Normative Values Of Strength Of Hip Adductors In Runners Assessed By Using Pressure Biofeedback Unit

Krupa H Mehta [*], Smitul S Parmar [**], Dinesh M Sorani [***], Sheshna R Rathod [****]

*First year MPT student, **Second year MPT student, *** I/C Principal ****Tutor/Physiotherapist,
Government Physiotherapy College, Rameshwernagar, Jamnagar, Gujarat, India

Abstract: Background: Muscle strength measurement is a key component of physiotherapists' assessment and is frequently used as an outcome measure. A pressure biofeedback unit can be potentially used as a tool to assess hip isometric muscle strength. Objectives: This study was designed to establish normative adductor squeeze test (AST) values in runners and investigate strength of adductor muscles during the performance of the thigh adductor squeeze test at 0°, 45°, and 90° of hip flexion. Material And Methods: A total of 51 healthy runners aged 23-27 years participated. Each participant performed 3 trials of the thigh adductor squeeze test in the three positions at 0°, 45°, and 90° of hip flexion. Pressure biofeedback unit was used to assess the strength of hip adductor muscles. Strength of the adductors was measured as the maximum pressure that was achieved by the subject from 10 mm Hg. Result: Mean strength is 103.05 ± 23.05 mmHg at 0° hip flexion, 141.03 ± 24.31 mmHg at 45° hip flexion and 134.86 ± 22.83 mmHg at 90° hip flexion position. Conclusion: The results of the present study suggest that the 45° of hip flexion test position is the optimal thigh adductor squeeze test position. [Mehta K Natl J Integr Res Med, 2019; 10(6):6-10]

Key Words: Adductor squeeze test, Hip adductors, Muscle strength, Pressure biofeedback unit.

Author for correspondence: Krupa H Mehta, Government Physiotherapy College, Jamnagar, Gujarat, India.
Email: krupahmehta@gmail.com. Mobile: 9428463528

Introduction: Running is one of the most popular leisure activities. Next to its beneficial health effects, there are negative side effects in terms of injuries. Groin pain is a common problem in runners. Groin injuries are common complaints in team sports such as soccer, rugby, and Australian rules football [1] that involve kicking, sprinting, and twisting movements, as these are actions that can overload numerous anatomical structures in the area [2]

The hip adductors are continuously active throughout running gait and function to stabilize the pelvis (with respect to the thigh) during stance and vice versa during swing phases, respectively. It has been reported that bilateral adductor muscle strength is reduced in the period proceeding and during the onset of groin pain. Moreover, differences in the motor control strategies employed by athletes with chronic groin pain may cause inefficient load transfer and altered stress to be attenuated across the pubic symphysis and the development of pain and other associated symptoms in regions such as the lumbar spine and sacroiliac joint [3]

Measurement of hip isometric muscle strength is commonly used by physiotherapists, both as a diagnostic tool and as an evaluative outcome measure for patients [4,5] . Methods that physiotherapists utilize to assess hip isometric muscle strength include manual muscle testing (MMT), handheld dynamometry (HHD) and sphygmomanometer.

MMT is a commonly used technique, as it is a relatively quick process not requiring any equipment; however, the subjective results reduce its reliability [6]. The recent use of HHD in clinical and research settings has overcome some of the limitations of MMT through the production of objective results [7]. Despite the established reliability and validity of HHD, the disadvantage of its use is expense, making them inaccessible to some clinicians [6].

The measurement of adductor squeeze values using a sphygmomanometer has previously been reported in the literature, [1, 3] and Delahunt et al [1] have reported pressure values and electromyographic activity during this test in 3 hip flexion positions (0, 45, and 90 degrees). This version of the test has been found to have excellent intrarater reliability among asymptomatic Gaelic games athletes and acceptable intrarater and interrater reliability among a mixed cohort of symptomatic and asymptomatic elite junior Australian Rules footballer and soccer players. The development of appropriate screening tools may be a crucial component in the prevention of lower extremity injuries [3].

A potentially viable alternative to sphygmomanometer is the pressure biofeedback unit that can be used as an affordable tool to assess hip isometric muscle strength. Khare, et al. in 2017; did a study to measure normative adductor squeeze test values in Indian women

cricketers and its correlation with body mass index in forty healthy women cricketers aged 20–28 years and concluded that there was no significant effect of body mass index (BMI) on the test score values, which furthermore signifies that adductor strength is an independent variable in itself and is not dependent on any other factors such as height and weight.

The normative values of mean strength was 149.98±19.770 mmHg at 0°, 171.75±17.609 mmHg at 45° and 133.35±17.968 mmHg at 90° hip flexion, and the adductor squeeze test values can be helpful in the reduction of injuries by early detection and management of injuries, giving attention to the techniques and monitoring the effects of intervention over time [8].

Garrett F et al. in 2004 ; conducted a study to establish normative adductor squeeze test (AST) values in one hundred four elite junior rugby union players and investigate if differences existed between field position units and categorizations, and it was found that the highest AST values were observed at 45 degrees of hip flexion in all field position categories. No differences were observed between position units and categorizations. The normative values of mean strength was 214.53 ± 36.09 mmHg at 0° hip flexion, 228.28 ± 37.92 mmHg at 45° hip flexion and 195.11 ± 37.81 mmHg at 90° hip flexion. And it concluded that clinically, the sports medicine professional may use these results in making decisions on the management of both symptomatic and asymptomatic players [3].

C.M. Hanna et al. in 2009; did a study to establish normative values of hip strength in adult male association football players assessed by handheld dynamometry in one hundred and twenty players. Mean strength for dominant leg hip flexion was 47.3 kg (95% confidence interval 45.6–49.0), non-dominant leg hip flexion was 42.5 kg (41.1–43.9), adduction at 0◦ hip flexion was 35.6 kg (34.1–37.1), adduction at 45◦ was 32.0 kg (30.9–33.1), and adduction at 90◦ was 25.5 kg (24.4–26.5). And it was concluded that the reference ranges and predictive equations for maximal isometric contraction strength of the hip muscles in non-injured adult male association football players will assist assessment and management of an athlete's return to play following injury [9].

Need of the study was to assess the strength of hip adductor muscles in runners by using a method which is quick and easy to administer in clinical settings. This method can be used as a part of assessment in day to day practice as it provides feedback and helps us to set the treatment goals.

The aim of this study was establish normative adductor squeeze test (AST) values in runners and investigate strength of adductor muscles during the performance of the thigh adductor squeeze test at 0°, 45°, and 90° of hip flexion by using the pressure biofeedback unit and to find out the optimal position to perform adductor squeeze test.

Material & Methods: Study design: Cross-sectional study. The study consisted of 51 healthy runners. Age group of subjects was 23-27 years. Sample size was decided based on the previous study. Before testing subjects were screened for eligibility criteria and informed consent was obtained from them prior to the testing.

Inclusion criteria: Subjects with no history of surgery, no self-reported history of groin or pelvic pain in either limb and no other lower limb injury in the past 3 months, and no pain reported during the testing procedure and who were willing to participate in the study were taken.

Goniometer was used for setting up the squeeze test at three different angles, and pressure biofeedback unit was used to quantify the adductor squeeze test score and adductor strength of the subjects.

Familiarization was done to the subjects by demonstrating the technique. The runners wore comfortable clothing for testing. All the subjects were barefoot, and they lied supine with the head flat on the plinth and hands across over the chest.
Materials and apparatus used: Consent form, Plinth, Pressure biofeedback unit (Chattanooga Stabilizer), Goniometer , Stop watch (Erma), Paper , Pen.

Procedure: Ethical clearance was obtained from institutional ethical committee. Each subject was explained the procedure prior to testing. Then, on their turn, they were asked to perform maximal adductor squeeze in 0°, 45°, and 90° of hip flexion position. The hip flexion position was measured using a goniometer for all the three test positions. And, the adductor squeeze test values were assessed using a pressure biofeedback unit. The cuff of the pressure biofeedback unit was pre-inflated to 10 mm Hg before each maximal effort

and it was placed between the prominent parts of the femoral condyles.

The subjects were asked to squeeze as hard as possible. They performed three trials for each test position. They were given 15 seconds rest between each trial and 1 minute rest for each hip flexion test position; the best out of three readings was selected. Trials were considered invalid and repeated if any of the following occurred: the participants' head lifted off the plinth, hands were removed from the chest, the pressure cuff slipped, or the subject pushed through heels/feet. The maximum pressure value obtained was recorded for 0°, 45°, and 90° of hip flexion. Subjects were advised to discontinue the test if pain was experienced.

Statistical Analysis: All analysis was carried out in SPSS windows Version 20.0. An alpha-level of 0.05 was used to determine statistical significance.

Results: Result are shown in Follwing Tables**.**

Table 1: Demographic characterization of study subjects

Characteristics	Mean (Standard deviation)
Age (years)	24.54 (1.20)
Height (meters)	1.74 (0.03)
Weight (kg)	62.66 (4.10)
Body Mass Index (kg/m2)	20.59 (1.62)

Table 2 : Mean And Standard Deviation Of All The 3 Groups

Position	Mean strength (mmHg) (Standard deviation)
Hip flexion at 0°	103.05 (23.05)
Hip flexion at 45°	141.03 (24.31)
Hip flexion at 90°	134.86 (22.83)

Table 3: Anova For Strength Measurement In All The Groups

Outcome measure		Sum of Squares	Mean Square	P - value	Result
Strength(mmHg)	Between Groups	42366.52	21183.26	.00	Significant
	Within Groups	82220.78	548.13		
	Total	124587.30			

Table 4: Post Hoc for between group comparisons

Outcome measure		Hip flexion		
		at 0°	at 45°	at 90°
Strength (mmHg) Hip flexion	at 0°	-	.00	.00
	at 45°	.00	-	.55
	at 90°	.00	.55	-

Discussion: In the present study total 51 subjects were taken and each participant performed 3 trials of the thigh adductor squeeze test in the three positions at 0°, 45°, and 90° of hip flexion. Strength of hip adductor muscles was assessed by using pressure biofeedback unit. In the present study we used pressure biofeedback unit to perform adductor squeeze test instead of other methods such as electromyography, dynamometer etc. this is because the pressure biofeedback unit is easy to administer and it is more feasible and cost-effective to use it in clinical settings.

The results of the present study as shown in table II are mean strength 103.05 ± 23.05 mmHg at 0° hip flexion, 141.03 ± 24.31 mmHg at 45° hip flexion and 134.86 ± 22.83 mmHg at 90° hip flexion position. Thus, it is found that strength is maximum when adductor squeeze test is done at 45° hip flexion position. But there was no significant difference found between the mean values of 45° and 90° hip flexion position.

Owing to the multi-planar function of the hip adductors, these muscles have an essential role in motor control and stability of the lower kinetic chain during the gait cycle. Ancillary to their action as hip adductors in the frontal plane, they also act as an accessory hip flexor up to 90 degrees of hip flexion and an accessory hip extensor at angles greater than this in the sagittal plane. In the transverse plane, they eccentrically control femoral internal rotation during the loading response, as well as producing external rotation during terminal stance and pre-swing. The findings of our study are consistent with the study of Garrett F et al. (2004) who found mean strength 214.53 ± 36.09 mmHg at 0° hip flexion, 228.28 ± 37.92 mmHg at 45° hip flexion and 195.11 ± 37.81 mmHg at 90° hip flexion. So from this it is concluded that the highest AST values were observed at 45 degrees of hip flexion in all field position categories [3].

Results of our study are similar to the study of Khare, et al. (2017) who found mean strength 149.98 ± 19.770 mmHg at 0°, 171.75 ± 17.609 mmHg at 45° and 133.35 ± 17.968 mmHg at 90° hip flexion. This supports our study that the highest squeeze test values were observed in batsmen at 45° of hip flexion [8].
Lovell et al. [10] suggest that the clinician should assess the strength of the gracilis adductor longus and adductor magnus muscle in 45° of hip flexion. We observed the lower squeeze test values in both the 0° and 90° of hip flexion position. In this study, the lower values in this range may result from the reduced ability of the adductors to produce force in the frontal plane because they change their orientation to work in sagittal plane as secondary hip flexors and extensors.

Similar results were demonstrated by E. Delahunt et al. (2011) who found mean strength 202.50 ± 57.28 mmHg at 0°, 236.76 ± 47.29 mmHg at 45° and 186.11 ± 44.01 mmHg at 90° hip flexion. And concluded that the 45° of hip flexion test position is the optimal thigh adductor squeeze test position, due to both the greatest pressure values and adductor muscle activity being observed in this test position, and should be adopted as the optimal test position during injury screening in non-pathological populations [1].

F. Nevin, E. Delahunt did a study in 2014 to find out adductor squeeze test values and hip joint range of motion in Gaelic football athletes with longstanding groin pain and injury-free controls. And it was found that Gaelic football players with current longstanding groin pain exhibit decreased hip joint ROM and adductor squeeze test values when compared to non-injured athletes [11].

J.F. Crow et al. did a study in 2010 to investigate hip adductor muscle strength preceding and during the onset of groin pain in elite junior Australian football players. And it was found that hip adductor muscle strength is decreased in elite junior Australian football players both before and during the onset of groin injury, and this change may be detected in the weeks prior to the onset of injury [4].

Limitations of the study were that we didn't use any sophisticated techniques such as electromyography and only male participants were taken. The results in this study represent the normative strength values for runners only and cannot be considered to be normative values for other athletic populations. For future recommendations study can be done in a larger population and in both males and females.

Conclusion: The results of the present study suggest that the 45° of hip flexion test position is the optimal thigh adductor squeeze test position due to greatest pressure values and it should be adopted as the optimal test position.

References:

1. Eamonn Delahunt CKBLMGFCBSG. The thigh adductor squeeze test: 45 of hip flexion as the optimal test position for eliciting adductor muscle activity and maximum pressure values. Manual Therapy 16. 2011.
2. Falvey EC et al. The groin triangle: a pathoanatomical approach to the diagnosis of chronic groin pain in athletes. Br J Sports Med. 2009; 43:213–220.
3. Garrett F. Coughlan EDBMCCFBSG. Normative Adductor Squeeze Test Values in Elite Junior Rugby Union Players. Clin J Sport Med. 2014 July ; 24(4).
4. Justin F. Crow AJPJPVDVPTCTP. Hip adductor muscle strength is reduced preceding and during the onset of groin pain in elite junior Australian football players. Journal of Science and Medicine in Sport 13. 2010.
5. Kristian Thorborg ASJPTMMPMaPH. Hip Adduction and Abduction Strength Profiles in Elite Soccer Players. The American Journal of Sports Medicine. 2011; 39(1).
6. Liam Anthony Toohey MDNCTJT. Is a sphygmomanometer a valid and reliable tool to measure the isometric strength of hip muscles? A systematic review. Physiotherapy Theory and Practice. 2015; 31.
7. Martin HJ et al., 2006 Is hand-held dynamometry useful for the measurement of quadriceps strength in older people? A comparison with the gold standard biodex dynamometry. Gerontology 52
8. Khare et al. Normative adductor squeeze test values in Indian women cricketers and its correlation with body mass index. Saudi Journal of Sports Medicine. 2017; 17(1).
9. Chris M. Hanna MLFCRESAM. Normative values of hip strength in adult male association football players assessed by handheld dynamometry. Journal of Science and Medicine in Sport 13. 2010.

10. Gregory A. Lovell PDBCJB. EMG of the hip adductor muscles in six clinical examination tests. Physical Therapy in Sport. 2012; 13.
11. F. Nevin ED. Adductor squeeze test values and hip joint range of motion in Gaelic football athletes with longstanding groin pain. Journal of Science and Medicine in Sport. 2014.

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