



## STRATEGY OF MUSCLES RELAXATION OF MALE AND FEMALE IN DIFFERENT GAMES

DR. B. ASHOK KUMAR <sup>1</sup>

<sup>1</sup> ASSISTANT PROFESSOR, DIRECTOR OF PHYSICAL EDUCATION, RAJA DORAISINGAM GOVT ARTS COLLEGE SIVAGANGAI.

### ABSTRACT:

**Background:** Many static and dynamic tests have been used in sports and clinical settings to assess hamstring muscle flexibility. However no or very less documented research is available to find relationship between the two of otherwise commonly used tests like passive straight leg raise(PSLR) and V-sit and reach(VSR) test results. **Objective:** To document relationship between PSLR and VSR results in measuring hamstring flexibility. **Study Design:** Co relational design. **Methodology:** 142 healthy adult females aged between 18-25 (out of 150) years were short listed on the basis of inclusion criteria. They were then explained the procedure of the study. The mean of three readings for both PSLR (dominant lower limb) and VSR were taken and co related using descriptive and inferential statistics and Graph Pad In stat version 3.05. **Results:** The results of this study indicated a significant relationship between the VSR and SLR, for the right ( $r = 0.5757$ ,  $p < 0.0001$ ) and left lower limbs ( $r = 0.4666$ ,  $p < 0.0001$ ). **Conclusion:** Concluding that VSR and PSLR results are positively correlated, it is recommended that the VSR test can be used as a clinical diagnostic tool in assessing hamstring flexibility.

### KEYWORDS:

PSLR, VSR, HAMSTRING FLEXIBILITY.

### 1. INTRODUCTION

Flexibility comes from a Latin term *flexibilis* which simply means "to bend." Flexibility is defined as the ability of a joint to move through a full range of movement.<sup>1</sup>This property of the musculoskeletal system can be examined by two kinds of biomechanical measurements: Static flexibility and Dynamic Flexibility. Static flexibility is a clinical measurement that defines the amount of motion at a joint or group of joints. Dynamic flexibility refers to the increase in resistance with muscle elongation for a given range of motion and can be quantified in terms of stiffness.<sup>2</sup>Adequate flexibility is an important characteristic of physical and health related fitness.<sup>4</sup> Assessments of flexibility measure the ability of a of skeletal muscle and tendon to lengthen. Flexibility really depends on the soft tissues (muscle, tendon, ligaments) of a joint rather than the bony structure.<sup>3</sup>Flexibility and stretching comprise what can essentially be recognized as the cornerstone of injury prevention, muscle recovery, and increased mobility for exercise enthusiasts.<sup>3</sup> Lack of hamstring flexibility has been associated with low back pain, postural deviations, gait limitations, risk of falling, susceptibility to musculoskeletal injuries.<sup>4</sup>Because of the importance of flexibility, fitness and sports medicine professionals typically assess an individual level of flexibility before prescribing an exercise, sports training, or physical rehabilitation programme.<sup>5</sup>

There are a number of factors that can influence a person's flexibility, including: Genetics, Connective tissue elasticity, Strength of opposing muscle groups, Gender, Age, Activity level and Previous injuries.<sup>1</sup>Inflexible muscle could make

the musculotendinous unit susceptible to injury<sup>6</sup>, especially in two joints muscles like hamstring.<sup>7</sup> Muscle flexibility is generally measured by the joint range of motion (ROM)<sup>8</sup>

#### 1.1 HAMSTRING MUSCLE

The hamstring muscles are the group of three muscles including semimembranosus, semitendinosus and biceps femoris, which originates at the pelvis, attaching at the ischium attaching to the fibula and tibia.<sup>9</sup>The hamstrings cross and act upon two joints – the hip and the knee. Semitendinosus and semimembranosus extend the hip when the trunk is fixed; they also flex the knee and medially (inwardly) rotate the lower leg when the knee is bent. The long head of the biceps femoris extends the hip as when beginning to walk; both short and long heads flex the knee and laterally (outwardly) rotates the lower leg when the knee is bent.

The hamstrings play a crucial role in many daily activities, such as walking, running, jumping, and controlling some movement in the trunk. In walking, they are most important as an antagonist to the quadriceps in the deceleration of knee extension.<sup>9</sup> Hamstring Muscle Length (HML) differed significantly between genders, females demonstrating greater flexibility than their male counterparts.<sup>10, 16</sup>

Factors that are also responsible for the frequent strains observed in the hamstring muscle are:

1. Lumbo-pelvic pathology or imbalance
2. Inadequate muscle flexibility
3. Imbalance in Q:H Strength ratio

#### 4. Faulty running mechanics<sup>11</sup>

Hamstring muscles flexibility is an important aspect of a treatment program aimed at decreasing the likelihood of hamstring muscles injury.<sup>12</sup> Static flexibility tests are used, which are based on linear and angular measures of the motion of a joint or group of joints measured by goniometers and inclinometers. Commonly accepted field tests of static flexibility include, among others, the sit and reach test, which evaluates combined flexibility of the lower back and hips, and the supine straight leg flexion test, which evaluates hamstring and hip flexor flexibility.<sup>2</sup>

#### 1.2 STRAIGHT LEG RAISE TEST

The straight leg raise (SLR) test is widely reported in the literature as useful for indicating hamstring muscle length and diagnosing sciatica and nerve root irritation. Several variations of this test have been developed to assist in the diagnostic process like passive ankle dorsiflexion. Added near the limit of pain free SLR, to put tension on the sciatic nerve and its roots. In the absence of nerve root irritation, however, passive ankle dorsiflexion has been shown to limit SLR.<sup>13</sup> Although the SLR test is most often described as a passive test, it is sometimes performed actively.

Active testing may be preferred over passive because the force applied to the hamstring muscles during active SLR may be more constant from test to test<sup>14</sup>. When passive tests are used to assess muscle length and joint angles, the results obtained are partially dependent on the force that is applied during measurement.<sup>13</sup>

The straight leg raise (SLR) test has been found in studies to have prevalent acceptance as a criterion measure for hamstrings flexibility over the Active Knee Extension (AKE) test due to the simplicity and ease of use in clinical measurement of hamstrings flexibility as compared to AKET.<sup>11</sup>

Ligamentous constraints and bony congruencies also limit motions depending on the joint and the motion being tested. For more static flexibility tests, the limits of motion are determined by the participant's tolerance of stretched position hence they are not truly objective measures of flexibility.

#### 1.3 SIT AND REACH TEST

The sit and reach (SR) test is a field test used to measure hamstring and low back flexibility. This test is present in most health related fitness test batteries because it is believed that maintaining hamstring and low back flexibility may prevent acute and chronic musculoskeletal injuries and low back problems, postural deviations, gait limitations, and risk of falling<sup>4,11</sup>. There is little research evidence that any kind of SR adequately measures low-back flexibility. Such field measures are only moderate indicators of hamstring extensibility. However, the SRs are frequently used to evaluate the hamstring muscle extensibility because the procedures are simple, easy to administer, require minimal skills training and are particularly useful in large scale extensibility evaluation in the field setting.

#### 11

Types of Sit-and-Reach Tests: Sit-and-reach test (SR); V sit-and-reach test (VSR); Chair sit and reach test (CSR); Back saver sit-and-reach test (BS); Modified back saver sit-and-reach test:

Regardless of the minor differences in administration procedures, participant postures, and the equipment used in various sit-and-reach test protocols, the literature agreed that sit- reach test produced

some validity in hamstring flexibility assessment but poor validity as a measure of

lower back flexibility.<sup>15</sup> The simultaneously stretching both hamstrings in the classical sit-and-reach test may result in excessive posterior disc compression due to the anterior portions of the vertebrae being pressed together.<sup>16</sup> There is however a paucity of documented studies examining the direct relationship between V sit and reach and the straight leg raise tests, which are used to measure hamstring flexibility.<sup>17</sup> There seems to be a lack of homogeneity in some of these studies.<sup>11</sup> This study therefore looked into the relationship between hamstring flexibility scores obtained by V sit-and-reach and straight leg raise tests.

To find out the relationship between straight leg raising test and V sit and reach test in measuring hamstring flexibility.

## 2. METHODOLOGY

### 2.1 SAMPLE

A total of 150 female participants were selected by convenient sampling method for the study on the basis of inclusion and exclusion criteria. The age ranged of the subjects was 18 to 25 years. Body mass Index of the female participant was between 19-22 kg. The subjects suffering from soft tissue injuries of lower limb, Fractures/ Dislocations., Hyper-mobility of lower limb joint. Muscle imbalance of lower limb and low back pain in last 2 month were excluded from the study.

### 2.2 TESTING PROCEDURE

On the basis of inclusion criteria, 150 females were selected for the study. After taking their consent 142 subjects (8 dropped out) were finalized for the study. Following the warm up protocol, subjects were asked to perform three trials of PSLR (left and right leg) and VSR test in randomized order and the average of each test was used for the data analysis. The subjects were allowed for rest for 5min between tests.

#### 2.2.1 PASSIVE STRAIGHT LEG RAISE TEST

Subject lies supine on the plinth.. Subject's leg was passively moved with into hip flexion ,with knee extended, until tightness was felt. At this point, angle between the stationary and movable arms of the goniometer was noted and recorded in degrees as a measure of the flexibility of the hamstring muscle<sup>12</sup>, by placing axis of the goniometer aligned to the axis of the hip. The stationary arm was positioned in line with the trunk and the movable arm in

line with the femur.

**2.2.2 V-SIT AND REACH TEST**

Mark a straight line two feet long on the floor as the baseline. Draw a measuring line perpendicular to the midpoint of the baseline extending two feet on each side and marked off in half-inches. The point where the baseline and measuring line intersect is the "0" point. Subjects sits on floor with measuring line between legs and soles of feet placed immediately behind baseline, heels 8-12" apart and clasps thumbs so that hands are together, palms down and places them on measuring line. With the legs held flat by a partner, subject slowly reaches forward as far as possible, keeping fingers on baseline and feet flexed. After three practice tries, she holds the fourth reach for three seconds while that distance is recorded. Legs must remain straight with soles of feet held perpendicular to the floor (feet flexed). Subjects should be encouraged to reach slowly rather than "bounce" while stretching. Scores, recorded to the nearest half inch, are read as plus scores for reaches beyond baseline, minus scores for reaches behind baseline.



Figure 1 : Measurement of VSR test

**3. RESULTS**

Descriptive statistics of mean, range and standard deviation was used for all the variables measured. Inferential statistics of Pearson product moment correlation was used to determine the relationship between V-sit and reach test and the criterion goniometric measurement (SLR test) for both right and left lower limbs using the Graph pad Instat version 3.05.

**TABLE 1  
DESCRIPTIVE STATISTICS OF PHYSICAL CHARACTERISTICS OF PARTICIPANTS**

1	VARIABLES	MEAN± SD
2	AGE(YEARS)	21.5±2.44
3	HEIGHT(CMS)	160.7±5.6
4	WEIGHT(KG)	56.5±4.18
5	BMI	21.96±0.71

**TABLE 2  
SHOWING MEANS AND RANGE OF SLR1 AND V-SIT AND REACH TEST.**

	MEAN	RANGE	P-VALUE
SLRrt(□)	94.37	75-115	<0.0001

V-SIT AND REACH TEST(cm)	h0.852	-7.2-8.1	
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**TABLE 3  
SHOWING MEANS AND RANGE OF SLR2 AND V-SIT AND REACH TEST.**

SR. NO	MEAN	RANGE	P-VALUE
SLRlt(□)	82.54	65-105	<0.0001
V-SIT AND REACH TEST(cm)	0.852	-7.2-8.1	

**TABLE 4  
SHOWING VARIATIONS IN READINGS OF STRAIGHT LEG RAISE TEST BETWEEN DOMINANT AND NON DOMINANT SIDE.**

	MEAN	SD	RANGE	P-VALUE
SLR(RIGHT LEG)	94.37	7.36	75-115	<0.0001
SLR(LEFT LEG)	82.54	7.99	65-105	<0.0001

**4. DISCUSSION**

The purpose of this study was to determine the correlation between hamstring flexibility scores obtained by the VSR and SLR tests. The results of this study indicated a significant relationship between the VSR and SLR, for the right ( $r = 0.5757, p < 0.0001$ ) and left lower limbs ( $r = 0.4666, p < 0.0001$ ) as strongly supported by Domholdt (2000), while the result obtained in the study of Baltaci et al (2002) showed moderate correlation coefficient

James W. Youdas, David A. Krause, Edward Laskowski<sup>10</sup> supports that there is a statistically significant effect of gender on HML, with women having more HML than their male counterparts for both dependent measures examined in the study. In contrast a study of comparison of hamstring quadriceps muscle strength ratio across the age groups by Jaiyesimi ao, Jegedeja relieved no significant gender difference was found among the subjects in the age groups 11-20 years and 41-60 years but in the age group 21-40 years the male subjects had a significantly higher Hamstring Quadriceps strength ratio than their female counterparts. Denise M. Cameron, Richard W. Bohannon, Steven V. Owen<sup>13</sup> stated that although the SLR test is most often described as a passive test, it is sometimes performed actively. Active testing may be preferred over passive because the force applied to the hamstring muscles during active SLR may be more constant from test to test<sup>15</sup>. When passive tests are used to assess muscle length and joint angles, the results obtained are partially dependent on the force that is applied during measurement. Baltaci, G., Un N., Tunay, V., Besler, A. & Gerceker, S. (2002)<sup>19</sup> stated that the straight leg raise (SLR) test has been found in studies to have prevalent acceptance as a criterion measure for hamstrings flexibility over the Active Knee Extension (AKE) test due to the simplicity and ease of use in clinical measurement of hamstrings flexibility as compared to AKET. However, like

most static flexibility tests, both the SLR and AKE tests are thought to be limited by the extensibility of the hamstring muscle. Due to the belief that maintaining hamstring and low back flexibility may prevent low back pain syndrome, sit and reach test becomes one of the most important common field test in physical fitness batteries to evaluate the flexibility of subjects. In this connection, many studies regarding the validity and reliability of sit and reach test were reported and a number of sit and reach test protocols were proposed. Often test administrator desires to select a test that allows greatest validity and reliability within the least discomfort to subjects by Stanley sai-chuen hui and pak y. yuen.<sup>17</sup> Modified versions of the Sit-and-reach test include a V sit-and-reach test and the Hoeger and Hopkins 20 modified sit-and-reach test. When the criterion-related validity of the various forms of sit-and-reach tests were compared for men, the modified back-saver sit-and-reach and the classical sit- and-reach but yielded as the V sit-and-reach. This is probably due to the horizontal trunk position when performing the MBBS and V sit and reach tests without the use of sit and reach box.

Regardless of the minor differences in administration procedures, participant postures, and the equipment used in various sit-and-reach test protocols, the literature agreed that sit- and- reach tests produced moderate validity in hamstring flexibility assessment but poor validity as a measure of lower back flexibility Martin, Jackson, Morrow, & Liemohn,. Warmbrodt stated that the sit-andreach test favors people with long arms in relation to their legs. Some investigators actually do believe long arms and legs are an advantage when performing the sit-and-reach test (1999). While other investigators have found that longer limb-length in a person does not favor greater results in the sit-and-reach test (1999). The forward reach score is the sum of anthropometric factors, scapular abduction, spine and hip flexion.

A study by Hui et al indicated that arm leg length discrepancies (Hoeger et al, ; Hopkins and Hoeger, )<sup>20</sup> and shoulder and scapula flexibility may play a role in allowing some individuals to achieve higher forward reach scores on SR and modify the concurrent validity. However, other studies found little association between anthropometric characteristics and forward reach score. In contrast, the norm referenced Passive Straight Leg Raise Test, described previously, allows the test administrator to assess the hamstring separately from the lumbar extensor musculature. It is anticipated that this test will provide exercise physiologists and physical educators with a reliable alternative to the Sit-and-Reach Test when assessing the hamstring flexibility.

## 5. CONCLUSION

The study concludes that V sit-and-reach test has a positive relationship with the criterion goniometric measure (SLR) for hamstring muscle flexibility. It is however less comfortable for individuals who have problems sitting with legs fully extended. Based on the findings of this study, it is recommended that the V sit-and-

reach test can be used by Physiotherapists, Physical Educationists, Athletic trainers and others involved in sports in assessment of hamstring flexibility in young adults, since it has high correlation coefficient with the criterion goniometric measure.

## 6. LIMITATIONS

Only female subjects were included in the sample. Data was collected from limited geographical area.

## 7. FUTURE SCOPE

Further research on therapeutic use of VSR can be done in athletic training and subjective upper limb reach can also be taken into account.

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