

# Correlation of Hamstring Tightness with Balance and Mobility in Young Adults

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## ABSTRACT

**Background:** Despite of the optimal health regarding metabolic energy levels, physical activity and fitness in young adults, major health concerns are increasing. This increasing dysfunction could be the basic cause for future impairments. Hamstrings muscles are most commonly subjecting to shortening and evaluated for the lower limb resilience. Balance, mobility, muscle strength are important elements to maintain normal functional capacity. The aim of this study was to evaluate Correlation between hamstrings tightness with balance and mobility in young adults.

**Methodology:** A Cross sectional correlational Study was conducted in 385 participants of age 19-24 years old of twin cities i-e Rawalpindi and Islamabad. Passive knee extension test (PKE) was performed to assess hamstrings tightness, whilst Y-Balance test (YBT) for evaluating balance and 6 Minute walk test (6MWT) for Mobility. The measurements are tabulated and analyzed statistically for the Correlation between hamstrings tightness with balance and mobility using SPSS.

**Results:** Sample size of 385 participants with 100% response rate, n= 255 (66.2%) were females while n= 130 (33.8 %) were males. Mean, median for variables along with the SD and Interquartile range was calculated. Correlation was analyzed using spearman's correlation with the coefficient r (ρ) between mean PKET and 6MWT were ρ= -0.21 and Mean PKET with Dominant side of YBT as ρ= 0.07 while with Non-dominant side as ρ= 0.06. Also, there are no significant differences between dominant and non-dominant sides for PKET and YBT separately as per Wilcoxon signed rank test.

**Conclusion:** Statistically significant weak negative correlation was found in hamstrings tightness with mobility, while there is no significant correlation of hamstrings tightness with balance for both dominant and non-dominant sides.

**Keywords:** Hamstring muscles, Balance, Mobility, hamstrings tightness.

## INTRODUCTION

Aging can affect the overall status of human body with the passage of time. Young adults have peak physical strength and performance in from 18 to 39 years of the age, but the flexibility may decrease in the adulthood<sup>(9)</sup>. Young adulthood is generally defined as the age 18 to 22 years or 18 to 25 years according to several theories and research. Despite of the optimum health benefits in young age, the health problems are shooting up worldwide including arthritis, asthma, depression, hypertension, diabetes, multiple sclerosis, ulcers, and musculoskeletal system abnormalities. Hamstrings is the group of three muscles which are responsible for the different activities which range from standing to high energy sprinting and jumping. They are located at the back of the thigh starts from hips and goes towards the knee joint. If we talk about the structural anatomy, hamstrings comprise of three heads,

1. Biceps femoris muscle, consists of a short head and a long head. The long Head has two articulations, which provides the movement not only on the hip joint but also on knee joint especially the extension of hip and flexion of knee joint. However, the short head of biceps femoris only provide knee flexion due to its mono-articulation.
2. Semimembranous muscle, runs medial to bicep femoris, originating from the ischial tuberosity of the pelvis and inserting into medial condyle of tibia. This muscle flexes and internally rotates the leg.
3. Semitendinous muscle, it also runs medially to the bicep femoris, but it is long fusiform muscle which flexes the leg and stabilizes the knee joint.

We can measure the flexibility of hamstring muscles with the following methods,

1. Straight leg raises
2. Toe Touch
3. Sit and reach
4. Knee extension angles tests – Active and Passive

The above methods are widely used out of which Active knee extension test (AKE) and Passive knee extension tests (PKE) are more accurate in determining the isolated evaluation of hamstring muscles. Active knee extension test (AKE) was used to measure popliteal angle. The mean value for sitting hours taken was 8 hours per day. The study showed; mean values of popliteal angle was > 20°. Also there was a significant correlation between

popliteal angle and sitting hours along with physical activity. Therefore, there was a significant increase in hamstring tightness with excessive sitting and inadequate physical performance.<sup>22</sup>

Balance is evaluated with the help of the following screening tools,

1. Y Balance Test
2. Functional movement screen Test

These tests are very crucial in determining the patient's problems, lacking and asymmetries in the core stability, neuromuscular control and their balance. Out of these two tests, YBT is the most important one as it assesses the dynamic stability of the body by specific movements of lower limb consisting of reaching tasks in anterior, posterolateral (PL) and posteromedial (PM) directions and it predicts injury to the lower limb<sup>(15)</sup>. Not only a predictor but this test also has a better interrater and intrarater reliability.

Third most important element alongside hamstring tightness, is mobility which is the cadency or tendency of a body to move one place to another. We can simply call mobility as an ambulation of the body

We can calculate mobility by the several physical performance tests used to assess functional capacity as well as mobility, which are as follows.

1. 6-minute walk test
2. Shuttle walk test
3. Timed get up and go test

## METHODS

This was a Cross sectional, Correlational, study started from March 2021 and completed till July 2022. The complete duration of the study was one year four months. This study was targeted to be performed on young adults of Rawalpindi and Islamabad but majority was taken from a single institute Foundation University, which has 2 campuses i-e Islamabad and Rawalpindi.

**Sampling Technique:** Purposive sampling technique was used for data collection Sample size was calculated using Raosoft software. The sample size was found to be 384, by setting 95% confidence interval, 5% margin of error, 50% response distribution. A total sample of 385 students was taken from Rawalpindi and Islamabad with the target age range of 19-24 years. Out of which 97 individuals were of 19 years which makes up 25.2% of total sample size, 84 individuals are of 20 years which covers 21.8%, 61

participants of 21 years which accounts for 15.8%, 63 participants of 22 years that was 16.4%, 41 participants of 23 years i.e. 10.6% and 39 participants of 24 years of age that comprises of the remaining 10.1% of the total sample size.

**Scoring System:**

- 1 Average Reach distance (cm)  
= (Reach 1+ Reach 2+ Reach 3)/3
  - 2 Relative (normalized) reach distance (%)  
= Absolute reach distance/limb length\*100.
  - 3 Then the composite Reach Distance (%)  
= sum of 3 reach directions / 3 times the limb length\* 100.
- Y-Balance Test Reliability: [ICC: 0.85-0.91]  
Composite Score Reliability [ICC: 0.91].

**Minute Walk Test:** For this test, the participant moves to the assessment of mobility test. Equipment's required were Stopwatch and 30-metre stretch of unimpeded walkway with two cones to mark the distance that needs to be covered. Participant was asked to walk in the normal/ usual pace for as far as possible for 6 minutes. You will walk back and forth in this hallway between the cones. The time will only stop once the 6 minutes are done including the periods of rest. The total distance covered by the participant was calculated by multiplying the distance of one side i.e 30 meter to the times pivots around the cone.

**RESULTS**

The results also showed no significant difference in passive knee extension angles for both dominant and non-dominant sides. Correlation was analyzed using spearman's correlation with the coefficient r (p) between mean PKET and 6MWT were  $\rho = -0.21$  and Mean PKET with Dominant side of YBT as  $\rho = 0.07$  while with Non-dominant side as  $\rho = 0.06$ . Also, there are no significant differences between dominant and non-dominant sides for PKET and YBT separately as per Wilcoxon signed rank test.

Table 1: Tests of normality

Variables	P-Value
Mean PKET	0.009
PKET of Dominant Leg	0.001
PKET of Non-Dominant Leg	0.001
Y-Balance Test of Non-Dominant Leg	0.000
Y-Balance Test of Dominant Leg	0.001
6 Minute Walk Test	0.000



Figure 1:

Table 2: Passive Knee Extension Angle Values (n=385)

Variables	Median	Interquartile
Passive Knee Extension Angle of Dominant Leg	35.00°	12.5
Passive Knee Extension Angle of Non-Dominant Leg	35.00°	12.5
Mean PKE Angle	36.00°	12.5

**DISCUSSION**

This study proves to be a basis of whole new set of information regarding compromised functional capabilities from such young age allows not only researchers to assess more functional parameters in this population but also the readers to self-evaluate themselves to alter their sedentary lifestyle and lack of physical activity in daily lives. In the support to the study an article by Grimer M. in 2019 about "Mobility related physical and functional loss due to aging and disease", revealed momentous decrease in mobility, number of steps, muscle power and strength, reaction time and walking speed to decrease with aging as low as starting from 20 years old.<sup>(23)</sup> Thus supports in the favor of the study that early assessment of functional capabilities like decreased mobility with progression of age could have a big impact in future. The conducted study indicated that increase in hamstrings tightness will cause decrease and compromised mobility. This could be due to the reason that, if knee cannot be extended completely because of tight hip extensor i.e hamstrings muscle so there is a possibility that the stride length is decreased causing a compromised mobility.

In a research, by Shah C. in 2013 on "The effect of hamstrings and calf tightness on static dynamic balance and mobility – a Correlation study" showed hamstrings and calf tightness has strong positive correlation with mobility using TUG test and strong negative correlation with balance in elderly population<sup>(12)</sup>. Results by S. Sailor in 2020 on "Association between hamstrings flexibility and functional performance of patients with knee osteoarthritis" suggested that with decrease in hamstrings flexibility there is a decrease in physical functions which means the ability of any individual to perform Activities of daily living with and without instruments independently. The population of concern in this study was OA patients, while the current study targeted young healthy population. This would give an idea about the correlation between these variables do exists between healthy and non-healthy population.<sup>(22)</sup>

Contrary results by Yusuhiro Endo in 2014 about the relationship of lower extremity tightness with balance by using star excursion balance test in basketball players of junior high school indicated to have negative correlation with gastrocnemius tightness and positive correlation with hamstrings tightness along with some correlation with iliopsoas and rotators in different direction of SEBT. The results showed that with the increase in gastrocnemius tightness there is decrease in balance of body while with increase in hamstrings tightness there is increase in balance. Thus there is moderate to high risk of injury related to lower extremity tightness. The results differ due to the activity level of the participants and physical fitness also, as all the muscle groups are tested and tightness for each muscle group which could be altering the results. The results also showed that there is a high upper limb risk of injury due to lower limb tightness.<sup>(23)</sup>

In his study, "the relationship of lumbar lordotic angle with hamstrings tightness" done in 2022, Mohamed A. M. Sarhan showed that there is no statistically significant correlation of hamstrings tightness with lumbar lordotic angle which underestimates the importance of stretching of hamstrings in patients complaining of low back pain. As lumbar lordotic angle is directly related to low back pain, posture, pelvic tilt and in conclusion with gait and mobility so this study also declines all the relations of hamstrings muscle tightness with posture, gait and mobility. The results differ as due to the limitation in the study having potential inaccurate palpation of anatomical markings be a source of error during the measurement method. (24)

A study by Parsa Salemi In 2021 on “The immediate effects of Hamstrings stretching on dynamic balance and gait biomechanical variable in athletes with hamstrings tightness” shows a contradicted idea. They took athletes with hamstrings tightness and evaluated their balance. The result came out as hamstring stretching increases hamstrings flexibility and also improves the balance hence having a positive correlation of hamstrings tightness with balance. This relation between hamstring tightness and balance could be due to the participant's activity level as they are athlete population.

Assessment of hamstrings tightness was done by Passive knee extension test (PKE). Passive knee extension test was chosen as it is highly preferred to check the capacity of muscle strength however active knee extension is also used along with passive knee extension test equally in evaluation processes<sup>(11)</sup>. In a study by Yildirim MS in 2018 about “the cut-off values for the diagnosis of hamstring shortness and related factors” aimed to determine the cut-off values of Active knee extension (AKE) angle and Passive knee extension angle (PKE) angle in young adults of age 18-24. The passive knee extension test was considered because the active knee extension test was related to the strength of quadriceps. According to results passive knee extension test was more preferred because there is effect of quadriceps strength on results of active knee extension. This study concluded with a positive correlation between knee extension angles and isokinetic knee extensor muscle strength thus supporting the study on the selection of tools for measuring hamstrings tightness. Considering the participant's dominant and non-dominant sides, Non-parametric Wilcoxon signed rank test was run which resulted in Descriptive Statistics P value which was greater than significance level, shows no significant differences between dominant and non-dominant sides. In the same study by Yildirim MS in 2018, also showed the difference of values in dominant and non-dominant sides of individuals which came out to have no significant difference between both sides.

As the results indicated significant association of hamstrings tightness with mobility, few general modifications like; maintaining an active lifestyle, stretching, walking, jumping etc. can bring huge benefits in their future lives.

## CONCLUSION

The study revealed that Hamstrings tightness has a significant correlation with mobility indicating that with increase in the hamstrings tightness the functional mobility of an individual decreases and vice versa. However, the study showed no significant correlation of hamstrings tightness with balance or any balance related issues in young adults, with no difference in dominant and non-dominant sides. The results also showed no significant difference in passive knee extension angles for both dominant and non-dominant sides.

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