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**ORIGINAL ARTICLE**

**Correlation between hamstring flexibility and back extensors endurance in healthy male college students -A Correlational study**

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**ABSTRACT**

*Lower back pain (LBP) is characterized as discomfort, includes or excludes leg pain, below the costal edge or lower gluteal crease. Mechanical Low back discomfort changes with physical activity or any action and may get worse. Reduced muscle strength in the back and hamstrings is the main result of LBP. The connection between the strength of hamstring and durability of back extensors in healthy male university students is examined in this study. A correlational analysis was taken from Krupanidhi College of institutions with 102 healthy male college students who fulfilled the inclusion parameters. Participants were checked with Biering-Sorensen and Modified sit and reach test. Modified sit and reach tests were used to measure the flexibility of hamstring muscles and lower back muscles. Biering-Sorensen test was used to evaluate the isometric endurance of the trunk extensors muscles. Pearson's correlation coefficient test. According to the study, there is a significant difference between these two tests at a significance level of 0.05. This study concluded that there is a positive but weak correlation between hamstring flexibility and back extensors endurance.*

**Keywords:** Trunk extensors endurance, LBP, hamstring flexibility.

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**INTRODUCTION**

Low back pain (LBP) is defined as pain and stiffness in the shoulder, just down to the coastal side, above the lower gluteal fold, with or without pain referred. Non-specific LBP is automatic as it varies from physical exercise because various postures because gestures may make the discomfort worse [1]. With modern living, the spine became burdened every day by the constant demand for improper postures, prompting a quest for an awareness of how these muscles behave in this circumstance [2]. Approximately 90 percent of individuals recover from an LBP incident at any stage in their life, 50 percent will have a recurring incident and 5–10 percent will acquire recurrent and permanently impaired LBP [3]. LBP is the most prevalent in males aged between 20 and 40 years [4]. Raising flexibility and raising low back agility frequently lead individuals to grow LBP, thus limiting performance. The fourth most popular cause for hospital trips to the United States is low back pain [5]. While optimal spinal alignment training and education is an important element in clinical treatment in non-specific LBP patients the exact connection between spinal posture and LBP remains unclear [6]. At the other side, back-resistance exercise is believed to enhance muscle reactivation and reconditioning. There is growing data to indicate that stability training with back extensors in patients with LBP may be an effective therapy to alleviate discomfort, fatigue, and function failure, and to raise thresholds for exhaustion and physical performance [7].

Muscle stiffness may be associated with musculoskeletal instability. This can lead to specific musculoskeletal conditions and may contribute to back injury. Practical studies have demonstrated that hamstring stiffness influences the rhythm of lumbar and pelvic. Which can interact with shifts in the sagittal curvature of the spine during bending of the neck [8]. Reduced extensibility as a consequence has been shown to raise high rates of abdominal muscle power, low back and hamstring versatility or both

may provide security against pain development [9]. LBP can be linked to decreased muscle capacity in the trunk. Unexpected stress on the trunk muscles may lead to tiredness that eventually leads to loss of control and precision that can tend to lead a person to develop LBP. Therefore, it was proposed that trunk muscle endurance training raise the resistance to tiredness and enhance efficiency during injury [10].

Back extensor muscles are postural muscles that help sustain a standing erect stance and regulate the lumbar leaning inward. Many trials in patients with LBP recorded a substantial decline in back extensor muscle endurance [11]. Lack of back muscle endurance of the trunk has been identified as an indication of the first occurrence of backache problems in people, and as a determining factor between those with LBP experience and those who do not [12]. Low back muscle strength extender is an important factor in high back safety and strength training programs for these muscles are primarily used for lower back recovery, injury prevention, and as part of fitness training programs to improve performance since many people with LBP are understood to have poor back muscles [13]. Flexibility means the tendency of a muscle to lengthen to allow one joint [or more than one joint in a series] to move across a range of motion [14]. Increasing muscular culture is similar to the pelvic ischial tuberosity. The pelvis is considered the foundation of the spine and its anteroposterior position influences the spinal sagittal curvatures [15]. There has always been a strong connection between muscle tightness and joint tightness. It has been stated that during postures that put position such as forward bending, standard hamstring duration should avoid unnecessary lumbar flexion. Mc Gill also found that anterior shearing tension reduces on the spine, and the risk of injury rises. Higher flexibility of the hamstring resulting in decreased lumbar flexion during bending anterior may raise the likelihood of spine injury because of technical stress [3]. Given that forward-leaning is one of the most common motions in everyday activities, shorten hamstrings that increase the likelihood of injury to the spine by physical stress [8].

Lack of hamstring muscle extensibility decreases pelvic strength [16]. Hamstring stiffness is generally presented in the case of patients with LBP conditions, it suggests stretching the hamstring will require additional movement happening over the hip and thereby relieve pressure on the lumbar region [17]. Differences in the sequence of hip and lumbar column movement patterns while progressive moving were suggested as a contributing factor for developing LBP [18]. Often multiple days with various examination types are used to assess hamstring extensibility. Usually, the strength of a joint or a set of joints is defined by the overall range of motion. Consequently, angular tests measuring specifically the hip flexion with the stretched knee (straight leg raise test) or the knee extend the range with the hip bent to 90 degrees (knee extension or popliteal inclination test) were widely regarded as parameter indicators for the extensibility of the hamstring [19]. Specific stability assessments were suggested for testing hamstring strength. Another way of assessing hamstring capacity is the targeted flexibility test. The sit and reach test are a field exercise used to measure hamstring and lower back muscle strength. This factor is included in most well-being-related exercise test batteries as it made us trust that maintaining these two group muscles' versatility will prevent current and reoccurring physical strains and lower back issues, positional instability, gait instability & dropping [20].

There is no scientific proof that low-back flexibility checks suitably for any type of SR. Such field experiments are just small measures of hamstring extensibility. Nonetheless, the hamstring test is also used to examine the extensibility of the hamstring muscle since the steps are quick, simple to perform, involve limited skills instruction, and are especially essential for huge-scale extensibility tests at place [21]. Jackson and Baker explained in their study that exploring the connection among measures of the S-R- test and hamstring parameters and muscles of lower trunk resistance in 13–15 female. Between the SR test and a hamstring Flexible category scale, we consider validity coefficients of  $r$  value was = 0.64 and  $r = 0.28$  relative to a low back flexibility test [20]. The Biering-Sorensen test is a widely used tool to check the extensor back's toughness. Biering-Sorensen has received an intraclass correlation coefficient (ICC) of 0.85 for inter-evaluator research. However, this precision was the product of a heterogeneous sample comprising men and women with a large age range from 20 to 60. Biering-Sorensen's approach is an isometric endurance measure that has proved to be accurate and reliable. The calculation consists of measuring the time the subject will keep his trunk horizontally against the force of gravity while in a prone posture. This position is held over the table with the chest loose of the patient, at the bottom of an exam bench iliac crest point is placed, and the knees, wrists, and buttocks fastened to the floor by braces. An Inclinator is placed in the interscapular region by an elevator to measure variations in the sagittal plane above  $10^\circ$  as such variations are stopped [2]. Low durability by the trunk extensor muscles will cause pressure at the lumbar region surrounding structures, automatically contributing to backache [10]. The need for this research is therefore to figure out the relationship between hamstring strength and back extensor stability in stable male college students. The study's main goal was to examine the associations in safe male college students between hamstring strength and back extensor strength. And

the purpose of the analysis was to achieve hamstring flexibility in cm, back extensors in sec and to compare them.

## MATERIAL AND METHODS

### Methodology:

The present work was performed at Krupanidhi College of physiotherapy, Bangalore, Karnataka. This research was the co-relationship analysis, and a random sampling approach was used to collect data. It had been accepted by the institute's ethics committee.

### Participants:

A total of 130 male participants with the age group of 18-25 years were taken from the Krupanidhi group of the institute, Bangalore. Participants having no case of low back pain in the past or any abdominal/spinal surgeries and with no history of spondylolisthesis, spondylosis and spondylitis were included in the study and participants with any lumbar radiculopathy or any history of the previous fracture were excluded. Out of 130 participants, only 102 participants met the inclusion criteria, and on 102 participants modified sit and reach test and Biering-Sorensen test was performed.

### Outcome Measures:

- Modified sit-and-reach test
- Biering Sorensen test

### Procedure:

This is a cross-sectional empirical analysis that includes 102 healthy male college students, with an 18-25-year age group. All participants received a written consent, and they were informed regarding the research protocol and intent.

### Modified sit and reach test

This test is a standard indicator of muscle versatility, primarily testing caudal region and hamstring muscular versatility. At the foot point, the S-Rs box is rendered with 9 inches (23 cm), such that the toes are registered as 11 inches past two centimeters. Box height is 12 "and box diameter is 12". Subjects were required to take a long sitting pose against a wall, with back and hands. A flexometer was then put against the foot of the participants, thus holding the back straight. Subjects were advised not to jump or move anymore to enter. Change the sliding ruler to insure the 0 marks is at the tips of the finger of the subject. The subject was told to position his hand's side by side and move forward as gradually as necessary (head and shoulders will fall off the wall) holding the fingers parallel with each other and the legs stable as practicable. They were told to hold the maximum reach location for two seconds, and they registered the score (i.e. reach distance). The score to nearest was registered.

### Biering - Sorensen test

This method is the most commonly employed tool for testing the isometric response capacity of trunk extensors' in reported studies. The patient is told to hold the above part isometrically in a horizontal posture with the crossed upper limb over the abdomen. In the period the patient tries to hold the upright body straight and horizontal is registered. The procedure is stopped after 240s, equal to 4 minutes, in patients who have little trouble in keeping the role. The posture followed was the prone pose with the trunk positioned above the table bottom, with the anterior upper iliac spine parallel with the table edge. Ankles, elbows, and pelvis is fastened onto the test table with belts. When such fixations were created the patients had their forearms lying in front of them on a table. When placed a timer was activated and the individual was directed by the evaluator to stay in that place for as long as possible. While the subjects encountered difficulties in keeping the position, the timer was stopped.

## RESULTS AND DISCUSSION

This chapter describes the data collected along with the result of the statistical analysis. Data were analyzed using Pearson's correlation coefficient test.

**Table 1:** Represents correlation between Sit & Reach test and Biering-Sorensen test.

| Correlations   |                     |                        |                             |
|--|---------------------|------------------------|-----------------------------|
|  |                     | Sit And Reach test(cm) | Biering- Sorensen Test(sec) |
| Sit And Reach test(cm)                                     | Pearson Correlation | 1                      | .246*                       |
| Biering-Sorensen Test(sec)                                 | Pearson Correlation | .246*                  | 1                           |
| * Correlation is significant at the 0.05 level (2-tailed). |                     |                        |                             |

The below table shows that out of 102 male college students 73.3% were between the age group of 18-21 and the rest 26.5 % were between the age group of 22 -25 yrs. old.

**Table 2:** Represents demographic feature of the subjects

| Age   |       |           |         |
|-------|-------|-----------|---------|
|       |       | Frequency | Percent |
| Valid | 18-21 | 75        | 73.5    |
|       | 22-25 | 27        | 26.5    |
|       | Total | 102       | 100.0   |

**Table 3:** Represents BMI category of the subjects

| BMI (kg/m2) |               |           |         |
|-------------|---------------|-----------|---------|
|             |               | Frequency | Percent |
| Valid       | Obese         | 2         | 2.0     |
|             | Overweight    | 12        | 11.8    |
|             | Normal Weight | 62        | 60.8    |
|             | Under Weight  | 26        | 25.5    |
|             | Total         | 102       | 100.0   |

The above box represents about at age group between 18 -25 only 2% male subjects are obese, 11.8% male students are overweight and 60% male students were normal weight and 25.5% were found to be underweight. So it can be used as prevalence rate obesity control value for further studies on whether the flexibility of hamstring muscles and weak back extensors are correlated?

The goal of this research was to figure out in healthy male college students the relationship between hamstring strength and endurance of back extensors. In this analysis 102 participants were included according to their baseline assessment. Instead, the strength of their hamstring and durability of the back extensors is measured. And we found that both are positively correlated to each other but have weak relation between them. The Sit and Reach test and Back extensors muscles are affecting each other performance but up to some extent only.

The outcome of this study suggests a favorable association between the versatility of hamstring and stability of back extensors which is also confirmed by NiraliKamani, et al. 2016 [22] recorded that in stable female students, they proved a strong positive association in hamstring strength and trunk extensors durability. Regardless of any underlying disease, other causes may contribute to the creation of loss of hamstring versatility, such as hereditary predisposition, muscle damage, and adaptive shortness. A western, sedentary lifestyle is one of the major sources of apparent postural anomalies in the western community. Extended sitting hours are needed in maximum occupations, & the institutional system will affect soft tissue flexibility, especially two joint muscles.

Sitting for too long is the cause of poor back muscles. This thing we call the human body is simply not made for sitting on a desk, particularly for long hours. The theory is that when we perform a physical work job, our joints and muscles strengthen over time the action as compared to deteriorating due to inactivity, rendering us more vulnerable to damage. Lack of workout & lack of adequate fitness support, lack of relaxation, a back-pain case, constant spinal discomfort, etc.

This also led to weak back muscle endurance O'Sullivan et.al; 2002 [23] research on weak back muscle endurance and associated with increased duration of sitting and decreased physical activity indicating a link between passive slumped sitting postures and reduced back muscle strength. There has always been a strong connection between the tightness of the muscle and joint. It was stated that regular hamstring duration during postures that put location such as forward bending would avoid unnecessary lumbar flexion (Erica N. Johnson et al. 2010) [3].

C.M.Norris et.al; stated in 2005 that stronger hamstring muscles will restrict front pelvic tilt [17]. It claimed as the pelvis front inclination should be minimized as the hamstring binds with ischial tuberosity, so this arrangement swings above as the pelvis start tilting, raising the gap from the hamstring's connection. The action line of the hamstrings, though, is almost vertical, and the contact to the ischial tuberosity is just marginally later than the femoral leg.

Esola et al. In 1996, for patients with LBP, both differences in the lumbar to hip front mobility ratio and increases in hamstring intensity were observed [18]. Felipe Jose Jandre Reis et al., 2015 A research examining the effect of lower hamstring muscles versatility on the trunk and pelvic motion techniques during performing tasks showed that participants along decreased extensibility exhibited advanced amplitude of trunk motion and limitation of pelvic movement while doing the activity [8].

Backbone Extensors are stated as stabilizers. As these groups of muscles are rich with greater-diameter type I muscle fibers, as it is suitable for sustaining decreased levels of operation over long periods [15]. EMG studies, though, suggest the fatigue rate of the paraspinal structures in LBP patients is greater than that of symptomless subjects. Investigators concluded that lower muscular ability present in people with LBP for multiple reasons such as elevated muscular metabolite levels resulting since long time muscular tension and spasm, a greater percentage of Type II muscle fibers in paraspinal, deconditioning, impaired muscle regulation, and irregular allocation of back extender muscular strength, restraint & atrophies [11].

### LIMITATIONS

A person with a sedentary lifestyle cannot perform back extensor endurance test effectively. The person with less physical fitness cannot perform back extensors endurance test effectively though the hamstring is not tight. Obesity may affect the back-extensor endurance, but body mass index is not taken into correlation in this study. A person with thoracolumbar fascia tightness may not perform the modified sit & reach test effectively. A person with low back pain may not back extensor endurance test because of this test the back pain may increase. Height and weight are not considered in collecting data so it may be possible that subjects with short height and abdominal obesity may scoreless.

### CLINICAL IMPLICATION

There is a slight connection between flexibility on the hamstring and stability on the back extensors. So, the tightness of the hamstring may alter the endurance of the back extensors. This can trigger discomfort in the back. The study indicates weak flexibility in the hamstring and stability in the back extensor can contribute to low back pain. It provides the researchers with the framework for determining a recovery strategy to boost the stability of the hamstring and the resilience of the extensor back.

### CONCLUSIONS

This study shows that there is positive but weak co-relation among hamstring flexibility & back extensors endurance. This imbalance may cause LBP. So, the result of this study interprets in favor of the hypothesis.

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