

THE EFFECT OF MUSCLE ENERGY TECHNIQUE ON FLEXIBILITY OF HAMSTRING MUSCLE IN FUTSAL PLAYERS

Narviena Shri a/p Srithren and Subramanian Shenbaga Sundaram*

Department of Physiotherapy, Faculty of Health & Sports Science,
MAHSA University, Malaysia

*Email: kavisubbu06@gmail.com

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Abstract

Futsal is an upcoming popular sport. It is an active dynamic sport which requires the players to perform various movements like rapidly accelerating and decelerating, and also requires them to rapidly change their direction of movement. It also involves a lot of sliding and kicking. Compared to other athletic sports played worldwide, futsal is a rather vigorous sport with increased incidence of injuries. Tightness in the hamstring muscles can lead to various injuries. The prevalence of hamstring muscle injuries is very high in futsal players due to muscle tightness. This study aims to determine the effects of Muscle Energy Technique (MET) on hamstring flexibility among futsal players. After being screened as per the inclusion and exclusion criteria, the participants were instructed in MET. The technique was performed for seven to ten seconds with twenty percent of resistive effort synchronized with the breathing pattern of the participant and then stretched to the new muscle length. This was repeated until no further gain was possible. Hamstring length was assessed using the Active Knee Extension Test (AKET) before and after the intervention, the values were then compared. The result of the study show improvements in the hamstring length following the intervention (16.50) to be statistically significant ($P < 0.01$) when compared to the baseline findings (23.67). It has been concluded that MET can increase the hamstring flexibility among futsal players, and thus will be able to reduce the injury rate.

Keywords: Hamstring Flexibility, Muscle Energy Technique, Futsal Players, Active Knee Extension

Introduction

Futsal is a variant of football played indoors on a smaller pitch. Currently there are around one million registered futsal players all over the world. Futsal is a team sport characterized as an intermittent high-intensity strenuous sport (Castagna et al., 2011). Hamstring tightness could play a role, as it affects the running and kicking motions. As stated by Ayala et al., (2011) tight hamstrings have been related with muscle strains, patella femoral pain and muscle damage during eccentric exercises. In futsal, the immersion of sudden variations in direction through gliding, sprinting or running causes swift eccentric contraction and this may contribute to hamstring straining or other non-contact injuries (Brooks et al., 2006). In a study that was done in 2018, it was stated that when a futsal player undergoes an injury that is non-contact, it can affect the player's performance in various ways, even after the recovery, as this may emotionally depress or demotivate the athlete, thus causing poor performance. (Moore et al., 2014). In many studies conducted by multiple researchers, it has been shown that futsal has a relatively high incidence of injuries. This is most likely due to the nature of the sport. Sprinting and sudden change of directions are required to score goals and to pass the ball. Besides that, kicking and sliding also increase the risk of muscular injuries. In a prevalence study conducted on 150 futsal players, it was shown that most futsal players do not effectively stretch or do not stretch at all prior to their futsal matches, which led to an increase in non-contact injuries (Gayardo et al., 2012). In a study conducted by Wan et al. (2017), a coed group of 20 participants who were university level futsal players were assessed in terms of the role of hamstring flexibility in getting injured during sprinting. She collected hamstring flexibility and isokinetic strength data, three-dimensional (3D) kinematic data in a hamstring isokinetic test, and kinematic data in a sprinting test for each participant. She concluded that there is potential for hamstring injury to occur during the late swing phase of sprinting due to the reduction in hamstring flexibility. Another study by Ceylan et al. (2014) studied the effects of warm up in the flexibility and performance of female futsal players. The study consisted of three groups of 10 futsal players each, and concluded that the group with jogging and dynamic stretching showed the most efficacy in muscle flexibility and performance. Based on these studies, warming up and stretching play crucial roles in the injury prevention and performance of futsal players, but due to the lack of time and lack of education, players do not stretch effectively.

The Muscle Energy Technique (MET) is said to be effective for numerous purposes, as well as lengthening a shortened or contracted muscle, strengthening muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood, and increasing the range of motion (ROM) of a restricted joint. It has been found that viscoelastic change in the muscle is accountable for the rise in muscle flexibility post MET. Stretching of the connective tissue elements when the muscle isometrically contracts from a lengthened position has been offered as an alternative explanation of the observed range of motion growth, and this may clarify the better flexibility achieved by Ballantyne et al. (2003). Various studies that have used MET as an intervention for muscle tightness. One study was performed by Sambandam et al. (2011) on the immediate effects of MET and Eccentric Training on 50 healthy female volunteers randomly grouped into two groups. After the grouping, the interventions were done and the outcomes were measured using a universal goniometer for knee extension. The study concluded that there was no

significant difference in the results from both the groups. In another study by Moore et al. (2011) on the immediate effects of MET on shoulder adductors, a randomized control trial study tested three groups, with each group testing a different shoulder movement with the same intervention. The study concluded that there was an immediate improvement in the ROM of the subjects immediately following the intervention. The next article was by Reed et al. (2018). They tested the acute effects of MET compared to Joint Mobilization on posterior shoulder tightness in throwing athletes. 42 asymptomatic high school throwing athletes were randomly divided in to two groups, the interventions were performed, and the outcome results were assessed 15 minutes after the intervention. The study concluded that MET provided acute improvement on posterior shoulder tightness in throwing athletes.

Flexibility is a physical fitness characteristic and is commonly assessed from the joint range of motion (ROM), a vital element of regular biomechanical functioning in sports (Hopper et al., 2005). Muscle tissue length is believed to play a crucial role in competence and effectiveness of human movement (Waseem et al., 2009). The aim of this research was to determine the effects of MET on reduced hamstring flexibility amid futsal players. The findings and outcomes of this study will guide futsal players to determine whether to improve the quality (duration, intensity, technique) of their stretching routine as part of their warmup session prior to the games and cooldown sessions after the games. The reason this study was chosen is that the particular topic of MET on futsal players has never before been addressed. Previous studies were done on samples of football players, but as the mechanism of injury and the mechanics of the two sports are different, this would be helpful. Football is a sport that does not require a sudden change in direction during a run and sudden jerky stop like futsal does. This is because futsal is played in a much smaller indoor (mostly) ground with a firm (cemented) surface, whereas football is played on a soft surface (grass). Thus, the mechanisms of the sport and the injuries acquired are different.

A comparative study conducted by Chinnavan et al. (2015) had two groups of 20 participants of futsal players in each group. The control group had undergone an intervention of pilates and the experimental group had MET as their intervention, with the aim of improving hamstring flexibility. It was concluded that the experimental group with the MET intervention had significantly higher improvements in hamstring flexibility. The problem identified here is the lack of education and awareness among the futsal players on how hamstring flexibility can reduce their risk of injuries and improve their overall performance. This problem can be addressed by effective stretching of the hamstrings during their warm-up sessions. The objective of this study is to determine the effects of MET on hamstring flexibility among futsal players. The findings and conclusions of this study would help futsal players to consider whether to improve the quality (duration, intensity, technique) of their stretching routine as part of their warm-up session prior to the games. This would give them the understanding behind the importance and benefits of stretching effectively. Based on all of these various studies, some awareness was brought to the participants of this research study on the importance of effective MET and the dangers of having tight muscles, including all the secondary musculoskeletal problems that tightness can cause.

Methods

Research Design: Quasi-experimental design

Sampling design and sample size

The sample size was determined using Cochran's (1977) sample calculation formulae. (*Equation 2.11: Cochran's Sample Calculation Formulae*)

$$\begin{aligned}n &= \frac{t^2 \times p(1-p)}{m^2} \\n &= \frac{1.96^2 \times 95(1-95)}{0.05^2} \\n &= 30\end{aligned}\tag{1}$$

Description of formulae:

n= minimum sample size needed

t= confidence level that was set to 0.05 (t=1.96) level of significance

p= proportion of futsal players with tightness

m=marginal error that was set to 5% (m=0.05)

Subjects who passed the study inclusion and exclusion criteria were selected using convenience sampling, a non-probability sampling method. The sample include 19 male participants and 11 female participants. Each participant was carefully screened as per the inclusion and exclusion criteria before being allowed to participate.

Inclusion criteria

1. Active futsal player that plays at least once a week with one hour each session
2. Playing futsal for at least four years (Ballantyne et al., 2003)
3. 18-40 years' old
4. Hamstring tightness bilaterally, above three months (Inability to achieve greater than 150° of knee extension with hip at 90° of flexion)
5. Both genders

Exclusion criteria

1. Recent surgery on trunk or lower limbs in the past six months)
2. History of torn hamstring in the past six months
3. Recent fracture or injury on trunk or lower limbs in the past six months
4. Neurological disorders
5. Limb length discrepancy

Procedures

The study began with the participants being given a consent form and a form to fill in their personal details. Screening for inclusion and exclusion criteria was then performed

by the researcher to ensure accuracy. Following the screening, Ankle Knee Extension Test (AKET) was performed and the data collected was noted as a baseline for comparison alongside the post intervention results. The tests were performed three times and the averages of the findings were used for the data analysis. Then MET was performed based on the chronic technique of implication. This is where the participant was in supine, with the lower leg of the side being treated on the author's shoulder. Here, the participant was told to flex his or her knee while maintaining a hip flexion of 90 degrees, an isometric contraction was given a little before the bind, with only 20% of the force from the participant, followed by seven to 10 seconds of contraction. Then, there was complete relaxation of the leg with exhalation. The knee was then extended through the barrier of the hamstring muscle with a degree of stretch, with the participant's assistance. The stretch was held up to 30 seconds and was repeated in three attempts before the average was used for data analysis.

After the intervention, a two-minute rest period was specified. Post-intervention hamstring examination was done using the AKET. Three attempts were made, then the average of the result was utilized for the data analysis. The data were documented for comparison to the pre-intervention (baseline) results in the data collection form. A mat was used to perform the screening test and the intervention, alongside AKET which was also done on an exercise mat.

Results

Interferential statistics have been used to develop decisions, estimates, predictions and generalizations about the population from the samples drawn. The statistical treatment of data used the Statistical Package for Social Sciences (SPSS) Version 20. The confidence interval was set at 95% while p-value was set at less than 0.05. The paired t-test was used to compare the values of pre- and post-interventions.

Table 1: Table of descriptive statistics.

	Mean	Standard Deviation
Age (18-40)	25.83	4.41
Years of Playing Futsal	5.63	4.31
Hours of Playing Futsal	2.73	0.45

The descriptive variable of age was represented in the form of a mean of 25.8 and a standard deviation of 4.41. Years of playing were represented by a mean of 5.63 and a standard deviation of 4.31. Lastly, hours of playing futsal per week were represented by a mean of 2.73 and a standard deviation of 0.45.

Table 2: Gender descriptive statistics table.

Gender (n=30)	Number	Percentage
Male	19	63.3%
Female	11	36.7%

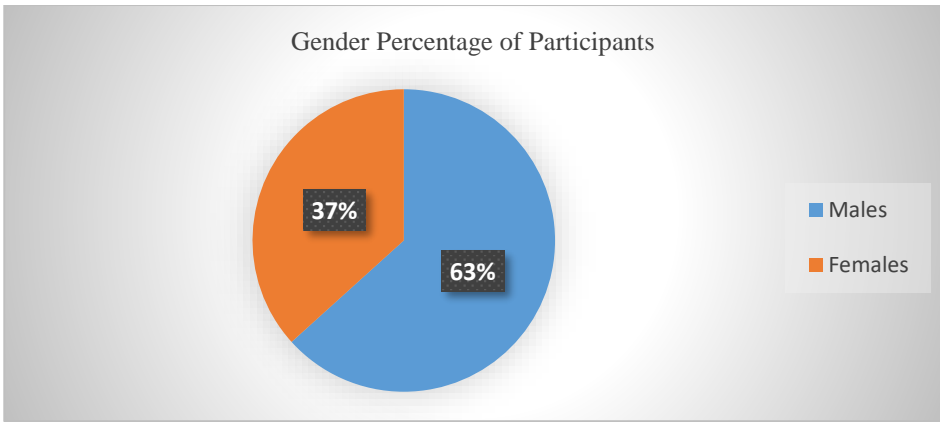


Figure 1: Gender percentage of participants.

As shown in the table above, the total sample size of this study was 30 participants, with 19 male participants (63.3%) and 11 female participants (36.7%).

Table 3: The paired t-test result table.

		Mean (degree)	Standard Deviation (degree)	P value
Right knee extension	Pre- Test	23.67	8.50	0.000
	Post- Test	16.50	7.56	0.000
Left knee extension	Pre- Test	23.00	8.47	0.000
	Post- Test	16.33	7.06	0.000

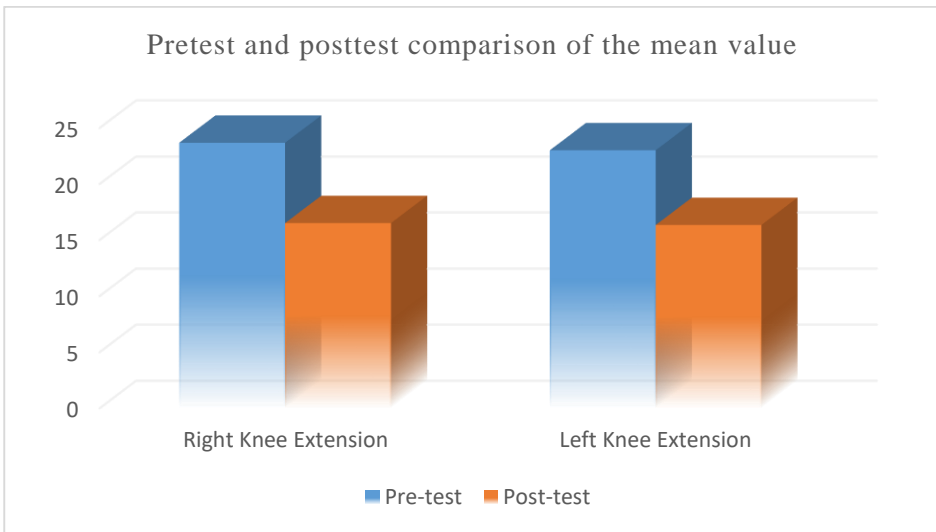


Figure 2: Pretest and posttest comparison chart.

As seen in the table and chart above, the paired t-test was used to compare the pre and post intervention findings. The right leg of the participants pretest value had a mean value of 23.67 and a posttest value of 16.50, showing a reduction in the value, which means that the hamstring flexibility of the participant had increased. This is because the full range of knee extension is zero degrees, thus the smaller the reading, the better the hamstring flexibility. The value of the standard deviation was 8.50 pretest and 7.56 posttest. The left leg had a mean value of 23.00 for pretest and a value of 16.33 for posttest. The standard deviation value of the left leg was 8.47 for pretest and 7.06 for posttest.

Table 4: The difference in pretest and posttest value.

	Mean Difference	Std Deviation	P value
Right Knee Extension	7.17	4.29	0.000
Left Knee Extension	6.67	3.55	0.000

As shown in the table above, the difference in the mean value for the right leg was 7.17 with a standard deviation value of 4.29 and the difference in the mean value for the left leg was 6.67 with a standard deviation value of 3.55. The p-value was set at less than 0.05, all these findings have a p-value of 0.000 clearly displaying a significant difference in the range of motion in the pretest and posttest findings. These shows that the hypothesis has been accepted and that MET has a significant effect on the flexibility of the hamstring muscle.

Discussion and conclusion

This research was performed to determine the effects of MET on the flexibility of hamstring muscle in futsal players. The results of the study revealed that following the intervention of MET in the chronic implication, the subjects displayed a significant improvement ($P < .05$) in the flexibility of the hamstring muscle. The participant in this study were futsal players. A study done by Ivan (2012) on futsal players states that MET is a non-traumatic manipulative technique which is effective, he said MET inhibits the motor activity through the Golgi tendon organs. The purpose of the relaxation phase immediately after MET is to reduce the tone of the muscle, which makes the movement towards the new length of the muscle much easier. Islam et al. (2017) stated that the changes inside connective tissues exhibit mechanical properties involving both viscous and elastic components. “Creep” represents the impermanent elongation of connective tissue during stretch by means of an outcome of its viscoelastic properties”. He also stated that everlasting “plastic” changes can happen as a result from micro-tearing and remodeling of the connective tissue fibers. He concluded that “MET may produce improved muscle length by a mixture of creep and plastic changes in the connective tissues”.

The clinical implication of this study, based on the literature review and the results of this study, is that MET is very effective in increasing the flexibility of any tight muscle. This can be applied in a clinical setting of a hospital or clinic when patients come in for

aches and pains that are due to tight muscles. Performing MET would allow an immediate relief of muscle tightness and this could also play a role as a guide for the physiotherapist on what the patients exercise and stretching routine should consist of (Franke et al., 2015). It was also learnt through the literature review of this study that practicing proper effective stretching methods would benefit futsal players by reducing the delayed onset of muscle soreness that they experience after games. This knowledge can also be used in clinical practice by educating patients, especially athletic patients who come to the hospital. They can be educated on the importance of stretching before and after their work out and the benefits that this practice would bring. It can also be taught by the physiotherapist as a correct and effective stretching method for athletes to perform prior to and after a game.

In this study, MET was performed as an intervention among futsal players to assess the effects of MET on hamstring flexibility. This study was motivated by the prevalence of injuries and poor performance that occur due to reduced muscle flexibility. Prevalence results were taken from a study conducted by Gayardo et al. (2012). This study was done on a sample size of 30 participants, using the pretest and posttest method. The findings and results of this study show significant improvements in the hamstring flexibility among the participants from the results acquired before and after MET intervention. The primary tool that was used was the AKET. The p-value was set to below .05 and the result showed .000 proving a significant improvement in the flexibility of hamstrings posttest. Through this study, the researcher was able to bring a certain amount of awareness to the futsal players on the importance of stretching effectively in their warm-up routine. This study also shows the implacability of MET in a clinical setting, where it can be performed as a treatment technique for patients who come in for physiotherapy relating to reduced hamstring flexibility.

Recommendations

There is a good amount of scope to reconduct the present study with the recommendation of keeping the currently identified limitations in mind. The study could be conducted with a larger sample size to improve the accuracy of the results and findings. The other recommendation would be to reconduct the study with gender specific inclusion criteria, as females tend to physiologically be further more flexible compared to males (Marshall & Siegler 2014); thus, having a group of samples within the same gender would produce more effective and specific findings.

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