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Research Paper

Influence Of Leg – Body Ratio on Nordic Hamstring Strength Test in Football Players – A Criterion Validity Study

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ABSTRACT
BACKGROUND: *Hamstring injury is most common in sports especially in football players, due to over force and acting of muscle in both open and closed kinematics. Based on previous studies Nordic hamstring strength exercises prevent hamstring injuries.* ***OBJECTIVE:*** *This study aims to find whether the leg-body ratio will have any impact on the Nordic hamstring strength test or not.* ***STUDY DESIGN:*** *Correlational study design.* ***SUBJECT:*** *50 subjects were selected football players. They received training 5 times and one official match per week and are semi-professional football players.* ***PROCEDURE:*** *A video-based Nordic hamstring strength test is performed on participants to analyze the Nordic break point angle (Eccentric mode). In Isometric mode, the tester stabilized the player on plantarflexed ankles at 20º. The video-based hamstring strength test is reliable and valid to measure eccentric hamstring strength among football players and it is less time-consuming it could be carried out in clinics or training grounds.* ***OUTCOME MEASURES****: Dartfish analysis software.* ***RESULTS:*** *The result of this study shows that* ***l****eg body ratio and both isometric and eccentric Nordic hamstring strength tests as a positive correlation.* ***CONCLUSION:*** *There is a positive correlation between the Leg body ratio in isometric and eccentric Nordic hamstring strength tests****.***

KEYWORDS: *Nordic hamstring strength, Leg body ratio, Dartfish Performance analysis.*

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I. INTRODUCTION

The hamstring muscle is most important for sports1and the most commonly injured in football is known as hamstring strain injury (HSI). During kicking in football the hamstring muscles lengthening in both hip and knee and muscle involves high activities in both open and closed kinematics and leads to HSI2.

It is mainly due to maximal running, kicking, and increasing speed like dashing3.

According to a recent study, hamstring muscle injury is more common than ankle sprains4. In the last 8-10 years hamstring becomes one of the most frequent sports injuries, particularly in football5.

The main causes are poor muscle flexibility, muscle fatigue, and lack of warm-up9. During running hamstring muscle activity is increased in the late swing phase, here the muscles work eccentrically to decrease the forward movement of the leg and also during foot strike, from eccentric to concentric muscle action. It is analyzed by electromyogram(EMG)10. It is concluded that the increased eccentric activity will cause muscle tendon injury11.

The reliability of a measurement tool is fundamental for an investigator to ensure quality and draw meaning from a study's data, such as determining the impact of a training program.

Even tools proven by use may not be considered reliable in some specific situations, such as when used in a particular population with special needs, or when one of the test parameters is changed (for instance, the movement speed). Maximal and submaximal strength tests are broadly used, but there are only a few investigations to prove their reliability, both inter and intra-tester.

Previous prospective cohort studies investigating hamstring muscle strength were done through an isokinetic dynamometer to predict the strength ratio as a risk factor for hamstring strain injury.

But isokinetic dynamometry is limited by various factors like time, cost, and lack of portability of the device, and players also get delayed onset muscle soreness (**DOMS)** after the test7.

Due to the above drawbacks, the clinical applicability of this method is limited for amateur and semi-professional players7.

Few field-based studies have proposed alternating measurement tools to identify hamstring injury risk factors. The measure includes hamstring eccentric strength, strength endurance, and isometric hamstring strength7.

A previous study based on a Nordic hamstring exercise as a field-based assessment of eccentric hamstring strength called Nordic Hamstring strength test – A video-based analysis7.

Compare to Isokinetic dynamometry, the video-based Nordic hamstring strength test is a moderately reliable and valid field-based assessment for football players7.

AIM OF THE STUDY

This study aims to find whether the leg-body ratio will have any impact on the Nordic hamstring strength test or not.

NEED FOR THE STUDY

The video-based hamstring strength test is reliable and valid to measure eccentric and isometric hamstring strength among football players and it is less time-consuming it could be carried out in clinics or training grounds7. But still considered a reliable tool to measure the hamstring test, certain criteria like torso and leg length (Leg-body ratio) will impact it or not. In this study as we are hypothesizing whether might the leg-body ratio will influence the Nordic hamstring strength test or not, so we intended to analyze it.

II. METHODOLOGY

STUDY DESIGN: Correlational study design
STUDY TYPE:
Observational
SAMPLE METHOD: Convenient sampling
SAMPLE SIZE: 50 samples
STUDY DURATION:
6 weeks
STUDY SETTING:
Football clubs, in and around Chennai.

INCLUSION CRITERIA

Gender: Male
Age group: 18 – 24
BMI ranges from 19 to 25 kg/m2
Participating at least 2 days per week
Semi-professional football players
Players who are all willing for this test.

EXCLUSION CRITERIA

Those who had hamstring injuries for the past 6 months.
Recent fractures
Upper limb injuries.

PROCEDURE AND MEASUREMENTS

LEG–BODY RATIO:

The players with bare feet stand upright against the wall, then measurements were taken from the top of their heads to the floor by using a stadiometer. Then the players were asked to sit in a chair, and torso length was measured from their head to the level of a chair seat. The player's torso length is subtracted from his total length to identify his leg length measurement

Example: If a person's torso is 40 inches and their leg is 30 inches then leg – the body ratio (LBR) is
40: 30 Reduce this to the lowest term by dividing both numbers into 10. LBR is 4 : 3

NORDIC HAMSTRING TEST:

The video-based hamstring strength test is based on Nordic hamstring exercises. The eccentric hamstring strength test protocol was based on previous studies. An explanation of the test is demonstrated by video to players and trials are provided. Three reflective markers were placed on the greater trochanter, femoral condyle, and lateral malleolus to calculate the angles. The players were instructed to wear minimal clothes to avoid restriction and movement of markers. The players started with a kneeling position on the yoga mat and the tester should hold tightly to his plantarflexed ankles.

The players were instructed to lean forward with an extension of the back and hips and instructed to use their arms while landing. Nordic break point angle is an angle between the line joining the hip with knee markers and the initial vertical position of players. Based on previous studies Nordic break point angle is measured by visual inspection, the time that the participants could not withstand the force of fall from the Nordic hamstring exercise was estimated and it is calculated for eccentric mode. In isometric mode, the tester stabilized the player on plantarflexed ankles at 20º.

Players were captured on video and camera set 3m away and 0.5 from the floor based on previous studies. The video clips were digitalized and analyzed by motion analysis software (Dartfish motion analysis software) the current motion analysis protocol was based on previous studies. To minimize the maximum errors excluded the eccentric exertion of hamstring groups at 120º/s. Before each assessment, the players performed submaximal trials to familiarize themselves with the protocol. The tester encouraged to participants.

Figure 1
The player performs an isometric Nordic hamstring strength test. A tester stabilizes the player's leg by pressing on plantar-flexed ankles.

Figure 2
The player performs an eccentric Nordic hamstring strength test. A tester stabilizes the player's leg by pressing on plantar-flexed ankles.

OUTCOME MEASURES

Dartfish analysis software
Stadiometer

DATA ANALYSIS

The statistical analysis was done by using the statistical package for social science IBM (SPSS) VERSION 22. Pearson correlation was used to correlate the Leg body ratio in the Nordic hamstring strength test.

TABLE 1CORRELATION OF LEG BODY RATIO IN ISOMETRIC NORDIC HAMSTRING STRENGTH TEST

	MEAN	STANDARD DEVIATION	N	r VALUE	p VALUE
LEG BODY RATIO	1.0166	.05655	50	-.803	.000
ISOMETRIC	9.2894	.88280	50		

The above table shows the Leg body ratio mean value of 1.0166 and its standard deviation is .05655 and the Isometric mean value is 9.2894 and its standard deviation is 2.166.The r value is -.803** and the p-value is <.000 it is statistically significant.

GRAPH 1SHOWS CORRELATION BETWEEN LEG-BODY RATIO AND ISOMETRIC NORDIC HAMSTRING STRENGTH TEST

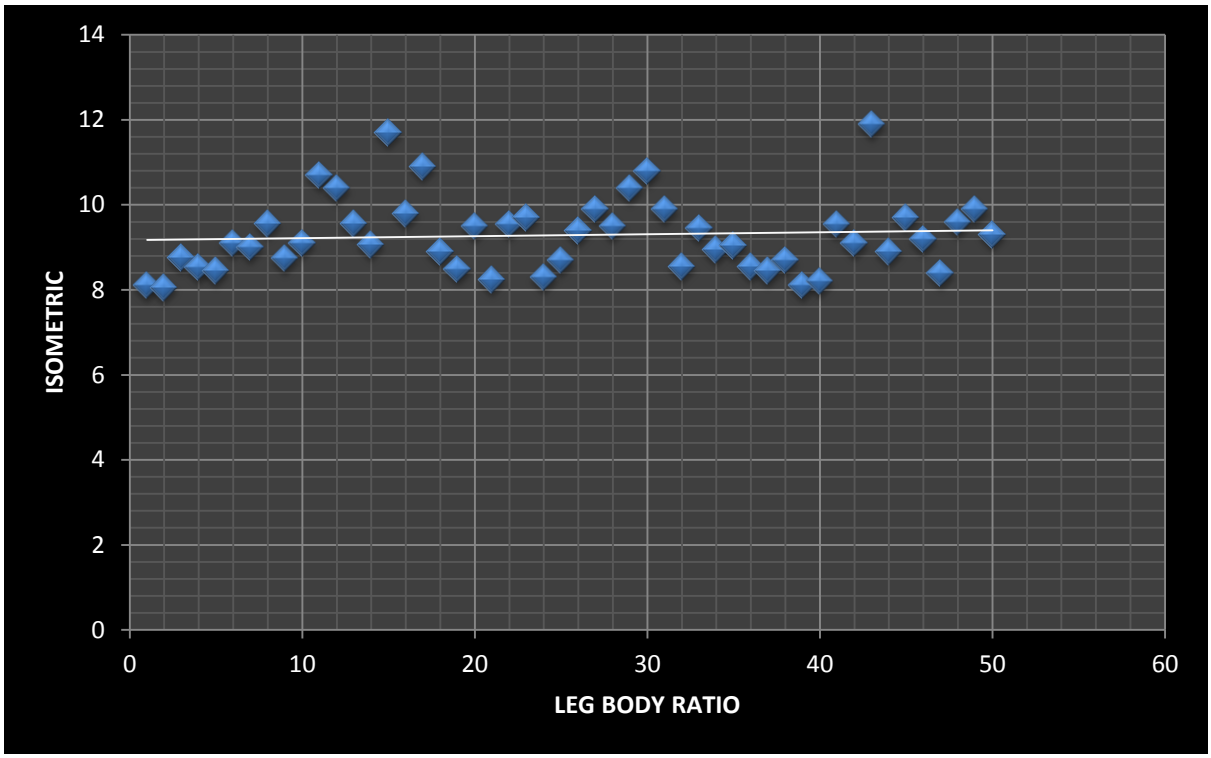
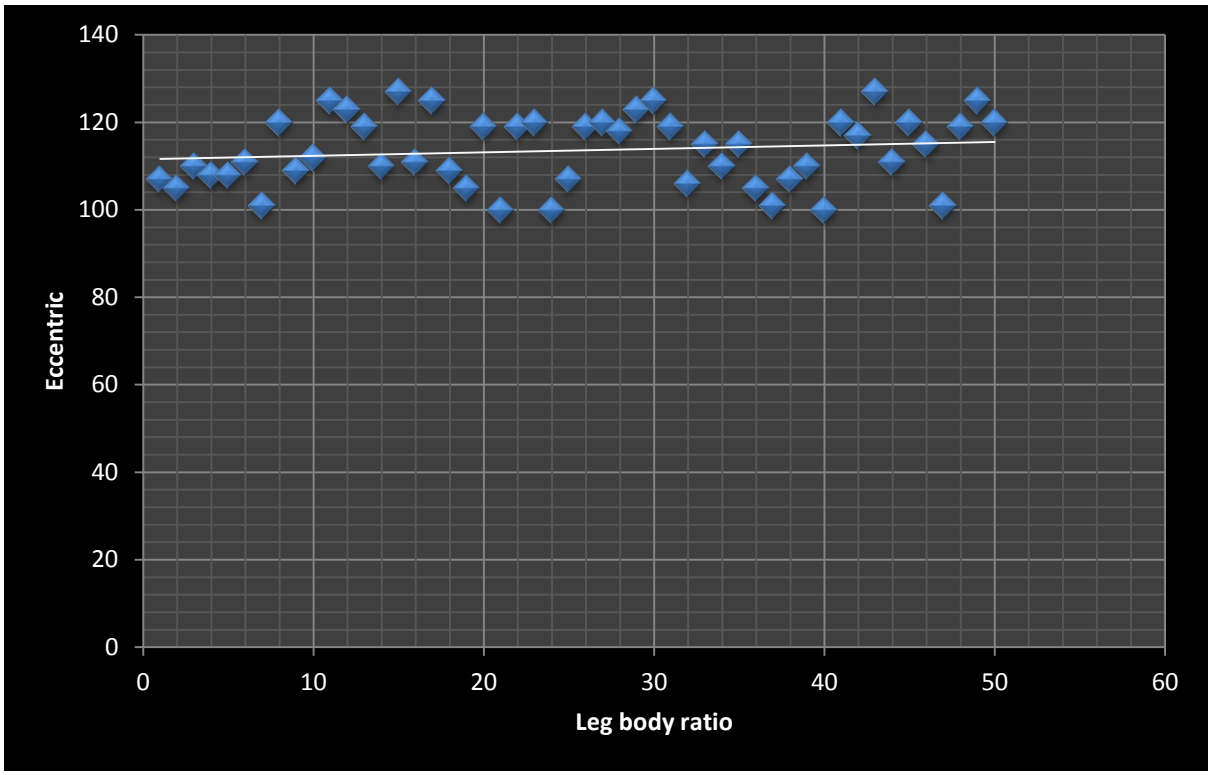


TABLE 2CORRELATION OF LEG BODY RATIO IN ISOMETRIC NORDIC HAMSTRING STRENGTH TEST

	MEAN	STANDARD DEVIATION	N	r VALUE	p VALUE
LEG BODY RATIO	1.0166	.05655	50		
ISOMETRIC	113.5600	7.99786	50	-.709	.000

The above table shows the Leg body ratio mean value of 1.0166 and its standard deviation is 0.5655 and the Eccentric mean value is 113.5600 and its standard deviation is 7.99786. The r value is - .70988 and p value is < .000 it is statistically proven.

GRAPH 2SHOWS A CORRELATION BETWEEN LEG-BODY RATIO AND ECCENTRIC NORDIC HAMSTRING STRENGTH TEST



III. RESULTS

Table 1 and graph 1 show that leg body ratio and isometric Nordic hamstring strength test values show a positive correlation with n = 50, the mean for leg body ratio is 1.0166, and the standard deviation is .05655. The mean for the isometric Nordic hamstring strength test is 9.2894 and the standard deviation is .88280.

Table 2 and graph 2 show that leg body ratio and eccentric Nordic hamstring strength test values show a positive correlation with n = 50, the mean for leg body ratio is 1.0166, and the standard deviation is .05655. The mean for the eccentric Nordic hamstring strength test is 113.5600 and the standard deviation is 7.99786.

IV. DISCUSSION

This study focuses on the influence of the Leg body ratio on the Nordic hamstring strength test within the inclusion criteria of division football players. They received training 5 times and one official match per week for those who are semiprofessional football players exclusion criteria are:
· Those who had hamstring injury less than 6 months before testing.
· Prolonged hamstring problems such as discomfort, recent fractures, ankle injuries, and upper limb injuries.

A previous study concluded that measuring the Nordic break–point angle in the video-based hamstring strength test is moderately reliable and valid among football players and this study was done to find any correlation exists between Leg body ratio and isometric, eccentric hamstring strength of football players.

The study of the Leg body ratio and isometric hamstring strength test **r value -.803**** and **p-value .000**, and the Leg body ratio and eccentric hamstring strength test **r value -.709**** and p-value **.000** results positive correlation. Hence we have concluded from this study that as the Leg body ratio increase, the Nordic strength also increases.

Newham DJ, Jones DA, Ghosh G, and Aurora P concluded that there is a length-dependent component in the development of pain and fatigue after eccentric exercise, which had previously been thought to be caused solely by high force generation.

Justin W.Y.LeeChengLiPatrickS.H.YungKai-MingChan, the author reveals in their study, if an individual maintains 30º forward flexion in Nordic hamstring exercise, the strong performance of ham string was good and results in no association between such ability and increased risk of HSI.

Eccentric strengthening changed the muscle architecture of the human biceps femoris and consequently, the knee range of motion. This is the first report of an increase in fascicle lengthening in the biceps femoris following eccentric resistance training. In addition, the results might imply that this fascicle lengthening could lead to an increase in the range of motion of the knee12.
Hamstring injuries are a common and often debilitating occurrence among athletes demanding eccentric maneuvers. Some studies suggest that poor eccentric hamstring strength is a predisposing element to hamstring injuries. Eccentric muscle actions are capable of producing higher force. The greater the muscle strength, the greater the muscle stiffness. Increasing muscle strength may increase resistance muscle resistance to elongation to prevent muscle from being overstretched, this particular can prevent injury during kicking.
P Nande et al., 2008 did a study comparing male and female athletes according to anthropometric profiles and found that the persons with more height, their performance is higher than those with fewer height athletes.
Hence it is concluded that the leg-body ratio influences the Nordic hamstring strength test.

V. CONCLUSION

The study concluded the positive correlation of Leg body ratio in isometric and eccentric Nordic hamstring strength tests.

VI. LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS

- The data output was not instant but according to the duration of the test is not problematic.
- Small sample size.
- Only male samples were included in the study.

RECOMMENDATIONS

- This study can be conducted with all age groups of both genders with different BMI ranges.
- 3D analysis can be done in different types of sports.

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