

Effect of eccentric strength training and static stretch on hamstring flexibility among futsal players

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Abstract

Futsal is a high intensity team sport game that demands a high physical, technical and tactical ability. The elements of kicking and jumping demands a strong lower body, in which quadriceps act as the primary muscles, whereas the hamstring act as the balancer of the knee joint. The aim of the study was to investigate the effect of eccentric strength training and static stretch on hamstring flexibility among futsal players. 10 recreational male futsal players ($n=10$) recruited from Universiti Teknologi MARA (UiTM) Samarahan for the study. Subjects were randomly assigned into two groups comprised of eccentric strength training group and static stretching group. Eccentric strength training performed the Nordic hamstring exercise while, static stretch group performed static stretching exercise. All participants went through a 4 weeks program respectively to the set group, with 3 sessions each week. Sit and reach flexibility test was measured. Both groups showed a significant improvement in hamstring flexibility between pre and post-test, eccentric strength training ($p=0.01$) and static stretching ($p=0.01$). Thus, both programs are applicable in order to enhance hamstring flexibility and may improve the performance.

Keyword: futsal; eccentric strength training; static stretch; hamstring

INTRODUCTION

Futsal is a growing popular sports branch (Roxburg, 2008) which demands both aerobic, anaerobic strength as well as high physical, technical and tactical demands on the players (Barbero-Alvarez, Soto & Vera, 2008). Futsal players need physical capacities such as sprint, strength to kick, make a tackle, turn and change pace, repeat sprint ability (Makaje, Ruangthai, Arkarapanthu & Yoopar, 2010) and explosive jumping during the game (Cometti, Maffiuletti, Pousson, Chatard & Mafulli, 2001). Besides that, futsal players also needs maximum strength for movement and direction changes during the game (Goral, 2014). Hence, the lower body strength such as hamstring and quadriceps are crucial to do variety of movements that required in the game.

Hamstring is critical in the action of knee extension and knee flexion during active daily life. Hamstring muscles contain three major muscles; biceps femoris, semitendinosus and semimembranosus, which composed of type II muscles fibre (Ruslan, Norman, Muhamad & Madzlan, 2014). The hamstring strength and flexibility is an important element in injury prevention (Bandy, Irion & Bringler, 1997). Sprinting is one of the most important motor characteristics in futsal players

(Nascimento, Lucas, Pupo, Arins, Castagna & Guglielmo, 2014). The length of the hamstring muscles is claimed to be a significant characteristics in both the adequacy and the proficiency of fundamental human developments, for example, strolling and running (Gajdosik & Lusin, 1991). In games treatment, short hamstrings have been identified with muscle strains (Croisier, Forthomme, Namurois, Vanderthommen & Crielaard, 2002) and a decrease in athletic execution (Kovacs, 2006).

Flexibility is suggested to benefits in improving athletic execution, diminishing damage hazard, aversion or decrease of post-practice soreness and improving co-appointment (Pope, Herbert & Kirwan, 2000). Previous studies by Hartig and Henderson (1999) and Kujala, Orava, and Järvinen (1997) claimed that by improving hamstring flexibility, it will significantly decrease the number of overuse injuries. Stretching usually used prior to any activity in order to prepare the muscles for the actual exercise or activity to reduce the risk of injury. The extension of the muscles have been appeared to build muscle adaptability, due to the upgraded extend resilience as opposed to physiological changes in the muscle that have been extended (Chan, Hong & Robinson, 2001; LaRoche & Connolly, 2006; Law, Harvey, Nicholas, Tonkin, De Sousa, & Finnis, 2009).

Both eccentric strength training and static stretching programs involve the extension of hamstring muscles. There were few studies proposed different methods of muscles extension that may improve hamstring muscle adaptability (Bandy & Irion, 1994; Cipriani, Abel & Pirrwitz, 2003; Davis, Ashby, McCale, McQuain & Wine, 2005). Eccentric extending is one of the method used in expand the movements. Previous study by Proske, Gregory, Morgan, Percival, Weerakkody and Canny (2004) found that adaption occurs following eccentric training helps in preventing muscle injury. Apart from that, eccentric training is also claimed as a method to strengthen aponeuroses tendon (Legner & Milner, 2008).

On the other hand, static extending is claimed to be the most secure and most regularly performed extending strategies used to quantify muscle length (De Weijer, Gorniak & Shamus, 2003). Static stretch of 30 seconds for 3 times a week were adequate to expand the muscle length (Bandy, Strong, Roberts & Dyer, 1996). Static stretching provides significant increment in the scope of movement of knee joint (Larsen, Lund, Christensen, Røgind, Danneskiold-Samsøe, & Bliddal, 2005). Thus, the aim of study was to investigate the effects of eccentric strength training and static stretching on hamstring flexibility among futsal players. The significance of conducting this study was to help some benefits for coaches in order for them to design training programs for improve hamstring flexibility of their futsal players. Future researcher can use this study as their references to study more on this research and improved the study, so it can be reliable references.

METHODS

Participants

Ten (N=10) recreational male futsal players aged between 18 to 24 years old studied in Universiti Teknologi MARA, Sarawak were recruited in the present study. The participants were randomly divided into two intervention groups; eccentric strength training group ($n=5$) and static stretching group ($n=5$).

Procedures

Pre and post-test of sit and reach flexibility test with $r=0.98$ (López-Miñarro, de Baranda Andújar & Rodríguez-García, 2009) had been conducted to measure the effects of two different interventions.

The sit and reach test is the most widely recognized estimation apparatuses utilized for assessing hamstring and lower back adaptability (Baltaci, Tunay, Besler & Gerçeker, 2003). In sit and reach test, the participants sat on the floor with legs together, knees was broadened, and bottoms of the feet place against the edge of the box. Participants then extended the arms forward, by placing one hand on top of the other. With palms down, the participants came to advance sliding hands along the estimating scale beyond what many would consider possible without bowing the knees. All through testing, the heel stayed at the 35 cm imprint and the knees were completely broadened. The score was recorded in cm to the closest 0.5 cm utilizing the scale on the left half of the achieve pointer.

Inform consent and Par-Q was fulfilled by the participants. Training program was set for four consecutive weeks with three sessions per week. The eccentric strength training group performed 5 repetitions for 2 sets (on 1st and 2nd week) and 6 repetitions for 3 sets (on 3rd and 4th week), while the static stretching group performed hamstring stretch for 30 seconds hold for 2 sets (on 1st and 2nd week), while 3 sets (on 3rd and 4th week) (Waseem, Shaphe & Nuhmani, 2009).

The data was analysed using Statistical Package for the Social Science (SPSS) version 22.0. The descriptive data was presented in mean (*M*) and standard deviation (*SD*). Repeated measure ANOVA was performed to measure the effect of eccentric strength training and static stretching on sit and reach flexibility test.

RESULTS

Table 1 shows the descriptive analysis of pre and post-test expressed in *M* and *SD* of sit and reach flexibility test for both groups. Mean difference of sit and reach flexibility test for eccentric strength training group between pre and post-test was 7.20 ± 4.44 , while static stretching group with 2.40 ± 0.89 . There was a significant difference in hamstring flexibility between pre and post-test for both eccentric training and static stretching, $p = .001$ ($p < .05$).

Table 1: Descriptive analysis of sit and reach test between eccentric training and static stretching

Groups	<i>n</i>	Pre-test (<i>M</i> ± <i>SD</i>)	Post-test (<i>M</i> ± <i>SD</i>)	Mean Diff	<i>p</i> -value
Eccentric strength training	5	43.2 ± 3.96	50.4 ± 4.56	7.20	.001
Static stretching	5	41.6 ± 3.51	44.0 ± 3.81	2.40	.001

Table 2 whereas shows that there was no significant difference in hamstring flexibility followed by whether eccentric training or static stretching group; $F = 3.016$, $p = .121$ ($p < .05$).

Table 2: Hamstring flexibility between eccentric training and static stretching groups

	Wilks' Lambda	<i>df</i>	<i>F</i>	<i>Sig.</i>
Sit and Reach Test between Groups	.587	1.000	3.016	.121

DISCUSSION

The findings from the present study showed that there was a significant improvement in hamstring flexibility from pre-test to post-test for both groups (eccentric strength training group and static stretching group).

Static Stretching

Results show that the static stretching group significantly improve in hamstring flexibility. The improvement of flexibility could be cause by the effect of static hold which was incorporated in the eccentric stretching protocol. This due to the various sarcomerogenesis movements, for example the addition of sarcomeres in series, which have been clearly shown after an eccentric stretch in animal studies. Previous study by O'Sullivan, McAuliffe, and DeBurca (2012) stated that eccentric training is effective in increasing lower body flexibility, in which provides an increment of muscle fascicle length. This will be a feasible reason for improvement of hamstring flexibility after an eccentric strength training intervention. Pereira and Varghese (2017) studied on quick impacts of erratic extending and static extending on hamstring adaptability and vertical bounce execution in basketball players shown that the unusual extending group observed in a higher improvement from pre to post-test as compared to the static stretching group. The static stretching intervention whereas, does improve flexibility probably due to the attributed changes in viscoelastic properties of the muscles. Previous study by Kubo, Kanehisa, Kawakami, and Fukunaga (2001) showed that static stretching decrease the viscosity of tendon but it increase of the elasticity and in order decreasing the stiffness of muscles.

Moreover, Waseem et al. (2009) also claimed that static stretching will adjust the positional sensitivity of the Golgi tendon organs by affecting the series elastic component of the muscle. Golgi tendon organs are stimulated when the small muscle fiber bond is compacted by tying muscles or stretching as an example of a tendon that detects muscle tension. Increased tension in the muscles stimulates Golgi tendon organs, a signal sent to the spine cord to cause reflexes to be blocked in response. This effect is called the lengthening reaction by (Guyton & Hall, 2006). In parallel with the current study, Page (2012), claimed that static stretching is an effective method to be used in various hamstring movements and the largest change in various strain static stretch happen between 15 and 30 seconds of stretching. This results also supported by Bandy et al. (1994), which stated that 30 seconds of static stretch is as effective as 60 seconds of static stretch in improving hamstring flexibility. Previous study by Ylinen, Kankainen, Kautiainen, Rezasoltani, Kuukkanen and Häkkinen (2009), stated that static stretching have increase in range of motion cause of increase in stretch tolerance and not by extensibility of the muscles. Knudson (2006) suggested that the biomechanics of stretching, the momentary increment in static adaptability is identified with an expansion in stretch resilience; in different words, the expanded of scope of movement will be identified with a pain relieving impact that will enables somebody to endure more elevated amounts of uninvolved strain that need to extend the muscle more remote than it was previously. Thus, this explained the mechanism of improvement with static stretching shown in pre to post-test of hamstring flexibility test.

Eccentric Strength Stretching

Eccentric strength training intervention shown insignificantly better improvement than static stretching intervention probably due to a prolonged transition consistently occurs in long muscle strain curves, indicating that the muscles adjust to the inferior inhibition of sarcomerogenesis after an eccentric shift.

This increases the torque generation to a longer connection position (O'Sullivan et al., 2012). Batista and Oliveira (2008), also concluded that eccentric stretching on knee flexors will give effect for increased the flexibility of the stretched muscles and the torque of the agonist and antagonists muscle groups when it been stretch. It will lead to the possibility for increasing performance after eccentric stretching activity. A parallel previous study (Sudhakar & Kumar, 2016) also show the better mean improvement in eccentric strength training (from pre-test of 15.80 ± 3.30 to 23.20 ± 3.23), as compared to static stretching intervention (from 15.13 ± 3.42 cm to 18.47 ± 3.20 cm) could be due to the mixed of stretching and contraction of the muscle that leads to a higher levels of tension on the musculotendinous unit that cause more viscoelastic stress. This in turn leads to diminished tension resistance that make the muscles become more compliant (Clark, Bryant, Culgan & Hartley, 2005).

Moreover, Askar, Pais, Mohan, Saad and Shaikhji (2015) which studied on the eccentric strength training and static stretching on active knee extension range also observed a better mean improvement for eccentric strength training intervention (mean different of 10.36cm) as compared to static stretching intervention (mean different of 9.77cm). The eccentric strength training may assists in improving the ability of the stretched muscle to keep the elastic potential energy during eccentric contraction as well as may improving the concentric contraction strength. The changes in viscoelastic can be result of the combination of the stretching and the contraction that occur in the muscles cause of high level of tension on musculotendinous unit. Thus, this will be able to keep more potential energy of elastic that will results in improving flexibility (Batista et al., 2008).

CONCLUSION

The findings of the present study suggest that there was a significant improvement in hamstring flexibility from pre and post-test among futsal players who underwent a 4 weeks of eccentric strength training and static training. On the other hand, there were no significant difference between groups (eccentric training and static stretch) on hamstring flexibility. To conclude, the static stretch and eccentric stretch can be applied to any type of sports, especially sports that have high intensity performance and use of strength on lower body such as futsal that required explosive movement and change in direction when playing. This preparation likewise can be connected to the kids and grown-up with appropriate power and time of preparing which can influencing their exhibition to be far superior. In conclusion, the static extending and erratic extending will a decent rest interim, practices and reasonable time of preparing has appeared to be fundamental to improved execution in youthful futsal players. The future studies should be conducted in term of static stretch and eccentric stretch on the short-term period of training to see whether the static stretch and eccentric stretch training in short-term period is useable and can be applied in training programme to increase the athlete's performance.

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