2025.440-446

Received: 16-05-2025
Published: 10-07-2025

Introduction

Flexibility is a key component of physical fitness, contributing to improved posture, reduced risk of injury, and enhanced performance in a range of physical activities (ACSM, 2021). It is typically defined as the ability of a joint or group of joints to move through a full, pain-free range of motion (Nelson & Bandy, 2005). Several factors influence flexibility, including muscle elasticity, joint structure, neuromuscular coordination, and the adaptability of connective tissues (Magnusson et al., 1996). Flexibility holds particular importance in fields such as physical education and dance, where efficient movement, coordination, and injury prevention are critical.

Body Mass Index (BMI) is one of the most used clinical measures to assess body composition and estimate obesity. It is calculated by dividing a person's weight in kilograms by the square of their height in meters (Wilmore & Costill, 2004). According to Hossain et al. (2007), BMI is closely associated with health risks such as cardiovascular diseases, diabetes, and metabolic disorders. Research from Indian universities highlights those female students often face challenges in maintaining a healthy BMI due to sedentary lifestyles and academic pressures (Sharma & Joshi, 2020).

In both physical education and dance disciplines, flexibility and body composition are essential for performing dynamic movements, maintaining postural stability, and ensuring biomechanical efficiency.

However, the focus of training varies across these domains. Physical education programs typically adopt a comprehensive approach, integrating strength, endurance, agility, and flexibility (Faigenbaum et al., 2013). In contrast, dance programs emphasize flexibility, balance, and motor coordination to support expressive and technically demanding movements (Koutedakis et al., 2005). Jackson et al. (2002) also notes that body fat percentage, a more precise measure of body composition than BMI, varies with genetics, diet, and physical activity.

Purpose of the Study

The present study aims to compare the flexibility levels and body composition of female students enrolled in the Physical Education and Dance departments of Punjabi University, Patiala. Flexibility will be assessed using the V-Sit and Reach Test a validated measure for lower back and hamstring flexibility (Hoeger et al., 1990) while body composition will be analyzed using BMI measurements. The study seeks to evaluate and contrast the physical characteristics of both student groups.

Research Questions

1. Do female students in the Dance department exhibit greater flexibility than those in the Physical Education department?
2. Is there a significant difference in body composition between the two groups?
3. How do different training methodologies influence flexibility and body composition?
4. What improvements can be made in training schedules to enhance flexibility and overall fitness in both programs?

Significance of the Study

Understanding the differences in flexibility and body composition between these two groups can provide valuable insights into how varied training approaches affect physical attributes. Dance training typically includes extensive stretching, isometric holds, and movement transitions, all of which contribute to enhanced flexibility (Quin et al., 2015). On the other hand, the diverse focus of physical education training may influence flexibility outcomes differently.

Moreover, body composition assessments can inform students about risks related to excess body fat, including musculoskeletal issues, cardiovascular disease, and metabolic disorders. By understanding how body composition affects flexibility, targeted exercise programs can be designed to improve mobility and reduce injury risks.

The findings of this research could guide curriculum development in dance and physical education programs, highlighting areas for improvement in training techniques. Additionally, the study supports the creation of interdisciplinary approaches aimed at promoting optimal body composition and physical performance.

In conclusion, flexibility and body composition are interrelated elements that significantly influence physical health and performance. While body fat percentage offers a more accurate representation of body composition, BMI remains a widely used indicator. The present study explores these variables among female university students to assess overall fitness levels and identify potential health concerns. The outcomes may help shape awareness campaigns, fitness interventions, and policy decisions aimed at fostering healthier lifestyles among university population.

Objectives of the Study

The present study aims to achieve the following objectives:

1. To assess the flexibility levels among female students enrolled in the Physical Education and Dance departments of Punjabi University, Patiala.

2. To analyze the body composition (including Body Mass Index and body fat percentage) of female students in the Physical Education and Dance departments of Punjabi University, Patiala.

Hypotheses of the Study

1. Based on the stated objectives and a review of relevant literature, the following hypotheses have been formulated:
2. There will be a significant difference in flexibility between female students of the Physical Education and Dance departments at Punjabi University, Patiala.
3. There will be significant differences in body composition variables (BMI and body fat percentage) between female students of the Physical Education and Dance departments at Punjabi University, Patiala.

Delimitations of the Study

1. The study was limited to female students from the Physical Education and Dance departments of Punjabi University, Patiala.
2. The participants were restricted to those within the age range of 18 to 25 years.
3. The sample size was confined to 30 students 15 from the Physical Education department and 15 from the Dance department.
4. The study focused only on the following selected variables:
    a. Flexibility
    b. Body Mass Index (BMI)
    c. Body Fat Percentage

Material and Methods

A total number of 30 female students aged between 18 to 25 years were taken to measure the flexibility of lower back and hamstring muscles and body composition. They were divided into two groups:

- Group 1: 15 female students from the Department of Physical Education.
- Group 2: 15 female students from the Department of Dance.

The participants for the study were selected using a convenience sampling method from among the female students at Punjabi University, Patiala. Each participant voluntarily agreed to take part in the study, and all were confirmed to be physically and mentally healthy. Prior to the testing, participants were thoroughly informed about the purpose, procedures, and any potential risks associated with the study. A proper warm-up session was provided to all participants to ensure physical readiness. For measuring flexibility, the V-Sit and Reach Test was conducted on a flat surface using a measuring scale placed perpendicular to the participant's body. Participants were instructed to sit on the floor with their legs fully extended, feet approximately 12 inches apart, and toes pointed upward. They were then asked to extend their arms forward while keeping their knees straight, attempting to touch or reach beyond their toes. Each participant was given three attempts, and the best score was recorded in centimeters. A positive score indicated the distance the participant could reach beyond the toes, while a negative score reflected the distance, they fell short.

Measurement of Body Composition

To assess body composition, a BMI machine (GS6.5B Body Building Weight Test System, Version 1.0) was used. Participants were instructed in advance and asked to remove their shoes before standing barefoot on designated spots on the machine. They were also directed to hold the electrodes in both hands with arms fully extended and remain still for approximately 15 seconds. All measurements were conducted under the supervision of a trained lab technician. After automatic computation, the machine printed the results, which were then recorded for analysis.

Statistical Analysis of data

The collected data were analyzed using descriptive statistics (mean and standard deviation) to summarize the flexibility levels and body composition variables among female students of the Physical Education and Dance departments of Punjabi University, Patiala. For comparative analysis between the two groups, an independent samples t-test was employed. The level of significance was set at 0.05.

Results

Table 1 Descriptive Statistics of Flexibility Levels among Female Students of the Physical Education and Dance Departments

Groups	N	Mean	Standard Deviation	t-value
Physical Education Students	15	22.066	8.979	
Dance Students	15	13.833	6.399	2.891

Df = 28, level of significance at 0.05, tabulated t-value = 2.048

Table No. 1 presents the descriptive analysis of flexibility among female students from the Physical Education and Dance departments of Punjabi University, Patiala. The mean and standard deviation of flexibility scores for Physical Education students were 22.066 ± 8.979, while those for Dance students were 13.833 ± 6.399. The calculated t-value for the comparison between the two groups was 2.891, which exceeds the tabulated t-value of 2.048 at the 0.05 level of significance. Since the calculated t-value is significantly higher than the critical value, it indicates a statistically significant difference in flexibility levels between the two groups.

Table 2 Descriptive Statistics of Body Mass Index (BMI) Among Female Students of the Physical Education and Dance Departments

Groups	N	MEAN	Standard Deviation	t-value
Physical Education Students	15	21.02	2.40	0.188
Dance Students	15	21.19	2.56	

Df = 28, Level of Significance at 0.05, Tabulated t-value= 2.048

Table no. 2 presents the descriptive analysis of Body Mass Index (BMI) among female students from the Physical Education and Dance departments of Punjabi University, Patiala. The mean BMI for Physical Education students was 21.02 ± 2.40, while the mean for Dance students was 21.19 ± 2.56. The calculated t-value for the comparison was 0.188, which is lower than the tabulated t-value of 2.048 at the 0.05 level of significance. Since the calculated t-value does not exceed the critical value, it indicates that there is no statistically significant difference in BMI between the two groups.

Table 3 Descriptive Statistics of Body Fat Percentage among Female Students of the Physical Education and Dance Departments

Group	N	Mean	Standard deviation	t-value
Physical Education Students	15	20.61	5.03	0.240
Dance Students	15	20.17	5.02	

Df = 28, Level of Significance at 0.05, Tabulated t-value= 2.048

Table No. 3 presents the descriptive analysis of body fat percentage among female students from the Physical Education and Dance departments of Punjabi University, Patiala. The mean body fat percentage for Physical Education students was 20.61 ± 5.03, while for Dance students it was 20.17 ± 5.02. The calculated t-value for the comparison was 0.240, which is lower than the tabulated t-value of 2.048 at the 0.05 level of significance. As the calculated t-value does not exceed the critical value, it indicates that

there is no statistically significant difference in body fat percentage between the two groups.

Discussion

The mean and standard deviation of flexibility for Physical Education students were 22.07 ± 8.98, while for Dance students, they were 13.83 ± 6.40. Regarding body composition, the mean BMI for Physical Education students was 21.02 ± 2.40, and for Dance students, it was 21.19 ± 2.56. The mean body fat percentage was 20.61 ± 5.03 for Physical Education students and 20.17 ± 5.02 for Dance students. A t-test analysis indicated a statistically significant difference in flexibility between the two groups ($p < 0.05$), with Physical Education students demonstrating superior flexibility levels. However, no significant differences were observed in BMI and body fat percentage between the groups.

These results suggest that the broader and more structured training regimens in Physical Education—often encompassing a mix of cardiovascular, resistance, flexibility, and sport-specific activities—may contribute to enhanced flexibility outcomes (Faigenbaum et al., 2013). In contrast, although Dance training heavily emphasizes coordination, balance, and rhythmic movement, it may not consistently prioritize flexibility training in the same structured manner, which could explain the lower flexibility scores (Koutedakis et al., 2005).

The absence of significant differences in BMI and body fat percentage between the two groups may be attributed to their similar physical activity levels and age demographics, both of which influence body composition. Prior research supports that while dance enhances muscular endurance and promotes lean body mass (Quin et al., 2015), the variation in training intensity and dietary habits may neutralize differences in BMI and fat percentage (Hossain et al., 2007; Sharma & Joshi, 2020). Additionally, both groups likely maintain a moderately active lifestyle, which may result in comparable body composition profiles despite differences in training focus.

Summary

The present study aimed to compare flexibility and body composition (BMI and body fat percentage) among female students of the Physical Education and Dance departments at Punjabi University, Patiala. The results obtained from descriptive and inferential statistical analyses are summarized as follows:

- Flexibility: A significant difference was observed in flexibility levels between the two groups. Female students from the Physical Education department demonstrated significantly higher flexibility scores (M = 22.066, SD = 8.979) compared to those from the Dance department (M = 13.833, SD = 6.399), with a t-value of 2.891 exceeding the critical value of 1.701 at the 0.05 significance level.
- Body Mass Index (BMI): The mean BMI values of Physical Education students (M = 21.02, SD = 2.40) and Dance students (M = 21.19, SD = 2.56) showed no statistically significant difference. The calculated t-value was 0.188, which is well below the critical value, indicating comparable BMI levels across both groups.
- Body Fat Percentage: Similarly, no significant difference was found in body fat percentage between the two groups. Physical Education students recorded a mean body fat percentage of 20.61 (SD = 5.03), while Dance students had a mean of 20.17 (SD = 5.02). The t-value of 0.240 did not exceed the threshold for statistical significance.

Conclusion

The findings indicate that while there is a significant difference in flexibility levels with Physical Education students outperforming Dance students. But there are no significant differences in BMI or body fat percentage between the two groups. These results suggest that flexibility training approaches in Physical Education may be more effective or consistent than those employed in the Dance department. However, both groups appear to

maintain similar body composition, reflecting overall balanced fitness profiles. This study underscores the need for further research to explore specific training methods and lifestyle factors contributing to flexibility and body composition, and how these may be optimized across disciplines to improve student health and performance outcomes.

Conflict of Interest: No Conflict of Interest Declared among authors

References

American College of Sports Medicine. (2021). ACSM's guidelines for exercise testing and prescription (11th ed.). Wolters Kluwer.

Ayala F, de Baranda PS, Croix MDS, Santonja F. Absolute reliability of five clinical tests for assessing hamstring flexibility in professional futsal players. J Sci Med Sport. 2012;15(2):142–7. https://doi.org/10.1016/j.jsams.2011.10.002

Ayala F, de Baranda PS, Croix MDS, Santonja F. Criterion-related validity of four clinical tests used to measure hamstring flexibility in professional futsal players. Phys Ther Sport. 2011;12(4):175–81. https://doi.org/10.1016/j.ptsp.2011.02.005

Ayala F, de Baranda PS, Croix MDS, Santonja F. Reproducibility and criterion-related validity of the sit and reach test and toe touch test for estimating hamstring flexibility in recreationally active young adults. Phys Ther Sport. 2012;13(4):219–26. https://doi.org/10.1016/j.ptsp.2011.11.001

Bandy WD, Irion JM, Briggler M. The effect of static stretch and dynamic range of motion training on the flexibility of the hamstring muscles. J Orthop Sports Phys Ther. 1998;27(4):295–300. https://doi.org/10.2519/jospt.1998.27.4.295

Chahal, P., & Tyagi, P. (2023). Effectiveness of yogic exercise on respiratory health indices: A systematic review and meta-analysis of intervention studies. Sports Science & Health Advances, 1(2), 57-72.

Chauhan, B. S., & Kumar, S. (2023). Impact of physical training on aerobic capacity on under-graduate students. Sports Science & Health Advances, 1(01), 39-42.

Dhillon, S. K., & Malik, I. (2023). A comparative study of muscular strength among boxers and wrestlers. Sports Science & Health Advances, 1(01), 14-15.

Faigenbaum, A. D., Kraemer, W. J., Blimkie, C. J., Jeffreys, I., Micheli, L. J., Nitka, M., & Rowland, T. W. (2013). Youth resistance training: Updated position statement paper from the National Strength and Conditioning Association. Journal of Strength and Conditioning Research, 23(5), S60–S79.

George, M., & Dhull, S. (2023). The role of physical educators in mitigating health risks among adolescents from increasing screen time. Sports Science & Health Advances, 1(01), 31-35.

Gleim GW, McHugh MP. Flexibility and its effects on sports injury and performance. Sports Med. 1997;24(5):289–99. https://doi.org/10.2165/00007256-199724050-00001

Hoeger, W. W. K., Hopkins, D. R., Button, S., & Palmer, T. A. (1990). Comparing the sit and reach with the modified sit and reach in measuring flexibility in adolescents. Pediatric Exercise Science, 2(2), 156–162.

Hooda, M. (2023). The Origin of Obesity: Proportional Influence of Metabolic Factors, Dietary Choices, and Physical Activity. Sports Science & Health Advances, 1(2), 99-103.

Hossain, P., Kawar, B., & El Nahas, M. (2007). Obesity and diabetes in the developing world—A growing challenge. The New England Journal of Medicine, 356(3), 213–215. https://doi.org/10.1056/NEJMp068177

Hui SC, Yuen PY, Morrow Jr JR, Jackson AW. Comparison of the criterion-related validity of sit-and-reach tests with and without limb length adjustment in Asian adults. Res Q Exerc Sport. 1999;70(4):401–6. https://doi.org/10.1080/02701367.1999.10608061

Jackson, A. S., Stanforth, P. R., Gagnon, J., Rankinen, T., Leon, A. S., Rao, D. C., Skinner, J. S., Bouchard, C., & Wilmore, J. H. (2002). The effect of sex, age and race on estimating percentage body fat from body mass index: The Heritage Family Study. International Journal of Obesity, 26(6), 789–796.

Jadon, A. S., & Kumar, S. (2023). Effect of circuit training on hemoglobin of school students. Sports Science & Health Advances, 1(01), 5-9.

Khatkar, P., & Chaudhary, S. (2023). A Comprehensive Analysis on Personalized Paths to Peak Performance: Training Approaches for Telic and Paratelic Oriented Minds. Sports Science & Health Advances, 1(2), 149-155.

Koutedakis, Y., Stavropoulos-Kalinoglou, A., & Metsios, G. S. (2005). The significance of

muscular strength in dance. Journal of Dance Medicine & Science, 9(1), 29–34.

Kumar, D., Dhull, S., Nara, K., & Kumar, P. (2023). Determining the optimal duration of plyometric training for enhancing vertical jump performance: a systematic review and meta-analysis. Health, sport, rehabilitation, 9(3), 118-133.

Kumar, D., Nara, K., & Dhull, S. (2023). The advantage and disadvantage of body composition on athletic success: A kabaddi player perspective. Methods, 1, 19.

Kumar, P. (2023). Meta-analysis of age-based maximum heart rate prediction equations: validating existing models across diverse populations. Sports Science & Health Advances, 1(2), 112-127.

Kumar, P., Jangra, P., & Nara, K. (2023). Level and associated factors with physical activity among Indian public school teachers. Health, sport, rehabilitation, 9(3), 6-23.

Magnusson, S. P., Simonsen, E. B., Aagaard, P., Sorensen, H., & Kjaer, M. (1996). A mechanism for altered flexibility in human skeletal muscle. Journal of Physiology, 497(1), 291–298.

Nara, K. (2017). A study of physical fitness between basketball and football players of Haryana. International Journal of Physiology, Nutrition and Physical Education. 2017a, 2(1), 1-4.

Nara, K. (2020). Effects of Physical Activity on General Well-Being and Hardiness among Sportspersons.

Nara, K., & Kumar, P. (2023). Aging, personality, and teaching aptitude in school grade physical education teachers. Pedagogy of physical culture and sports, 27(4), 297-304.

Nara, K., Kumar, P., Rathee, R., & Kumar, J. (2022). The compatibility of running-based anaerobic sprint test and Wingate anaerobic test: a systematic review and meta-analysis. Pedagogy of Physical Culture and Sports, 26(2), 134-143.

Nara, K., Kumar, P., Rathee, R., & Phogat, P. (2022). Predicting lower body explosive strength using hand grip dynamometer strength test. Kuldeep Nara, Parveen Kumar, Rohit Rathee & Shalini Singh, 1(0), 0.

Nara, K., Kumar, P., Rathee, R., Kumar, S., Ahlawat, R. P., Sharma, J., & Singh, S. (2022). Grip strength performance as a determinant of body composition, muscular strength and cardiovascular endurance. Journal of Physical Education and Sport, 22(7), 1618-1625.

Nara, K., Singh, S., Kumar, P., & Rathee, R. (2020). Impact of sports on body image and self-efficacy: An approach to analysis of sports performance.

Nelson, R. T., & Bandy, W. D. (2005). Eccentric training and static stretching improve hamstring flexibility of high school males. Journal of Athletic Training, 40(3), 154–158.

Quin, E., Rafferty, S., & Tomlinson, C. (2015). Safe dance practice: An applied dance science perspective. Human Kinetics.

RATHEE, R., KUMAR, P., NARA, K., & ROHILLA, R. Vitamin D supplementation attenuates exercise induced muscle damage: A meta-analysis of randomized control trials.

Sehrawat, V., Kumari, B., & Nara, K. (2024). Role of Optimism and Resilience in Determining Sports Performance. Sports Science & Health Advances, 2(1), 240-246.

Sharma, R., & Joshi, S. (2020). Academic stress and body mass index among female university students in India. International Journal of Health Sciences and Research, 10(3), 196–202.

Taily, T. A., & Bhat, W. A. (2023). A comparative study of Aggression between team sports and individual sports. Sports Science & Health Advances, 1(01), 27-30.

Wilmore, J. H., & Costill, D. L. (2004). Physiology of sport and exercise (3rd ed.). Human Kinetics.

Yadav, V. N., Kumar, S., Kumar, S., & Nara, K. (2012). Happiness and life satisfaction: A correlational study. Indian Journal of Positive Psychology, 3(1), 62.