

Original Research Article

Correlation of hamstring muscle flexibility with dynamic balance and agility in physiotherapy students in Navi Mumbai: a correlational study

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ABSTRACT

Background: Physiotherapy students often engage in activities like exercise demonstrations, transfer techniques, and gait training that require both health-related and skill-related fitness. However, hamstring strain from extended sitting during lectures can negatively impact agility and dynamic balance, two crucial aspects of skill-related fitness required for clinical competency.

Methods: 75 physiotherapy students in Navi Mumbai, ages 18 to 28, participated in a correlational study. The modified sit and reach test was used to measure hamstring flexibility, the functional reach test was used to measure dynamic balance, and the Illinois agility test was used to measure agility. The significance level for Pearson's correlation test was set at $p < 0.05$.

Results: The average agility, dynamic balance, and hamstring flexibility scores were 19.90 ± 2.85 seconds, 15.58 ± 2.79 inches, and 23.96 ± 4.38 cm, respectively. Agility displayed a mild, non-significant positive connection ($r = 0.12$, $p = 0.306$), whereas dynamic balance and hamstring flexibility revealed a small but significant positive correlation ($r = 0.235$, $p = 0.042$).

Conclusions: The study concluded that in physiotherapy students, there is a weak positive correlation between hamstring flexibility and both dynamic balance and agility. These results underscore the importance of early assessment and focused flexibility training to enhance skill-related fitness within physiotherapy students.

Keywords: Agility, Dynamic balance, Hamstring flexibility, Physiotherapy students

INTRODUCTION

Physical fitness is described as the capacity to perform daily activities with energy and sufficient stamina for leisure activities and handling unexpected situations without experiencing fatigue. It can be classified into two important components: Health-related physical fitness which focuses on overall health and well-being and includes:¹⁻³ Body composition- refers to the proportion of fat, bone, muscle and other important parts of body.^{1,3} Cardiorespiratory endurance-ability of circulatory and respiratory system to supply fuel during sustained physical activity and to eliminate fatigue products after

supplying fuel.^{1,3} Muscle strength- amount of external force that a muscle can exert.^{1,3} Muscle endurance-ability of muscle groups to exert external force for many repetitions or successive exertions.^{1,3} Flexibility- relates to range of motion available at a joint.^{1,3}

Skill-related physical fitness which emphasizes specific skills and abilities needed for sports and activities and: Speed of movement- ability to perform a movement within a short time period.^{1,3} Balance- maintenance of equilibrium while stationary or moving.^{1,3} Agility- ability to rapidly change position of entire body in space with speed and accuracy.^{1,3} Coordination- the ability to use

bodily parts and senses like hearing and sight to carry out motor activities precisely and fluidly.^{1,3} Both aspects contribute to overall physical fitness and well-rounded performance.^{1,2}

Physical fitness is important for physiotherapy students because they attend numerous practical sessions and spend full days in clinical placement where they have to perform therapeutic exercises, transfer techniques, and gait training. Additionally, mastering skill-related fitness is essential to demonstrate patient tasks and reduce the risk of injury, as impaired balance increases the likelihood of lower extremity injuries in healthy adults.^{1,2}

Physiotherapy students must be fit in terms of both health and skills in order to satisfy professional demands and lower their risk of injury.^{1,3} Exercise demonstration and patient transfer require hamstring flexibility, a crucial aspect of health-related fitness. Prolonged sitting reduces hamstring flexibility in physiotherapy students, leading to posterior pelvic tilt, decreased lumbar lordosis, and ultimately it affects lower-limb and pelvic mechanics.^{4,6} There is, little data on skill-related fitness components, especially dynamic balance and agility. Therefore, it is necessary to investigate the relationship between these skill-related fitness characteristics and hamstring flexibility.^{1,2}

Objectives of the study

To assess hamstrings flexibility in physiotherapy students by using modified sit and reach test. To assess agility in physiotherapy students by using Illinois test. To assess dynamic balance in physiotherapy students by using functional reach test. To find out correlation between hamstrings flexibility and agility in physiotherapy students. To find out correlation between hamstrings flexibility and dynamic balance in physiotherapy students.

METHODS

The aim of this study was to find the correlation between hamstring muscle flexibility with dynamic balance and agility in Physiotherapy students of Navi Mumbai. This study was designed as a correlational type of study. The modified sit and reach test were used for hamstrings flexibility, functional reach test for dynamic balance and Illinois agility test for agility.

Convenience sampling was used to find 75 male and female students between the ages of 18 and 28. The study was conducted over a period of six months, from March 2025 to September 2025. Individuals who were willing to participate and did not have any recent musculoskeletal injuries, pre-existing neurological or cardiorespiratory problems, lower-limb joint discomfort, trauma history, vertigo, postural hypotension, or use of sedatives, hypnotics, or antidepressants were included. Each and every participant gave their informed consent.

Microsoft Excel was used to code and enter the data, and SPSS (version 26) was used for analysis. To find correlations between variables, descriptive statistics (mean and standard deviation) were calculated and Pearson’s correlation coefficient was used. P<0.05, 80% research power, and α=5% were used to determine statistical significance.

Table 1: Modified sit and reach test.

Test	Aim	Method
Modified sit and reach test	To check for hamstring flexibility	A 30 × 30 × 30 cm wooden box with two 1-meter rulers set on top is used. A sliding wooden block is placed so the zero mark matches the student’s fingertip while long sitting against a wall. After one practice trial, three test trials are performed, and the average score is recorded and compared with normative data

Table 2: Functional reach test.

Test	Aim	Method
Functional reach test	To assess for dynamic balance	In relaxed standing, raise the right arm forward to 90° with a closed, palm-down hand. Reach forward as far as possible without stepping or touching the yardstick placed at acromion height. Measure the third-metacarpal position before and after the reach; the difference is the score. Give 2 practice tries, then record 3 trials and average them (in inches)

Table 3: Illinois agility test.

Test	Aim	Method
Illinois agility test	To assess for agility	IAT is a 10 m course marked with four center cones (3.3 m apart) and four corner cones (2.5 m out). Start lying prone. On “go,” stand up, sprint to the first line and touch it, return to the first center cone, weave up and back between the four center cones, sprint to the far line and touch it, then turn and sprint through the finish. Record time in seconds



Figure 1: Modified sit and reach test.

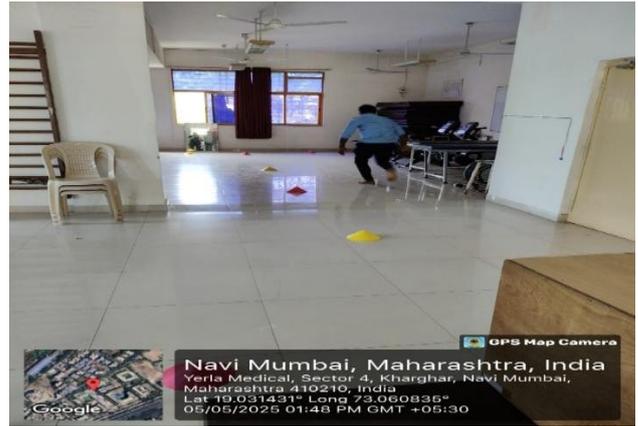


Figure 3: Illinois agility test.



Figure 2: Functional reach test.

RESULTS

A total of 75 physiotherapy students participated in the study, among which 53 were females (70.66%) and 22 were males (29.33%) belonging to the age group of 18-28 years. The mean hamstring flexibility score was 23.96 ± 4.377 , with minimum and maximum values of 12.83 and 30.26 respectively. The mean dynamic balance score was 15.58 ± 2.788 , ranging from 9.26 to 19.83. The mean agility score was 19.90 ± 2.846 , with minimum and maximum values of 11.26 and 23.16 respectively.

Table 4: Mean and SD of hamstring flexibility, dynamic balance and agility in physiotherapy students.

	N	Minimum	Maximum	Mean	Standard deviation
Hamstring flexibility	75	12.83	30.26	23.96	± 4.377
Dynamic balance	75	9.26	19.83	15.58	± 2.788
Agility	75	11.26	23.16	19.90	± 2.846

Table 5: Correlation of hamstrings flexibility with dynamic balance.

Variable 1 (modified sit and reach test)	Variable 2 (functional reach test)	r value	P value	Significance
23.96 ± 4.377	15.58 ± 2.788	0.2352	0.042227	The result is significant at $p < 0.05$

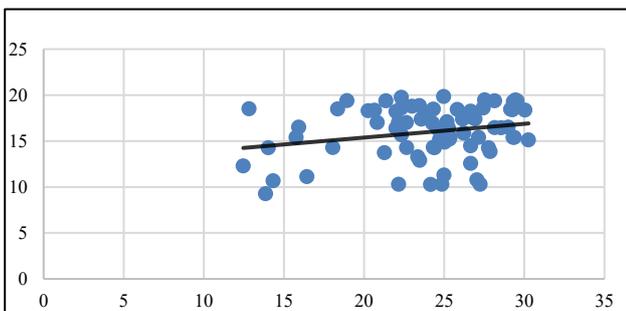


Figure 4: Correlation of hamstring flexibility with dynamic balance.

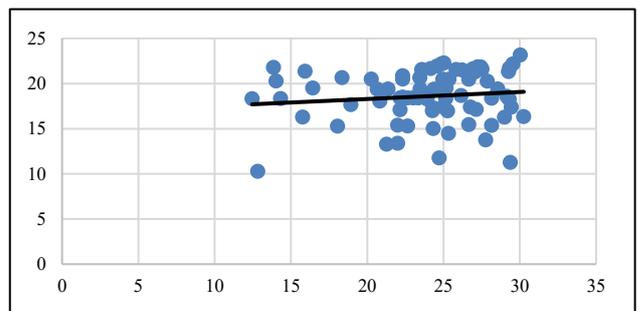


Figure 5: Correlation of hamstring flexibility with agility.

Table 6: Correlation of hamstrings flexibility with agility.

Variable 1 (modified sit and reach test)	Variable 3 (Illinois agility test)	r value	P value	Significance
23.96±4.377	19.90±2.846	0.1197	0.306353	The result is not significant at p <0.05

Correlation analysis showed a weak positive correlation between hamstring flexibility and dynamic balance among physiotherapy students ($r=0.2352$, $p=0.042227$), which was statistically significant at $p<0.05$. However, a weak positive correlation was found between hamstring flexibility and agility ($r=0.1197$, $p=0.306353$), which was statistically not significant at $p<0.05$.

DISCUSSION

The objective of this study was to find out the correlation between hamstring flexibility with dynamic balance and agility in physiotherapy students in Navi Mumbai. We have conducted the study on 75 participants, 53 male and 22 female participants, where hamstring flexibility was checked by modified sit and reach test (23.96±4.377), dynamic balance was checked by functional reach test (15.58±2.788) and agility was checked by Illinois agility test (19.90±2.846). Normal values of modified sit and reach test for good hamstrings flexibility should be >17.9 cm, functional reach test for good dynamic balance should be >37.3 cm, Illinois agility test for good agility should be <15.2 and <17 sec for males and females respectively. But according to our data the values shows that hamstrings flexibility, dynamic balance and agility is affected in physiotherapy students. Similar result is seen in previous studies done on health and skill related fitness in physiotherapy students done by previous authors.¹

The main objective of our research was to find the correlation between physiotherapy students' hamstring flexibility and agility, since agility is crucial for activities like patient transfers, exercise demonstrations, and skill-related tasks. A weak positive but statistically insignificant association between these two factors was revealed by our findings. Extended periods of sitting during lectures may cause tight hamstrings and posterior pelvic tilt, which could impair the agility needed for clinical tasks. Increased hip and knee range of motion, which enables rapid leg movements and direction changes necessary for agility, may account for the weak positive link. Furthermore, a more flexible muscle-tendon unit can handle quick eccentric-concentric motions and operate efficiently over a greater excursion. Our results match with earlier research, which also showed positive but also non-significant correlations between agility and hamstring flexibility.^{8,9,17} The lack of statistical significance may be explained by the fact that other variables that affect agility, such as muscle power, body composition, and lower-limb and core strength, were not evaluated in this study. Research by previous authors also showed non-significant correlations between these variables.^{9,18}

Another goal of the research was to find the relationship between hamstring flexibility and dynamic balance among physiotherapy students, as dynamic balance is important for gait training, demonstrating exercises, and performing transfer techniques. The research revealed a weak positive and statistically significant correlation between these two factors. Extended periods of sitting during lectures may lead to tightness in the hamstrings, which could impact the dynamic balance required for standing for long durations, shifting weight, and executing clinical tasks. Potential reasons for the weak correlation include the importance of flexible hamstrings in facilitating hip and knee adjustments for controlling the centre of mass, the destabilizing effects of compensatory pelvic tilt resulting from tight hamstrings,⁹ and the effect of posterior chain flexibility on the alignment of lower limbs during dynamic activities.^{9,19,20} Our results match with previous studies, who also found a weak positive correlation.^{9,21,22} We did not consider other responsible factors like ankle mobility, core, hip and knee muscle strength, proprioception, shoulder mobility, height of subjects Hence a weak positive correlation was found but it was statistically significant.

Limitation of the study is that other aspect like core strength, hip and knee strength, ankle mobility were not considered in this study.

Future scope of study

Interventional studies can evaluate the effect of hamstrings flexibility or balance training programs on agility and dynamic balance outcomes.

To properly explain the association, factors that may potentially affect dynamic balance and agility, such as lower limb muscle strength, proprioception, ankle mobility, core stability, and body composition, can be included.

Clinical implication

Early screening and detection- routine screening of hamstring flexibility in physiotherapy students can identify those at risk of balance and agility. Interventional studies- this study provides a rationale for future interventional studies

CONCLUSION

The study concluded that hamstrings flexibility shows a weak positive correlation with dynamic balance and

agility in physiotherapy students in Navi Mumbai. By demonstrating the possible impact of hamstring flexibility on functional performance elements like balance and agility in young, healthy individuals, our findings add to the body of existing evidence. The study highlighted how crucial it is to maintain ideal hamstring flexibility as a component of postural stability and neuromuscular control. Additionally, it offers clinicians and physiotherapy students baseline data in favor of incorporating flexibility training and assessment into injury prevention and performance improvement initiatives. In order to improve knowledge in the fields of physiotherapy and sports rehabilitation, this research also provides room for future investigations into other musculoskeletal and neuromotor elements affecting balance and agility.

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Ethical approval: The study was approved by the Institutional Ethics Committee of YMT college of physiotherapy, Kharghar, Navi Mumbai. Maharashtra university of health science, Nashik

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