EFFECTIVENESS OF MYOFASCIAL RELEASE ON BALANCE AND FLEXIBILITY IN SEPAK TAKRAW PLAYERS

By

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Research Project Report Submitted For the Degree of Master of Science (Sports Science) For the Course Code GTS 508

SCHOOL OF HEALTH SCIENCES

UNIVERSITI SAINS MALAYSIA

JULY 2018

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Thesis submitted in fulfilment of the requirements

for the degree of

Master of Science

JULY 2018

CERTIFICATE

This is to certify that the dissertation entitled

EFFECTIVENESS OF MYOFASCIAL RELEASE ON BALANCE AND FLEXIBILITY IN SEPAK TAKRAW PLAYERS

Is the bona fide record of research work done by

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at University Sains Malaysia or other institutions. I grant University Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

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Date:

ACKNOWLEDGEMENTS

First and foremost, I would like to thank God for giving me an opportunity and strength for completing my research project successfully. I would also like to express my special appreciation to my supervisor Mr Erie who has always provided me the possibility to stay focused in order to complete this final year research thesis. Not forgetting, I would also like to hand in my appreciation to my co-supervisor, Prof. Madya Dr. Hairul Hashim. I would also like to thank all the academic staffs in Sports Science Unit for their continuous encouragements and willingness to help.

Besides that, I would like to thank the school participants who have given me a chance to conduct my research. Nevertheless, without them, my thesis would be incomplete. I would also like to convey my gratitude and sincere thanks to my grandparents who has always been there for me. Not forgetting my mother, Mundeep, Binderjit, Ramadip, Nihaliysha, Sukhinderjit, Sandeep Chaurley and Sandeep Hans for their understanding, strength and encouragement throughout my entire Msc course.

Lastly, I would like to thank my friends, Kavitha, Mahesh, Sarah, Brian, and Harini for their best support during this study

CONTENTS

TABLE CONTENT

FIGURE CONTENT

Keberkesanan regangan myofascial dalam keseimbangan dan fleksibiliti kepada pemain sepak takraw

Abstrak

Regangan myofascial adalah kaedah yang murah dan mudah diakses yang membolehkan individu mengekalkan kelenturan mereka dan berpotensi melepaskan ketegangan fascia pemain di mana saja dan bila-bila masa. Kajian ini bertujuan untuk mengetahui keberkesanan regangan myofascial dalam keseimbangan dan fleksibiliti kepada pemain sepak takraw. Seramai 23 peserta lelaki (umur purata 14.70 ± 2.69; tinggi: 142.48 ± 12.40; berat: 46.70 ± 9.60 dan jisim indek badan: 22.62 ± 2.49) yang mempunyai ketegangan otot hamstring, quadriceps dan otot betis telah menyertai kajian ini. Fleksibiliti dan keseimbangan bagi tiga kumpulan otot telah diukur menggunakan "goniometer and balance foam". Intervensi telah dibuat kepada tiga sesi dengan berselang dua hari di antara hari tersebut, dan pengukuran sebelum dan selepas bagi setiap sesi. Dapatan kajian ini apabila diukur menggunakan one way repeated measure ANOVA telah menunjukkan tiada prbezaan yang ketara dalam fleksibiliti kanan dan kiri otot 'hamstring', 'quadricep', dan betis *(p >0.05)*, bagi setiap sesi. Keputusan keseimbangan ke atas permukaan 'firm' dan 'foam' *(p >0.05*), juga telah menunjukkan tiada perbezaan yang ketara. Sebagai tambahan, apabila menganalisis menggunakan 'paired t-test', keputusan telah menunjukkan perbezaan signifikan dalam setiap sebelum dan selepas di antara sesi iaitu dalam hari sesi yang sama. Fleksibiliti otot hamstring, quadriceps dan betis ($p<0.001$) telah menunjukkan

perbezaan secara signifikan semasa setiap sesi dan ke atas kanan dan kiri kaki. Tambahan pula,keseimbangan ke atas permukaan ‘firm’ tidak menunjukkan perbezaan yang ketara (*p>0.05)*. Sebaliknya, keseimbangan ke atas permukaan ‘foam’ menunjukkan perbezaan yang ketara (*p<0.001)*. Sebagai kesimpulan, kajian ini telah menemui kesan regangan myofascial tidak memberi kesan lebih daripada dua hari (48 jam). Sebaliknya, MFR boleh dilakukan untuk kesan jangka pendek ke atas pemain yang diperlukan semasa permainan atau di antara permainan iaitu sebelum permainan yang seterusnya bermula dalam hari yang sama.

Effectiveness of Myofascial Release on Balance and Flexibility in Sepak Takraw Players

Abstract

Myofascial release is an inexpensive and accessible method which allows the individual to maintain their flexibility and potentially release the player's fascia tightness anywhere and anytime. The present study aims to determine if myofascial release would improve the flexibility and balance among sepak takraw players. Twenty-three (N=23) male participants (mean age: 14.70 ± 2.69 years; height: 142.48 ± 12.40; weight: 46.70 ± 9.60 and BMI: 22.62 ± 2.49) who has tightness of their hamstring, quadriceps and calf muscles participated in the study. Participant's flexibility of the three muscle groups and balance were measured by using goniometer and balance foam. The intervention was done for three sessions with a two days gap in between the days; and a pre-post measurement within each session. The finding from this current study when measured using one-way repeated measure ANOVA showed no significant difference in flexibility of the right and left hamstring, quadriceps and calf muscle ($p>0.05$) in each session. In addition, balance result on firm and foam surface also showed no significant difference ($p>0.05$). However, the results showed a significant difference in between each pre-post's day session (i.e., within the same day session). The flexibility of hamstring, quadriceps and calf muscle showed a highly significant difference ($p<0.001$) during each session and over the right and left leg. Furthermore, the balance on firm surface did not show a significance difference ($p>0.05$).

In contrast, the balance on the foam surface showed a significance difference (p<0.001). In summary, the study has found that the effect of myofascial release does not last more than two days (48 hours). However, MFR can be performed for a short term effect on the required players during games rest interval or in between games (i.e., before the next game start) within the same day.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF STUDY

Myofascial release (MFR) is a manual therapy which is widely an applied treatment which involves a guided long duration mechanical forces to manipulate the Myofascial complex which is purposefully done to restore optimal length, decrease the pain and improve function (Barnes, 1990; Ajimsha, Al-Mudhaka and Al-Madzhar, 2014). Myofascial release assorted to be effective and provides immediate relief of pain and tissue tenderness (Hou *et al*., 2002; Mckenny *et al*., 2013). In addition, it is also a foreseen as hands on soft tissue technique which requires a gentle stretch to the constrained fascia (Kalichman, 2016). Deep tissue manipulation is a type of massage therapy concentrating on readjusting deeper layers of muscles and connective tissue (Riggs, 2007).

Myofascial release has been categorized into two different techniques which is the direct and the indirect technique (Grant and Rigg, 2007). Direct technique works directly over the restricted fascia and in conjunction to this, the practitioner uses knuckles, elbow or other tools to slowly sink into the fascia as well the pressure which is applied to the concern area weights a few kilogram. This process will slowly stretch the fascia and manipulates the Myofascial complex. In contrast to the direct technique, the indirect MFR technique involves a gentle stretch which is guided along the way with minimal amount of

resistance until the movement is free from its restriction (GOT 2006). In addition, the force applied while performing the indirect MFR technique is a few grams; whereby the hand tends to pursue in the direction of fascia restriction hold the stretch and therefore allow the fascia to loosen by itself (Ajimsha, Al-Mudhaka and Al-Madzhar, 2014).

Fascia is termed as a "soft tissue component of connective tissue system that permeates the human body" (Huijing and Langevin, 2009). Each muscle is covered superficially by a fascia which gives the muscle a tissue paper appearance superficially.

There was a research done on MFR which stated that reduced flexibility in certain muscle and a tightness of one muscle maybe an aetiological cause for a condition. (Grieve *et al*., 2014) As an example, Ajimsha, Al-Mudhaka and Al-Madzhar (2014), study highlighted that MFR treatment is more effective than a control intervention or plantar heel pain. This study was done with a randomised control trial and double blinded trial. Total amount of 66 patients were recruited for plantar heel pain and was randomized picked into MFR and control group (no treatment). Randomly picked groups were given 12 session of treatment per client over 4 weeks.

Sport is an area whereby most of the athletes would have experienced injuries whether during sports matches or either during trainings. Injury prevention on involves identifying and understanding of the factors leading to that injury. Such an approach could allow the development of the most appropriate strategy for reducing the risk (Louis, Croisier, Sebastian Ganteaume, Binet,Genty and Marcel Ferret,2008).The causes of injuries could be derived by many factors, such as the lack of warm up's, flexibility limitations, insufficient balance control, uneven grounds, lack of muscular strength, and improper coordination. In order to prevent these injuries, there are many ways of approaching it, such as proper warm-up and cool-down techniques, stretching and Myofascial release.

Myofascial release can be implemented well in cases of limited flexibility (i.e., limited range of motion) athlete's. Studies have been done to improve the assessment of athletes on balance as well as on their flexibility. Sherer (2013), reported greater improvement of hamstring flexibility in the group that utilise self-myofascial release using a foam roller as to the control group (i.e., without self-myofascial release foam roller). In another study, Aaron and colleagues reported a significant improvement when applying Myofascial release technique on an idiopathic scoliosis patient (Aaron, Robert and Katherine, 2008).

In view of this, flexibility is an area which is more of a concern for all athletes, trainers, therapists, physicians as well as scientists whereby each of them would have their own view regarding the term flexibility and the management towards increasing the rate of injuries involving muscle flexibility. (Gleim and McHugh, 1997).

Researchers reported flexibility related injuries in athletes (Hartig, and Henderson, 1999). Elizabeth (2013) and Opar (2012) reported the prevalence in hamstring muscle injury was due to muscle tightness. Hence, it is possible to regain the length of the muscle from shorten to lengthen position. This includes rehabilitation which comprises with multiple stretching, exercises and manual therapy or self- induced manual therapy, myofascial release technique and massage (Curran, 2008; Hartig, 1999; and Huang, 2010).

Besides flexibility, stability or balance is also an important component for athletes. Balance is referred as the ability to maintain the body's centre of mass in its base of support with the least swaying or the most stability (Tabrizi, Abbasi and Sarvestani, 2013). Hrysomallis, McLaughin and Goodman (2006), reported that impaired balance ability may lead to falls that would injure the ligaments of the lower limb. In their study, each Australian Football League team on an average sustained 2.5 ankle and 2.2 knee ligament injuries per season.

Sepak takraw is a well-known traditional game in Malaysia. It was introduced to the South East Asian (SEA) Games in the year of 1990, and as a demonstration sports in the 1998 Kuala Lumpur Commonwealth Games (Jawis, Singh, Singh & Yasin, 2005). Therefore this sport has been widely recognized around the whole south Asian countries as well as worldwide namely, Argentina, Australia, Brazil, Canada, Korea, Germany, England, India, Japan, Rico, Spain and USA (Rezai, Mimar, and Azhad, 2013; Jawis, Singh, Singh, Yasin, 2005).

Sepak takraw is mainly referred to as a game which uses any part of the body excluding/except the arm and the forearm (Rezai, Mimar, and Azhad, 2013). This game focuses on the need of skills, balance, flexibility, strength, speed as well as coordination.

Since sepak takraw is a game which consists of full intense body biomechanical movement thus balance and flexibility plays an important role for the players in order to prevent further injuries as well as falls during the match and while training.

Myofascial release can be implemented to improve on the flexibility of the sepak takraw players as Myofascial release has been applied for many sports conditions and it has shown a significant result (Mohr, and Goad, 2013). In addition to this, flexibility is an important component for this sport as they would be using the upper (e.g., head) and lower limb (e.g., thigh and foot) most of the time. Razei, Mimar, and Paziraei (2013), have shown that flexibility of the lower limb is an important attribute for the excellence in sepak takraw.

In addition, Aziz (2003) stated that kicking the ball at the highest point in sepak takraw is very important. Therefore, players with a sufficient range of motion (ROM) especially in the hip joint are able to serve or spike the ball with a sharper angle as well as blocking the opponent's spiker. Nevertheless, balance is a key point which involves proper biomechanical parameter such as the flexibility, endurance, muscle strength balance and many more that can affect the performance of sepak takraw players and can also be used as a test battery for selecting players (Rezai, Mimar, and Azhad, 2013).

Many settings which also include the rehabilitation setting uses self-foam Myofascial release for many reasons. Some of the reason includes improving muscle compliance, decreasing in delayed onset of muscle soreness, decreasing the adhesion in the tissue, increasing the joint range of motion, improving balance as well as decreasing muscle pains (Fiscella,2004 and Snideman, 2011). Myofascial release technique is a cost

effective procedure that needs not much of effort to be done but results in a positive manner. This would benefit the players as well as prevents the rate of increasing injuries. Myofascial release has significance effect for improving the flexibility and balance of athletes. However, there has been limited study on the effectiveness of myofascial release on sepak takraw players.

Therefore, the aim of the current study is to assess the effectiveness of Myofascial release in balance and flexibility components of sepak takraw players.

Figure 1.1 : Students during sepak takraw training

1.2 RESEARCH OBJECTIVES

The purpose to this study was to assess the effect of myofascial release on balance and flexibility of developmental level sepak takraw players.

1.2.1 GENERAL OBJECTIVE

The general objective of this study was to evaluate whether by applying Myofascial release (MFR) technique on the hamstring, quadriceps and calf muscles would increase the flexibility of these muscles and also improves on the balance of sepak takraw players.

1.2.2 SPECIFIC OBJECTIVES

1. To determine the effectiveness of Myofascial release on the hamstring, quadriceps and calf muscles flexibility in developmental level sepak takraw players

2. To determine balance after Myofascial release is given to developmental level sepak takraw players.

1.3 HYPOTHESIS

Null hypothesis (H_o1): There is no significant difference in flexibility after Myofascial release treatment on hamstring, quadriceps and calf muscles of developmental level sepak takraw players.

Alternative hypothesis ($H_1 1$): There is a significant difference in flexibility after Myofascial release treatment on hamstring, quadriceps and calf muscles of developmental level sepak takraw players.

Null hypothesis (H_o2): There is no significant difference in balance after Myofascial release treatment to developmental level sepak takraw players.

Alternative hypothesis ($H_1 2$): There is a significant difference in balance after Myofascial release treatment to developmental level sepak takraw players.

1.4 RESEARCH QUESTION

1) Will myofascial release be effective for improving the flexibility of hamstring, quadriceps and calf muscle and balance when given for the duration of 5 minutes for each muscle?

1.5 SIGNIFICANCE OF THE STUDY

Significance for this study is that, there were only a few articles as well as journal that were published for sepak takraw athletes and the implementation of Myofascial release on checking the balance and flexibility was not conducted as far for now.

1.6 DEFINITIONS OF THE TERMS

As per below are the terms that are defined for the purposes of the study:

1) Myofascial release: Widely employed manual therapy treatment that involves specifically guided low load, long duration mechanical forces to manipulate the myofascial complex, intended to restore optimal length, decrease pain, and improve function (Barnes, 1990)

2) Fascia: As a ‘soft tissue component of the connective tissue system that permeates the human body’ (Huijing and Langevin, 2009).

3) Flexibility: Amount of movement of a joint through its normal plane of motion (Gleim, and McHugh, 1997).

4) Balance : Statically as the ability to maintain a base of support with minimal movement and dynamically as the ability to perform a task while maintaining a stable position (Winter , Patla , Frank , 1990)

5) Sepak takraw: A Malaysian tradisional game that was introduced to southeast Asian sea games in 1990 (Jawis, Singh, Singh, Yasin, 2005).

6) Goniometer : Device used to measure range of motion around a joint in the body.(Brett, 2017)

7) BESS: Balance Error Scoring System was developed by researchers and clinicians at the University of North Carolina’s sports medicine laboratory. It is used to measure the static and dynamic balance.

CHAPTER 2: LITERATURE REVIEW

The literature review that is about to be discussed is compressed and related to the current study that will be conducted which is divided into the origin of Myofascial release (MFR), anatomy and physiology of fascia, definition of MFR, types of MFR techniques, mechanisms of MFR and the indications and contraindications of MFR.

The idea of Myofascial Release is to slowly stretch the fascia because fascia does not respond to quick tensile forces. Rather it will elongate with a slow moderate stretching (Starkey, 2004). This will help the muscle to glide over the fascia because it is giving the muscle more space to move, increasing flexibility. Other techniques help break down different adhesions to also increase flexibility and decrease associated pain (Starkey, 2004)

2.1 ORIGIN OF MYOFASCIAL RELEASE

Myofascial release is a collection of approaches and techniques that focuses on releasing any restrictions in movement that arises in the soft tissues of a human body. There are direct bodily effects ranges from alleviation of pain, improvement in athletic performance, better flexibility and ease of movement to more subjective issue such as

better posture. (Grant and Rigg, Myofascial release, modalities for massage and bodywork, 2014)

The definite term of Myofascial Release was not utilized until 1981. It was used in the heading of a course on Myofascial Release at Michigan State University. Myofascial Release is based on the philosophies created by Andrew Taylor Still, the originator of Osteopathic Medicine, in the 19th century. The primer method of Myofascial Release that was used was the indirect method. This technique includes a gentle stretching of the fascia, such as the cross-hand technique. The indirect method was growing at the Kansas City College of Osteopathy and Surgery. Dr. George Andrew Laughlin and Dr. Esther Smoot were very dominant in the growth of this indirect method (Manheim, 2001).

2.2 ANATOMY AND PHYSIOLOGY OF FASCIA

Before proceeding further into MFR, the anatomy and physiology of Myofascial work should be known. The largest difference between a fascia and muscle is that a fascia is not potential enough to have a voluntary contraction. Fascia defines surfaces between structures and acts as adaptable but passive structural support, creating connections between fibers. (Grant and Rigg, Myofascial release; modalities for massage and bodywork, 2007)

According to Hou et al (2002) and McKenney et al., (2013), MFR when used in juxtaposition with conventional treatment is said to be in effect to afford instantaneous reprieve of pain and soft tissue soreness. It has been theorized that fascia restrictions in one region of the body cause unwarranted stress in additional regions of the body due to fascial continuity. Schleip (2003) has mentioned that this may result in strain on any structures that are encircled, distributed, or buoyed by fascia. Myofascial experts claimed that by refurbishing the length and health of constrained connective tissue, compression can be relieved on pain delicate structures such as nerves and blood vessels (Schleip, 2003).

Sherer (2013) in his study has mentioned that applying mechanical compression is speculated to reduce adhesions between the tissue layers, increase muscular acquiescence and decrease muscle stiffness of the muscle fibers. Myofascial would help athletes reduce muscle tightness by increasing blood flow to the skin and muscles, decrease parasympathetic activity and release relaxation hormones and endorphins (Sherer, 2013)

In the recent Fascia Research Congresses (FRC) the term fascia was defined as a 'soft tissue component of the connective tissue system that permeates the human body' (Hailing and Langevin, 2009). Some refer fascia as a fibrous collagenous tissues that are part of a body-wide tensional force transmission system (Schleip *et al*., 2012). The

complete fascia bed includes dense planar tissue sheets, ligaments, tendons, superficial fascia and the innermost intramuscular layer of the endomysium. The term fascia focuses on the dura mater, periosteum, perineurium, fibrous capsular layer of vertebral discs, organ capsules and also the bronchial connective tissue and the mesentery of abdomen (Schleip *et al*., 2012).

Authors such as Day *et al*. (2009); Stecco *et al*. (2013) and Langevin *et al*. (2011) have proposed that fascia might be even tensed in overuse situations, or after traumatic injuries, but it is not certain if it is an alteration of collagen fiber composition, fibroblasts, or ground substance. Authors also suggested that differences of fascia pliability might be the source of misalignment in the body which leads to poor muscular biomechanics, altered structural.

2.3 DEFINITION OF MYOFASCIAL RELEASE

Myofascial release (MFR) is a widely employed manual therapy treatment that involves specifically guided low load, long duration mechanical forces to manipulate the myofascial complex, intended to restore optimal length, decrease pain, and improve function (Barnes., 1990). MFR when used in conjunction with conventional treatment is

said to be effective to provide immediate relief of pain and tissue tenderness (Hou et al., 2002, McKenney et al., 2013).

2.4 TYPES OF TECHNIQUES

Importance of mastering the Myofascial release is to major the techniques that have been implemented such as the direct technique, indirect technique, the combination of both direct and indirect technique, self myofascial release technique, compression method, trigger point release, positional release and various forms of post isometric relaxation.

Direct technique of the myofascial release approach is works on the deeper tissue as well applies a more aggressive manipulation of fascia where practitioner uses knuckles, elbow or tools to sink into the fascia with the pressure applied worth few kilograms to force the contact of the fascia; tension is applied and stretches the fascia. (Grant and Rigg, Ajimsha, 2013).

As explained by GOT (2009), an indirect technique is what involves a gentle stretch along the way until resistance free movement is achieved. Therefore, the pressure applied is worth a few kilograms of force and the hand is used to follow the direction of

fascia restrictions, hold the stretch in position and allow the fascia to loosen by itself (Ajimsha et al., 2013).

In the trending current situation, self myofascial release is being carried out by many researchers (Mohr, Long, and Goad, 2014). Foam rollers are being used to perform MFR techniques on one group of the muscle and this doesn't require therapist, just the foam roller, tennis ball, PVC pipe or field hockey ball depending on the muscles or portion which is being applied.

A study done by Kalichman and David (2016), mentioned previously the therapist and fitness professional has applied self myofascial release as maintenance tool. Researchers have observed a significant improvement in joint range of motion after self myofascial release session and with no decrease in muscle force or changes in performance.

2.5 MECHANISM OF MYOFASCIAL RELEASE

As mentioned by Pilat (2003), it is understand the mechanism of Myofascial release for a better understanding on how this technique could benefit us. There are few mechanism that is related to the fascia release, namely are the piezoelectricity which is linked to the mechanical tension and the properties of elasticity, flexibility, elongation and the resistance will depend on the information flow which is transmitted electrically through the connective tissue matrix (Oschmann, 2003).

Similarly, the fascia system is innervated by mechanoreceptors (stecco *et al.,* 2008) that when a manual pressure is applied, it may create a range of responses that will facilitate a movement. Not only has that, but also the viscoelastic properties of fascia been observed by numerous studies and concepts for practical treatment applications have been defined by varying authors, including; Rolf (1994), Barnes (1997), Cantu and Gordin (2001) and Pilat (2003, 2009).

Self myofascial release (SMR), has almost the same concept as the manual myofascial release and has been as accorning to Sullivan et.al, (2013), it has been permitted for regular and consequent application without being proposed by the therapist themselves. It differs as this technique depends on the individuals body mass and the amount they exert over the foam (MacDonald et al., 2013) or a tennis ball on the plantar

aspect of the foot (Myers, 2014). Earlier to this, there was a research conducted on the effect of SMR with a foam roller to check on the flexibility and force production was conducted (MacDonald et al., 2013; Sullivan et al., 2013) was compared to postural alignment exercises and static stretches (Roylance et al., 2013).

2.6 INDICATIONS AND CONTRAINDICATIONS OF MYOFASCIAL RELEASE

One of the major benefits of Myofascial release is that it increases and promotes a smoother movement for the tissue if there were any types of restrictions. As a practitioner, coach or sport therapist, one should know the indications and contraindications. Examples conditions that responses well to MFR are adhesion and scar tissues from strains, sprains, surgical procedures, fibromyalgia, Myofascial pain syndrome, tendinitis/ tenosynovitis, neck pain, back pain and osteoarthritis (Grant and Riggs 2014). Contraindications refers to the “don’ts” and the conditions which should be avoided to be given myofascial release is acute inflammation, person on anticoagulant medications, cellulitis, deep vein thrombosis, fractures of bones, heart attack symptoms’, hematoma, hypermobility and many more that may be a treat to the person.(Grant and Riggs 2014).

2.7 COMPARING MYOFASCIAL RELEASE IN THE IMPROVEMENT OF RANGE OF MOTION

Myofascial release is one of many techniques which is used to increase mobility in a joint as well improve athletic performance whether it could be flexibility, balance, co-ordination and many more.(Peacock, Krein, Silver, Sanders & von Carlowitz, 2014). As reported by Opar, (2012) there is an increasing trend in the incidence of hamstring injuries over the past several seasons.

Comparing to the study by Opar, (2012), there were no significant studies relating that impaired range of motion leads to higher rate or amount of injury. Increasing the range of motion is important for both athletes and non- athletes because it reduces the chances of being injured. Marchetti, et al. (2013) agreed that myofascial release improves the range of motion and athlete's performance

As for the comparison of sports and the flexibility, there are numerous researches conducted from self Myofascial release technique as well as from the Myofascial release technique.

Presently, there are studies which showed various results defining the effectiveness of Myofascial release as a way to improve on the athletic performance. A study titled "*An acute bout of self Myofascial release in the form of foam rolling improves performance testing*, compared the effectiveness of self Myofascial release by using a foam roller comparing with a dynamic warm up (Peacock, *et al*., 2014). For this study, 11 healthy, athletic and active males with the age group (mean and SD) varying from 22.18 ±2.18 were taken. Each participant were given 5 minute warm session with slow and dynamic warm up such as arm circles, body weight squats, squat jumps, high knees, butt kickers, alternating jump lunges, alternating log jumps, scapular pushups, thoracic rotations, and clapping pushups. Each movement was performed 2 set with 10 times each repetitions. After the dynamic warm up, tests were done to measure their performance.

During the self Myofascial release testing sessions, the same warm up and dynamic warm up were used, but has an additional of foam rolling session. Foam roller was used on the thoracic and lumbar regions, gluteal muscle group, hamstring region, calf region, quadriceps and hip flexor region, and the pectoral region. Each of it was conducted with 5 strokes over 30 seconds. The performance testing measured differences in flexibility, power, agility and strength. Performance tests was measured using a sit and reach test for testing hamstring and back flexibility, vertical jump and standing long jump for power, an agility test, an indirect one rep bench press for maximum strength testing, and a 37 meter sprint. As a conclusion, results showed a significant difference between the dynamic warm up testing and also with the foam roller. The vertical jump, standing long

jump, agility test, indirect one rep max bench press, and 37 meter sprint were significantly improved for the Myofascial sessions and no differences for the sit and reach test and any change in range of motion after foam rolling. Thus, even if this study doesn't show any significant changes in the flexibility, it is suggested that more studies should be done on manual as well as self Myofascial release for the betterment of a significant studies.

Other studies such as *Self Myofascial Release: Effects on Hamstring Range of Motion and Torque*, with the focus to evaluate changes in hamstring range of motion (ROM) and isokinetic, eccentric/concentric hamstring torque production (Evans, 2014) and *The Effects of Myofascial Release with Foam Rolling on Performance*, researchers examined if Myofascial release enhanced performance in athletic tests (Healey, Hatfield, Blanpied, Dorfman & Riebe, 2014) as well showed that there were no significant improvement after applying self Myofascial release technique.

A study conducted by MacDonald et al. (2013) stated that two sets of 1 min self myofascial release by a foam roller quadriceps muscles, has increased the range of motion of the knee joint by 10 degree without reducing the performance. The study consisted of 11 healthy active male participants. Participants were verified on their all-out voluntary contraction force of quadriceps, educed force and activation as well as knee range of motion (ROM) former to two and ten minutes after the intervention session. One of the protocols contained two of one-minute trials of self-myofascial release by using a foam

roller and the control session consisted of no myofascial release techniques. The test was performed by using a two way ANOVA with repeated measures. There were no significant differences between the different sessions. However, there was a significant difference in the knee ROM measurements between the different conditions. Average ROM was significantly different with an increase of 12% at the two minute after measurement and 10% during the ten minutes trial after the self-myofascial release

Sherer et al (Sherer, 2013) studied the effects of foam roller on hamstring flexibility which was measured by using a sit to reach test within a group of weight training athletes. Participants who were in the treatment group performed foam rolling twice a week for four weeks duration. The control group has no treatment given. This resulted in no changes for the hamstring flexibility in the control group whereas the foam group showed a significant increase in the hamstring flexibility (Sherer, 2013).

Similarly, Sullivan et al. (2013) achieved a result of 4.7% increase in hamstring range of motion after two sets of five and 10 seconds of roller massager. Opposing this, there were research studies stating that self myofascial release was ineffective in increasing hamstring flexibility (Couture et al., 2015; Miller and Rockey, 2006; Morton et al., 2016). As a description, Miller and Rockey (2006) studied whether foam rollers would increase the flexibility of the hamstring when it is measured by an active knee extension test. Foam rolling was given three days in a week for duration of 8 weeks on participants who have

tight hamstrings before the study was conducted and resulted in no significant differences in the control and the foam rolling experimental groups.

In a study by Sharp (2012), the advantages of using a manual hands on Myofascial release ‘Emmet technique' was compared with the usage of a self Myofascial release tool (foam roller). This resulted in significantly increased for both groups, but the Emmet manual technique was more effective in improving the range of motion.

Similarly, there is a contradicting situation in where there were several studies that was conducted using Myofascial release technique showed significant changes in the range of motions. Research done by MacDonald *et al.*., (2013), portrayed a significant difference in the range of motion. However, this study measured the measurement of the range of motion during a forward lunged position. Technically, maybe by using a different mode of measuring the range of motion varies the results.

2.8 COMPARISON FOR MYOFASCIAL RELEASE AND BALANCE

As much research that has been done on the flexibility and range of motion, there is still lack of researches done for the effectiveness of Myofascial release on balance in sports