

# Prevalence of Hamstring muscle tightness among undergraduate physiotherapy students of Nepal using Passive Knee Extension Angle Test

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**Abstract-** Inability to extend the knee completely when the hip is flexed, accompanied by discomfort or pain along the posterior thigh and/or knee is hamstring muscle tightness. This study aims to find the prevalence of the hamstring muscle tightness among the undergraduate physiotherapy students and assess association between hamstring muscle tightness and Low back pain.

**Methods:** A cross-sectional study was conducted among 107 physiotherapy students of Kathmandu University School of Medical Sciences (KUSMS). Passive knee extension test was used to determine the hamstring muscle length. Descriptive analysis was done by using SPSS version 16 to find out the result.

**Results:** Out of 107 respondents, the study showed 40.17% with prevalence of hamstring muscle tightness, in which tightness was found to be high in male than female participants. Prevalence of hamstring muscle tightness is greater in clinically exposed student compared to clinically not exposed students. The present study has revealed no significant association between hamstring tightness and LBP.

**Conclusion:** The present study shows medium prevalence of hamstring muscle tightness among physiotherapy students of KUSMS and no association were found between low back pain and hamstring muscle tightness.

**Index Terms-**Hamstring muscle tightness, Knee extension angle, Prevalence, Physiotherapy students

## I. INTRODUCTION

### Background:

The hamstrings comprise three large muscles, namely semi-tendinous, semi-membranous and biceps femoris which originate from the infero-medial impression on the upper part of the Ischial tuberosity and gets inserted on the upper parts of posterior surface of tibia. They are located in the posterior compartment of the thigh and acts on the hip and knee joint. Hence, they are extensors of the hip and flexors of the knee. Muscle tightness is caused by decrease in the ability of the muscle to deform, resulting in a decrease in the range of motion at the joint on which it acts[1].

“Inability to extend the knee completely when the hip is flexed accompanied by discomfort or pain along the posterior thigh and/or knee is usually attributed to hamstring muscle

tightness”[2]. Clinically, hamstring muscle length is not measured directly but instead, it is represented indirectly by angular measurements of unilateral hip flexion with the knee extended[3]. Hamstring muscle tightness is defined as Knee Extension Angle (KEA) greater than 20 degrees where KEA is the degree of knee flexion from terminal knee extension[4].

Methods to assess hamstring flexibility include the Straight-Leg-Raising (SLR) test, Sit and Reach (SR) test and Active Knee Extension (AKE) test[1, 4, 5]. The SLR test specificity has been questioned, as it is also widely used as a neurological test. Further, cinematographic study showed that pelvic rotation may influence the validity of SLR angle measurements. Even though hamstring flexibility assessment is easy using the Sit and Reach (SR) test, the validity of this test is considered poor[6]. Among them KEA with plantar flexion is the gold standard measure for hamstring muscle length with the Intra-Tester reliability 0.99[4, 7].

Hamstring tightness occurs in early childhood and it tends to increase with age. The progressive decline in flexibility with age has been attributed to change in elasticity and decreased level of physical activities[1,8]. Hamstring extensibility is a physical fitness component widely recognized as an important marker of health and quality of life[9]. Female tends to be more flexible than male of same age throughout the life, this is because of anatomical variation in joint structure and also performance of more rigorous physical work by men, resulting in greater micro trauma[8].

LBP is defined as pain in the area from below the ribs to the hips. Hamstring muscle tightness leads to decrease in range of motion of lumbar flexion and pelvic tilt. Reduction of hamstring flexibility was found to be one of the cause for development of low back pain. One previous study stated that there is no relationship of hamstrings flexibility and development of low back pain. Due to lack of adequate physical activity, muscle weakness and some degenerative factors like osteoarthritis, senile osteoporosis and degenerative disk disease, low back pain occurs in elderly people[8,10]. Young people with adequate hamstring extensibility seems to have lower risk of current low back pain[11]. LBP is commonly treated by physiotherapist. However physiotherapist themselves have been reported as being LBP sufferer. Students aged 20 and 21 years, and were in final year of the program, demonstrated significantly higher risk of all measure of LBP compared with younger students[12]. Educational exposures of 'sitting, looking down' and 'treating

patients' were related to recent occurrence of LBP. Physiotherapy students reported a higher prevalence of LBP when compared with other medical students. One in six physiotherapist changed settings or left the profession due to work related musculoskeletal injuries[13].

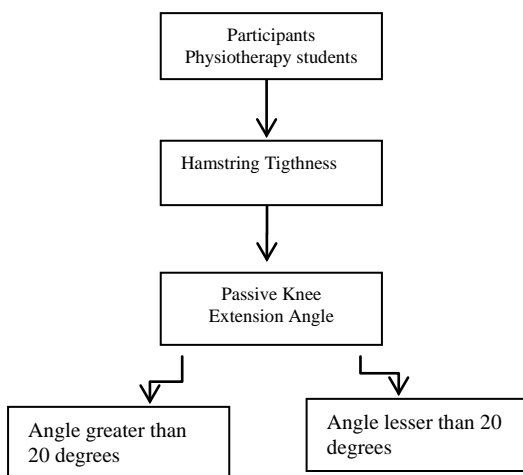
**Statement of the Problem:**

Hamstring muscle tightness is present in all age group population and it increases with age. Study shows that physiotherapy students have more low back pain compared to other medical students. One study stated that there is no relationship of hamstrings flexibility and development of low back pain. Similarly, it was reported that hamstring flexibility was strongly correlated with pelvic rotation and forward bending range (Bellew et al, 2010), which may affect the lumbar region and in this study, there is a strong correlation between hamstring flexibility and low back pain. Therefore there are different studies with controversial findings relating to hamstring tightness and low back pain. Moreover, such research study has never been performed in the context of Nepal.

**Research Question:**

What is the prevalence of hamstring muscle tightness in physiotherapy students in Nepal?

**Conceptual Framework:**



**OBJECTIVES**

**Primary Objective:**

To identify the hamstring muscle tightness among the undergraduate Physiotherapy students in Nepal.

**Secondary Objective(s):**

- a. To compare hamstring muscle tightness between Physiotherapy students with and without clinical exposure.
- b. To identify the association between hamstring muscle tightness and low back pain.

**LITERATURE REVIEWS**

Hamstring extensibility is a physical fitness component widely recognized as an important marker of health and quality of life. Young people with adequate hamstring extensibility seems to have a lower risk of current low back pain.[14]

In a study by Jose Muyor, Pedro A.lopez (2013), among 75 male cyclists, the average passive knee extensive test was 77.13° and showed higher significant correlation between pelvic tilt and hamstring muscle extensibility than thoracic spine. The cyclist had greater hamstring muscle extensibility than sedentary subject which might be because of influence of training[15]

An exploratory study with 72 participants concludes that there was a possible relationship between low back pain and hamstring tightness. It was found that more the tightness, the higher the severity of back pain. Dominant lower extremities of patients were more flexible than non dominant.[16]

A study done in university of South Australia, City East Campus shows that the risk of low back pain for physiotherapy student in year 2-4 was significantly greater compared with 1<sup>st</sup> year student. The gender specific response rates were not different from the proportion of males and females enrolled in each year level. Educational exposure of sitting, looking down and treating patient were related to occurrence of low back pain.

Another study done by Asdrubal Falavigna et.al revealed that physiotherapy students are potentially exposed to same low back pain as graduate students with poor working posture and frequent manual handling.77.9% of student had LBP at some point of their lives, 66.8% in the last year and 14.4% of them reported suffering from LBP at moment of answering the questionnaire. The result showed that physiotherapy students were 2.51 times more likely to have low back pain than other medical students, as physiotherapy students perform manual therapy such as soft tissue manipulation, transferring dependent patients, assisting patients in gait, providing manual resistance and heavy lifting[13]

A study done in University of Ibadan, Nigeria showed that among 240 individual which comprised of 122 male and 118 female, tightness is higher in male than in female. Hamstring tightness occurs in early childhood and tends to increase with age. At age of 5-12yrs, tightness was 40° whereas at age of 50-59, tightness increases to 52.6°.The progressive decline in flexibility with age has been attributed to change in elasticity and decreased level of physical activities[1]

A randomized controlled study done in a College of physiotherapy, Gujarat with 60 participants, 30 in each group concluded that there was significant difference of hamstring flexibility between participant having low back pain and normal individual .The knee extension angle of participant with low back pain was 31.63° and 14.30° in normal individual[11]

## METHODOLOGY

### Study design:

Quantitative cross sectional study.

### Study Site and justification:

The study was conducted at Kathmandu University School of Medical Sciences, Dhulikhel Hospital which is running the only Bachelor of Physiotherapy course in Nepal.

### Population and Sample:

#### Study population:

Physiotherapy Students studying in Kathmandu University School of Medical Science (KUSMS).

#### Selection Criteria:

##### Inclusion Criteria:

- All undergraduated physiotherapy students studying in KUSMS

##### Exclusion Criteria:

- Surgery of hamstring or lumbar muscles in past 6 months
- Lower extremities or spine fracture in past 6 months
- Students who are not interested to take part in this study

#### Sampling method:Census

**Sample Size:** All Physiotherapy Students studying BPT in Nepal

### Measurement

The Study measurement was divided into two variables i.e. dependent and independent variables. The following study attributes were measured in the study.

#### Independent Variable:

- Gender
- Year level

#### Dependent Variables:

- Hamstring muscle length

### Data Collection Tools/ Measures:

The students were asked if they have ever suffered LBP at some point and at the moment they were filling the questionnaire. Pain intensity was assessed by the numerical rating scale, ranging from zero (no pain) to ten (worst pain)[13]

### Passive Knee Extension Angle

Passive knee extension angle is used to assess hamstring muscle length. Hamstring muscle tightness is defined as Knee Extension Angle (KEA) greater than 20 degrees where KEA is the degree of knee flexion from terminal knee extension. It is a gold standard measure for hamstring muscle length. Inclinometer is used to measure the angle.

Passive Knee Extension Angle has good psychometric properties. It has excellent test-retest reliability (ICC=0.94). It has moderate concurrent validity (correlation with sit and reach test,  $r = 0.57$ , correlation with straight leg raise,  $r = 0.63$ ). Inter rater reliability

of inclinometer (ICC=0.80) is good and the concurrent validity with universal goniometer is 0.85.

### Ethical considerations and Data Collection

This research was conducted after the approval from Institutional Review Committee, Kathmandu University School of Medical Sciences considering the guidelines to conduct research given by Declaration of Helsinki and permission was taken from the physiotherapy Department. Verbal and written consents were taken from all subjects prior to data collection. The purpose of the study was explained to all the participants. The participants could withdraw from the study at any time without giving reason and without fear. The privacy and confidentiality of the subject was maintained throughout the study and thereafter.

Data was collected administering the Passive Knee Extension Angle. At first dominant leg will be determined as in the previous study (O' Hora et al, 2011). Passive knee extension angle of both legs were measured. For dominant leg, subject was positioned supine on examination table, and the non dominant lower extremity will be secured to the table with a cloth strap across the thigh. Another cloth strap was placed over the anterior superior spine of iliac to stabilize the pelvic. Gravity inclinometers will be placed at two points on the tested lower extremity. One inclinometer was placed on the distal thigh 5cm superior to the patella, and second inclinometer was placed on the distal anterior tibia. The distal edge of the inclinometer was aligned with the superior aspect of the medial malleolus. The tested lower extremity would be then passively raised by examiner to 90 degree of hip flexion as recorded by the inclinometer placed at distal thigh. The subject's knee would be then passively straightened to a point where the subject reported a strong but tolerable stretching at their posterior thigh. The angle of the knee will be measured using the inclinometer placed on lower leg. Alternatively, the tester could measure the obtuse adjacent angle measured between the femur and the tibia. The angle is called popliteal angle. The sum of knee extension angle and popliteal angle is 180 degrees. Same procedure will be continued in the non dominant leg.

### Analytical procedure and methods

#### Data processing

##### Editing

After data collection, the scores were rechecked and compared with the normative scores for accuracy and completeness. It was seen that none of the components were skipped or missed. The obtained informations were only accessible to the researchers.

#### Categorization, Coding and Tabulation of data

All the collected data were analyzed and categorized on the basis of research objectives. Each data were given de-identification code after the data was gathered. Data were tabulated as per the number of responses in master sheet for each test. They were arranged and entered in SPSS-16.0 for further analysis.

#### Data Analysis and Summarization

The raw data collected were analyzed in SPSS-16.0 version for both descriptive and inferential statistics. Frequency distributions

were used to present the demographic information of the participants. Chi-Square test was used to assess the association between low back pain and Hamstring muscle length. After the data analysis, the findings were summarized in accordance to the consultation with the statistician.

**Interpretation of Data**

After careful analysis of the collected data and upon completion of summarizing and drawing conclusions, exploration of their significance was done. Attempts were made to search for their meaning in relation to the conceptual framework, purpose and all research decisions made in developing and implementing the empirical phase of the study and to determine its possibility of generalization, recommendation and application.

**Data Presentation**

The information data was presented in the tables and pie chart.

**RESULT**

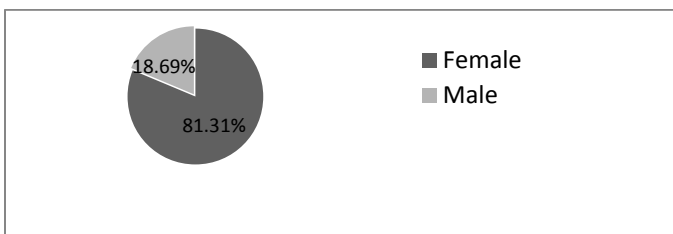
This study deals with the findings of prevalence of hamstring muscle tightness among physiotherapy students of Kathmandu University School of Medical Sciences. All undergraduate physiotherapy students including 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year participated. Total 107 subjects were screened in the study and all of them were included. The analysis and interpretation of the study are presented by addressing each objective of the study. Prevalence of hamstring muscle tightness among the physiotherapy students of KUSMS according to gender and clinical exposure and the association of hamstring muscle tightness with low back pain was analysed.

In Figure 1, among 107 participants, 87 students were female (81.31%) and 20 students were male (18.69%).

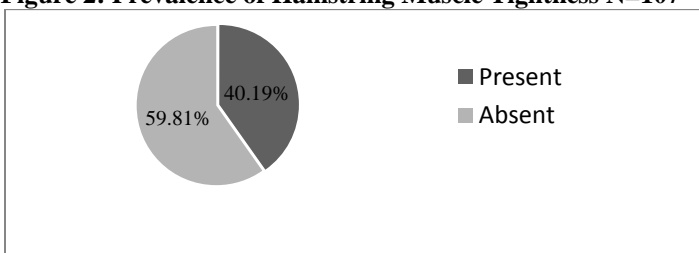
In Figure 2, among 107 students, 40.19% had hamstring muscle tightness and 59.81% did not have tightness.

In Figure 3, among 107 students, 10.3% complained of LBP at the time of questionnaires filling and 89.7 did not complain of LBP.

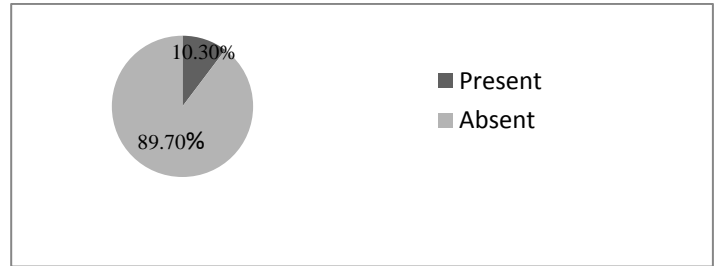
**Figure 1: Gender wise Demographic data N=107**



**Figure 2: Prevalence of Hamstring Muscle Tightness N=107**



**Figure 3: Prevalence of Low Back Pain N=107**



**Table 1: Prevalence of Hamstring Muscle Tightness according to gender**

Gender	Normal Hamstring	Tight Hamstring	Total
Male	7	13	20
Female	57	30	87
Total	64	43	107

Table 1. showed tha Hamstring tightness was seen in 13 male students(65%) and 30 female students(35%) out of total 107 participants. According to the table, the prevalence of hamstring muscle tightness is greater in male compared to female students.

**Table 2: Prevalence of Hamstring Muscle Tightness according to Clinical Exposure**

Exposure	Normal Hamstring	Tight Hamstring	Total
Clinically exposed	24	20	44
Clinically non exposed	40	23	63
Total	64	43	107

Table 2. showed out of 107 participants, 44 were clinically exposed and 63 students were not. Among clinically exposed students, hamstring tightness was seen in 20 students (45.45%) of exposed students and among not exposed students, hamstring tightness was seen in 23 students(36.5%). The prevalence of hamstring muscle tightness was found to be greater in clinically exposed students compared to non exposed students.

**Table 3: Hamstring Muscle Tightness and its association with LBP**

LBP	Normal Hamstring	Tight Hamstring	Total	P-Value
Present	6	5	11	
Absent	58	38	96	
Total	64	43	107	0.707

Table 3. revealed that out of 107 students, 11 students report LBP pain at time of data collection and there was no statistically



significant association found between hamstring muscle tightness and low back pain with p-value 0.707.

## DISCUSSION

Reduction in hamstrings flexibility has been found to be one of the causes for development of low back pain[8]. Hamstring muscle tightness leads to decrease range of motion of lumbar flexion and pelvic tilt[8]. This can alter the biomechanics of lumbar spine and may lead to back pain. Stiffness of one muscle group can cause compensatory movement at an adjoining joint that is controlled by muscles or joints with less stiffness[15].

The result of present study shows that females tend to be more flexible than males of the same age throughout the life. Results also showed that males recorded higher values of hamstring tightness compared to their female counterparts across the age groups (Female=40.48±9.24 Male=49.03±7.50). Our study also showed that the prevalence of hamstring muscle tightness is greater in male compared to female students.

Undergraduate physiotherapy students represent a group of young-adults expected to have a good working knowledge of physical activity and related health benefits[18]. They are expected to promote and prescribe exercise to patients and the general public[17]. But a study done on Physical inactivity among physiotherapy undergraduates shows higher percentage of participants were 'inactive' (48.7%), while only 15.9% were in the 'Highly active' group. Lack of support and encouragement received during childhood to engage in sports activity seems to have played an important role in continuing their exercise behavior through to the adult life. Academic activities were given priority by both parents and teachers[18]. Similar studies among physiotherapy students and physiotherapist conducted in developed countries such as Australia and Latvia, have indicated that majority of the participants were either 'Moderately' or 'Highly' active[17].

It is also predicted that prolonged tight hamstring muscle causes low back pain (Bellew et al, 2010)[19]. But Stutchfield and Coleman (2006) in their study found no association between low back pain and hamstring flexibility while studying university male rowers[8]. Also in a study done by Leino et al (1994) and Hurwitz and Morgenstern (1997), the findings of the study showed no association of hamstring flexibility and low back pain[10, 20] which correlates with the findings of our study.

In one of the studies conducted, 77.9% of the students had LBP at some point in their lives, 66.8% in the last year and 14.4% of them reported they were suffering from LBP at the moment of answering the questionnaire. It is interesting that 37% of LBP worldwide are attributable to occupational risk factor, they observed that patient transfers and repositioning were the main risk factors for LBP. 27% physiotherapy students were reported in one study to have experienced LBP as a direct result of handling patients[12,13].

Due to lack of adequate physical activity, muscle weakness and some degenerative factors like osteoarthritis, senile osteoporosis and degenerative disk disease low back pain occurs in elderly people[20].

Hence routine stretching of the hamstring muscles need to be taught to all age groups, especially before age 30 when the tightness seems to increase greatly[5]. School teachers, especially physical education teachers can help in this condition. Physiotherapists should also include hamstring stretching exercises into the treatment programmes of patients suffering from musculoskeletal disorders of the lower limbs and the lower back. This may reduce the possible contribution of hamstring tightness to these disorders, especially low back pain syndrome.

## Limitations

In this research, Low back pain classification was not described and there was unequal ratio of male and female.

## Conclusion

The present study showed medium prevalence of hamstring muscle tightness (40.17%) among physiotherapy students of KUSMS. The prevalence of hamstring muscle tightness is found to be greater in male compared to female students and there was no statistically significant association between hamstring muscle tightness and low back pain with p-value 0.707.

## Clinical Implications

Stretching once a week shows good result with hamstring flexibility. Therefore routine stretching of the hamstring muscles need to be taught to all age groups, especially before age 30 when the tightness seems to increase greatly.

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