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EFFECTS OF FOAM ROLLING VS MASSAGE AS RECOVERY TOOL TOWARDS UITM PERLIS FC.

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledgement as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledgement that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRAK

Untuk mempercepatkan proses pemulihan dan mempertingkatkan prestasi dalam bola sepak, mod pemulihan pasca latihan yang berbeza telah dicadangkan dalam kajian ini yang merupakan "*foam rolling*", urut dan pemulihan pasif. Walau bagaimanapun, atlet dapat mengalami keletihan otot dalam sukan yang berbeza seperti bola sepak, ragbi, sprinter dan sebagainya. Ini boleh berlaku jika atlet melakukan terlalu banyak latihan atau bermain tanpa masa pemulihan yang mencukupi dan pemulihan yang betul. Kajian ini bertujuan untuk mengkaji kesan pembebasan "*myofascial*" dan pemulihan pasif sebagai kaedah pemulihan kepada pemain bola sepak profesional sejurus selepas peristiwa kompetitif semasa proses pemulihan. Kajian ini melibatkan kaedah kuantitatif menggunakan reka bentuk eksperimen untuk membandingkan kesan tiga alat intervensi yang berbeza untuk proses pemulihan di kalangan pemain UiTM Perlis FC. Sebanyak 30 pemain bola sepak lelaki melengkapkan PAR-Q + dan borang persetujuan. Pembolehubah yang diukur dalam kajian ini adalah (1) Jumlah Pemulihan Kualiti (2) duduk dan mencapai (3) pecut 20-meter (4) berdiri panjang melompat. Sementara itu, kaedah intervensi adalah (1) "*foam* rolling" (2) urut dan (3) pemulihan pasif (kawalan). Tiga percubaan telah diberikan kepada semua peserta untuk setiap pemboleh ubah pada pra-ujian dan ujian pasca. Data dianalisis dengan menggunakan ujian t-sampel berpasangan untuk membandingkan dalam kumpulan dan ANOVA Satu Arah untuk membandingkan antara kumpulan. Keputusan menunjukkan bahawa hanya Pemulihan Kualiti Keseluruhan mempunyai kesan yang signifikan (p = 0.05). Walaupun, duduk dan mencapai, pecut 20-meter dan lompat jauh berdiri tidak menunjukkan kesan yang ketara (p > 0.05). Kajian ini mendapati bahawa modaliti pemulihan telah mengubah persepsi individu terhadap pemulihan dan tidak menjejaskan prestasi.

Kata Kunci: *pelepasan "myofascial", "foam rolling", urut, pemulihan, pemulihan pasif, tisu lembut*

ABSTRACT

To accelerate the recovery process and enhance performance in football, different post-exercise recovery modes have been suggested in this research which are foam rolling, massage and passive recovery. However, athletes can experience muscle fatigue in different sports like soccer, rugby, sprinter and etc. it can happen if the athletes do too many exercises, training or games without sufficient recovery time and proper recovery. This research aimed to examine the effects of myofascial release and passive recovery as methods of recovery to professional footballers right after the competitive events during the recovery process. This study involved quantitative method using experimental design to compare the effects of three different interventions tools for recovery process among UiTM Perlis FC players. A total of 30 male footballers completed PAR-Q+ and consent form. The variables measured in this study were (1) Total Quality Recovery (2) sit and reach (3) 20-meter sprint (4) standing long jump. Meanwhile, the interventions modalities were (1) foam rolling (2) massage and (3) passive recovery (control). Three trial has given to all participants for each variable on pre-test and post-test. Data were analysed by using paired sample t-test to compare within groups and One-Way ANOVA to compare between groups. Results shown that only Total Quality Recovery has a significant effect ($p = 0.05$). While, sit and reach, 20-meter sprint and standing long jump did not show any significant effects ($p > 0.05$). This study found that recovery modalities did change the individual's perception of recovery and does not affect the performance.

Keywords: *myofascial release, foam rolling, massage, recovery, passive recovery, soft tissue*

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviations

FR	Foam Rolling
M	Massage
PR	Passive Recovery
SD	Standard Deviation
SPSS	Statistical Package for Social Science
UiTM	Universiti Teknologi MARA

CHAPTER ONE
INTRODUCTION

1.1. BACKGROUND OF STUDY

Football has been a contact team sport involving technological, tactical and physical skills (Stolen, Chamari, Castagna, & Wisløff, 2005). The analysis showed that football requires a high-intensity short-duration activity like sprinting, jumping dribbling, tackling and kicking (Rampinini et al., 2011). According to (Rey, Padrón-Cabo, Costa, & Barcala-Furelos, 2017) professional football players may cover between 10 and 12 kilometres of running with a maximum heart rate of between 70 and 80% of the available oxygen in the 90-minute match played. Metabolic homeostasis, muscle damage and loss of anaerobic efficiency were restored after a competitive match between 48 and 72 hours(Nédélec et al., 2013).

Through ongoing activities, human body processes may be stressed. This can lead to acute tiredness. Continuous training and match in football can predispose footballers to experience acute fatigue at the same time as overload injuries can occur to footballers due to continuous training and matching. This condition can occur particularly when the footballer has to play and train regularly within a short period of time (Nédélec et al., 2013). The research by (Junker & Stoggl, 2015) claimed that athletes need to restore metabolic homeostasis, muscle damage, and anaerobic performance for at least 48-72 hours.

Myofascial released a new concept in the recovery process (Behara & Jacobson, 2017). There are many examples of myofascial release such as

massage, foam rolling, tennis ball, roll massager and etc. Myofascial release can help with pain due to what is commonly referred as 'trigger points' which can described as small, hyperirritable areas within a muscle(C. Mauntel, A. Clark, & Padua, 2014). Foam rolling is a form of self-manual therapy which aims to reduce myofascial tightness. The current belief is that this localised tightness causes restrictions in joint range of motion (ROM) and local blood flow(Findley, Chaudhry, Stecco, & Roman, 2012). Foam rolling has become a staple in the majority of athletic training programmes and even for recreational use, simply due to its practicality and alleged performance-enhancing effects such as increased ROM, enhanced recovery, and improved performance. Whilst these effects have been primarily based upon practical knowledge, scientific empirical evidence on this topic has begun to grow and identify the true impacts of foam rolling on performance. One of the prime reasons for the use of foam rolling is to speed-up the recovery process post-exercise and reduce the effects of DOMS. However, until recent years there has been very little evidence-based information to validate the effectiveness of this technique. Having said this, recent research has demonstrated that foam rolling can reduce the sensation of DOMS following exercise(Jay et al., 2014)(Pearcey et al., 2014) (MacDonald et al., 2013). Apart from the positive effects of foam rolling upon DOMS, little else is known regarding how foam rolling can influence the speed of recovery from physical activity. Regardless, the ability of foam rolling to reduce the sensations of DOMS following exercise should suggest that this technique may serve as a valuable tool for athletes particularly during strenuous training and competition periods .During the myofascial process of foam rolling, individuals will use their body weight in the recovery process to put pressure on the

damaged soft tissues (Junker & Stoggl, 2015). The explanation of why foam rolling was considered the self-induced massage was that a massage therapist manually manipulated the foam roller exerting pressure on the muscle resembles (Pearcey et al., 2014). The foam roller used to recover the overused soft tissues. Furthermore, the foam rolling technique focuses primarily on muscle soreness and muscle fatigue on the body of the athlete right after the sporting events (Jaggers, Swank, Frost, & Lee, 2008). There was, however, no peer review and lack of evidence to justify the use of rehabilitation strategies from acute tiredness (Pearcey et al., 2014). Foam rolling (FR) could be considered as a new recovery process initiative approach focused on myofascial issued. But there was still no specific evidence of myofascial release among footballers (Rey et al., 2017).

Massage is known as ‘‘mechanical manipulation of body tissues with rhythmical pressure and stroking for the purpose of promoting health and well-being’’(Cafarelli & Flint, 1992), and it is used in sport for many purposes such as pre-exercise preparation, post-exercise recovery, injury prevention and injury rehabilitation(Moraska, 2005; Poppendieck, Wegmann, & Ferrauti, 2016). Massage was another method of action generally meant to alleviate acute tiredness. The previous researchers had shown that after massaging, pain associated with acute fatigue could be reduced (Pearcey et al., 2015). Massaged could provide an advantage for complex multi-joint measures. At the same time, though, it may not be appropriate for single-joint and isometric exercises. Another strategy that is usually called passive recovery for the recovery process. This technique could enhance athletes ' performance during the sporting event

(G. Dupont, Blondel, & Berthoin, 2003). The athlete was not able to engage in any rehabilitation treatment during the passive recovery that could strengthen the muscle condition. To conclude, this research aims to examine the effect of myofascial release and passive recovery as methods of recovery to professional footballers right after the competitive events during the recovery process.

1.2. PROBLEM STATEMENT

Modalities of treatment widely used in functional environments decreased physical performance and released muscle aches as a result of rapid recovery (Junker & Stoggl, 2015). There have been many methods of myofascial release, however, such as sports massage, sauna, foam rolling and whole-body cryotherapy. During the healing process, foam rolling has now been promoted by athletes as rehabilitation tools. Massage may be considered a common technique used during the recovery process (Pearcey et al., 2014). Previous research found that passive recovery could also promote better results and reduce fatigue (Buchheit et al., 2009)

Nonetheless, it could take a long time to use the myofascial release technique with the session lasting up to 90 minutes (Ryan et al., 2008). Using foam rolling as a myofascial tool could exert pressure on the affected soft tissues to stimulate the Golgi tendon unit and reduce muscle tension (Junker & Stoggl, 2015). Whereas massaged, acute pain and exhaustion on the lower limb of triathletes could be minimized (Nunes et al., 2016). The previous research by Buchheit et al. (2009)stated that Passive recovery may enhance performance. Unfortunately, no prior research has been conducted to compare recovery

methods (1) foam rolling, (2) massaged and (3) passive recovery as a tool of recovery process on UiTM Perlis FC footballer. Without taking an action, the efficiency of applying the myofascial released approach to the UiTM Perlis FC footballer had to be investigated.

1.3. RESEARCH OBJECTIVE

- This research aims to examine the effect of foam rolling vs massage as recovery tools among UiTM Perlis FC footballers.

1.4. SIGNIFICANCE OF STUDY

The findings of this study would give the athletes the advantage since the myofascial release plays an important role in the strength and conditioning area. Athletes will be expected to use the best recovery strategies to improve performance at the next competitive events. The results of this study, together with the latest research in this field, will help coaches, physical trainers, technical and medical staff and athletes find the best and effective approach to apply to athletes during the recovery process immediately after the competitive events. The use of foam rolling as a method of myofascial release technique may become necessary in order to improvise the way in which football recovers. As a result of this research, the coach will help speed up the recovery process of the athlete in preparation for the highest performance level during the playtime.

1.5. DEFINITION OF TERMS

1.5.1 Myofascial Release

Myofascial released was a secure and very successful hands-on technique involving the application of gentle and sustained pressure in myofascial connective tissue restrictions to relieve pain and restore mobility. It operated by relaxing contracting muscles, enhancing blood and lymphatic circulation, and activating the stretched muscle reflex.

1.5.2 Foam Rolling

A foam rolling was a compressed foam lightweight, cylindrical tube. For several reasons, they were used, including improved flexibility, reduced soreness, and remove muscle knots. Foam rolling has been published as a self-myofascial method.

1.5.3 Massage

To order to normalize them massaged was the systematized manipulation of soft tissues. Practitioners used a range of physical techniques that included applying fixed or mobile pressure, retaining or causing the body to move. The underlying aim of massage therapy was to help the body recover itself and to improve health and well-being.

1.5.4 Recovery

Recovery has been a return to normal health, mind, or strength. Recovery also enables the body to replenish supplies of energy and repair damaged tissues. Exercise or any other physical activity induces changes in the body such as weakening of muscle tissue and depletion of energy stores (muscle glycogen) and loss of fluid.

1.5.5 Passive Recovery

Passive recovery is one of the recovery processes which in this term of study the athletes were not allowed to engage with another recovery process or movement that might improve the muscle condition. In simpler word, the athletes need to sit within 20 minutes in recovery process after the training.

1.5.6 Soft Tissue

Soft tissue includes the tissues that connect, support, or surround other structures and organs of the body, not being hard tissue such as bone. Soft tissue includes tendons, ligaments, fascia, skin, fibrous tissues, fat, and synovial membranes which are connective tissue, and muscles, nerves and blood vessels which are not connective tissue.

1.5.7 Perception of Recovery

Perception of recovery is been used in this study to make sure that the participants reach the fatigue after the training session. In this study, researcher was using the scale of Total Quality Recovery towards the participants after training session. With the scale of 6-20 which the lowest the number indicates the poor recovery that participants had after a day training.

1.6. Limitation of Study

This study had several limitations that cannot be controlled by the researcher. First limitation was lack of participants. In this experimental study required 36 participants, however UiTM Perlis FC footballers only consisted of 30 participants and had shortage of 6 participants.

Second limitation was time duration during data collection. Some of the participants came late to the training session due to finished class late. The participants cannot be punctual at the training field and they were not reach the training intensity that coach had been given. So, they definitely not reach the induced fatigue that required in this experimental study. Due to that issue, researcher need to find another suitable time to collect data collection with the participants.

Next, third limitation during this study was the equipment is not up to date such as stopwatch. The used of timing gate would be better and can get accurate data during this experimental study.

CHAPTER TWO
LITERATURE REVIEW

2.1. CONCEPT OF FOOTBALL

Football is recognized as one of the heavy contact team sports that needed a technological, tactical and physical component (Stolen et al., 2005). Based on the common football match analysis, football requires sporadic high-intensity short-term activities because of the action needed in football. Sprinting, jumping dribbling, tackling and kicking were the examples of high-intensity short-term action required in football (Rampinini et al., 2011). A typical professional footballer could cover a distance of 10-12 kilometres, while a professional goalkeeper could cover a distance of 4 kilometres in 90 minutes. Many studies have shown that the longest distance covered by midfielder players is compared to other football positions. In the second half, the activity rate decreased by 5-10% compared to the first half. The sprint bout can last in 2-4 seconds per sprint per 90 seconds (Reilly & Thomas, 1976).

For football, both strength and power were needed. Maximum strength refers to the highest force the neuromuscular system may produce during the maximum voluntary contraction. Although power was the source of strength and speed. This also referred to the capability of the neuromuscular system to give the maximum impulse in a given period. A jump test and a 30-meter sprinting test assisted both the maximum strength and the power relationship (Wisløff, Castagna, Helgerud, Jones, & Hoff, 2004).

Football relied on aerobic metabolism based on the length of a football match of 90 minutes. Usually, 80-90% of the maximum heart rate generated by

professional footballers during a football match for 90 minutes. A small study was conducted to measure oxygen (O^2) in a football match. The study by (Stolen et al., 2005) stated that approximately 70-80% of the maximum heart rate expected by a professional footballer for the entire 90-minute match. Relationship between heart rate (HR) and oxygen (O^2) may accurately reflect the energy expenditure in steady-state exercise. The previous study showed that HR – O^2 line was valid, in heavy exercise. It was significant in a laboratory experiment on a treadmill by contrasting heavy exercise and continuous exercise.

Throughout ongoing exercises, human body systems will be stressed. This might lead to acute tiredness. Continuous training and match in football can predispose footballers to experience acute fatigue at the same time as overload injuries can occur to footballers due to continuous training and matching. This situation can occur particularly when footballers have to play and train frequently in a short time frame (Nedelec et al., 2014). The study by (Junker & Stoggl, 2015) stated that Athletes need to recover metabolic homeostasis, muscle damage and anaerobic efficiency for at least 48-72 hours of rest.

2.2. NATURE OF FOOTBALL

Football's physiological needs were complex. The complexity is due to the nature of the exercise pattern. The constant change in speed and direction makes the activity irregular. The intermittent exercise was related to the aerobic and anaerobic energy systems contribution to football need. Effective ways of improving both strength and movement, particularly on the lower limbs, were needed in order to make the systematic training planned and carried out. The training plan prioritized the technique and tactical session. A large number of soccer matches provide a time limit for physical training during the competitive season.

Different physical and technical football drills and practices were the keys to routine implementation in order to prepare players to meet the different types of match demands. Adequate preparation was required to achieve the necessary physiological goals. Some of the football drilling and running is designed to train the metabolic processes of athletes. All drill condition whether specific or running may achieve a physical outcome that is required. Footballer will be regularly trained 5-6 days a week with the team. The football team also regularly play in the competitive season for one official batch of football for each week. The intense football training session that can give the footballer acute exhaustion where they need at least 24 hours of rest after the training.

2.3. TYPE OF RECOVERY

2.3.1 Foam Rolling

2.3.1.1 Importance

Foam rolling was a common technique used with no resulting drop in performance to increase the motion range dramatically. Therefore, it uses a foam roller before, during and after athletic exercise (Monteiro & Neto, 2016). The foam roller came out with a variety of models as a solid foam cylinder. A certain type of foam roller with a different degree of durability and size was available (Junker & Stoggl, 2015). The foam roller has been produced with several models such as low-density foam roller, firm foam roller, short foam roller, bumpy foam roller and medium-density foam roller.

The foam roller could be considered as self-massage, depending on how it is used where the foam roller allowed a person to use their body weight during the process (Sullivan, Silvey, Button, & Behm, 2013). Direct pressure on the soft tissue caused the fascia to be stretched and the range of movement (ROM) increased.

2.3.1.2 Technique

The well-known method used as a self-massage treatment could be the foam roller. Many researchers believe that the technique of foam rolling will simultaneously boost myofascial mobility. The time of the application of foam rolling was varied. The application is recommended within 60-90 seconds and can be extended for up to 5 minutes (Paolini, 2009). However, the frequency, set and duration used by the previous study also varied. Self-myofascial intervention released from previously studied was rolled foam, but with the same force different target area, different session and duration.

According to (Bushell, Dawson, & Webster, 2015) The target region of the anterior thigh, with a period of 1 minute in 3 sessions, should be done without cadence, but the pressure of the bodyweight of the participant. Furthermore, from (Mohr, Long, & Goad, 2014) for the resulting thigh region with the result calculated on the hip flexion ROM, the suggested 1 minute in 3 sessions included cadence 1 second up and down and also the forced bodyweight of the participant. A studied by (Peacock et al., 2015) as for lumbar pelvic region, the outcome measures were sitting and reached test (ROM), vertical jumped, broad jumped, shuttle run, and bench pressed, then duration recommended was 30 seconds with 1 session per muscle group. Moreover, (Macdonald, Button, Drinkwater, & Behm, 2014) Suggested the result measured in the quadriceps region was different from other studies using knee flexion ROM, maximum voluntary contraction (MVC) and electromyography (EMG). The time used was 1 minute with 2 sessions, cadence 2 to 4 times (up and down) per minute.

Last but not least, (Škarabot, Beardsley, & Štirn, 2015) stated the ankle was the main area he concentrated on in his analysis. The result was calculated on ankle ROM with 1-minute rolling time and 3 sessions with no cadence. The effect of foam rolling time was significant, as the outcome could be noticeable or not, and most previous studies said that all improvements from the interventions lasted less than 10 minutes (Škarabot et al., 2015).

2.3.1.3 Benefits

Foam rolling provides many benefits and could be considered equivalent to massage based on the application of dense forced soft tissue, including relief

of muscle tension, increased flexibility and improved range of motion (ROM) (Halperin, Aboodarda, Button, Andersen, & Behm, 2014).

According to the American College of Sports Medicine (ACSM), (Schroeder & Best, 2015) find that foam rolling activity gives the impression of increased flexibility before exercise and results in reduced exercise soreness and fatigue.

The foam rolling can also increase flexibility if, with the corrected technique, the person applies it to the muscle. The greater muscle strength the more motion range could be effective at the joint. Foam rolling improves ROM significantly without reducing muscle strength at the same time.

However, (Schroeder & Best, 2015) claimed that foam rolling can increase blood flow and enhance joint ROM. In addition, foam rolling may impact the body's many different systems. This may also play a role in the nervous system, relieve anxiety and stress, and even help with the pain.

Foam rolling introduces a new challenge and should, therefore, be used on a regular basis so that the body can adjust. While the popularity of self-myofascial releases such as foam roller was not outstanding compared to massage, it could have a similar effect on the person who used it. The physiological effect was still under consideration and there is no agreement on the best program for a range of movement, recovery and performance (Grieve et al., 2015). The previous study showed that myofascial therapies as a group significantly improved ROM, but did not result in any significant muscle junction improvements after treatment (C. Mauntel et al., 2014).

2.3.1.4 Gap Previous Literature in Foam Rolling Exercise Protocol

Different region has different measure as well as the duration and set. It is recommended that myofascial release happen in 60-90 seconds up to five minutes, or until a release is felt (Paolini, 2009). Study by (Halperin et al., 2014) apply three repetitions of the 30 seconds and 10 seconds rest in between used a roller massager saw a 4% increase in ankle ROM. Moreover, from (Macdonald et al., 2014) use up a PVC pipe covered in foam on the quadriceps and tested two one minutes sessions with one minute rest and a 12.7% increment in quadriceps ROM two minutes post-rolling. In addition, according to (Sullivan et al., 2013) rolling with roller massage on hamstring by used four dissimilar time session decrease an improvement of ROM from pre-test to post-test.

In addition, the design of the foam roller may considerably influence, treating the deep tissue and bring a therapeutic effect. According to (Curran, Fiore, & Crisco, 2008) showed that a full roll exerted more pressure per square inch than a less dense foam roller. Pressure is supported on the force exerted by the roller and area of contact with the roller. The roller used in studies show an increase in ROM were denser than the foam roller used. These rollers had higher density and smaller diameters compared to the commercial roller used in the present study. These variables add to expand the applied force and increasing the pressure that applied directly to the tissue, hence decreasing the associate region of roller. According to (Couture, Karlik, Glass, & Hatzel, 2015) major factor influencing the result was the pressure per unit area exerted by the roller on the tissue, which is influenced by the roller density and diameter.

2.3.2 Sports Massage

2.3.2.1 Importance

Massaged was described as "a rhythmic pressure and stroking mechanical manipulation of muscle tissues to promote health and well-being" (Cafarelli & Flint, 1992). A classic Western massage, or popularly known as Swedish massage, was the most common massage technique actually commonly used around the world for athletes and sedentary people with supposed medicinal benefits.

2.3.2.2 Technique

There have been a variety of massaged methods and their roles rely on the therapist's expertise and the desired therapeutic advantage. Since the beginning of civilization, massage methods have existed. Swedish massage incorporates many of the latest and emerging methods used in the field of massage for sports. Massaged sports consist of five primary strategies and can be carried out in many different combinations. Massaged in Swedish, the four primary strategies were effleurage, petrissage, tapotement and friction.

Effleurage (stroking) was Massaged one of the most widely used strokes in athletics. At the beginning of a session, light pressure was applied to prepare the skin and soft tissues for greater massage pressure or for flushing and relaxation purposes at the end of the procedure (Fritz, 2005). Based on the depth and speed of the strokes used, the effleurage techniques were too relaxed, muscle tissues warmed, blood circulation and tissue drainage helped, muscle and fascia extended, and soothed or sore areas (Fritz, 2005). Petrissage uses methods of tissue kneading and lifting to penetrate deeper muscle tissues. Gently kneaded or compressed skin and muscle tissues and then released (Benjamin &

Lamp, 2005). This massage technique could have a relaxing and calming effect on the muscles depending on the rate and force of the massage applied and the amount of tissue stretched. Petrissage helps to remove metabolic waste and increases the distribution of blood around the tissue.

The technique of friction deepens soft tissue fibres and strengthens the fibrous tissues of muscles, tendons or ligaments while breaking down undesirable tissue adhesions and restoring muscle mobility. Massaged friction was a deep stroke that was either applied transversally to (cross-fibre) or parallel to (linear) the underlying tissue fibre path (Benjamin & Lamp, 2005). The use of friction technique was to induce a small and regulated inflammatory response to break down scar tissue, separate adhered tissue, increase local blood circulation and decrease trigger-pointed activity (Futral, 2002). The technique of vibration was to relax and activate muscles to prepare for an activity. Vibration (shaking) was a method used before a competition to stimulate the target muscle groups (Benjamin & Lamp, 2005). It also helps return the muscles after exercise to homeostasis equilibrium. Eventually, the tapotement technique also known as percussion involves repeated light striking movement of the skin and superficial muscles with hands in a cupped position. Figure 2.1 shows some pressure method towards the participants body.

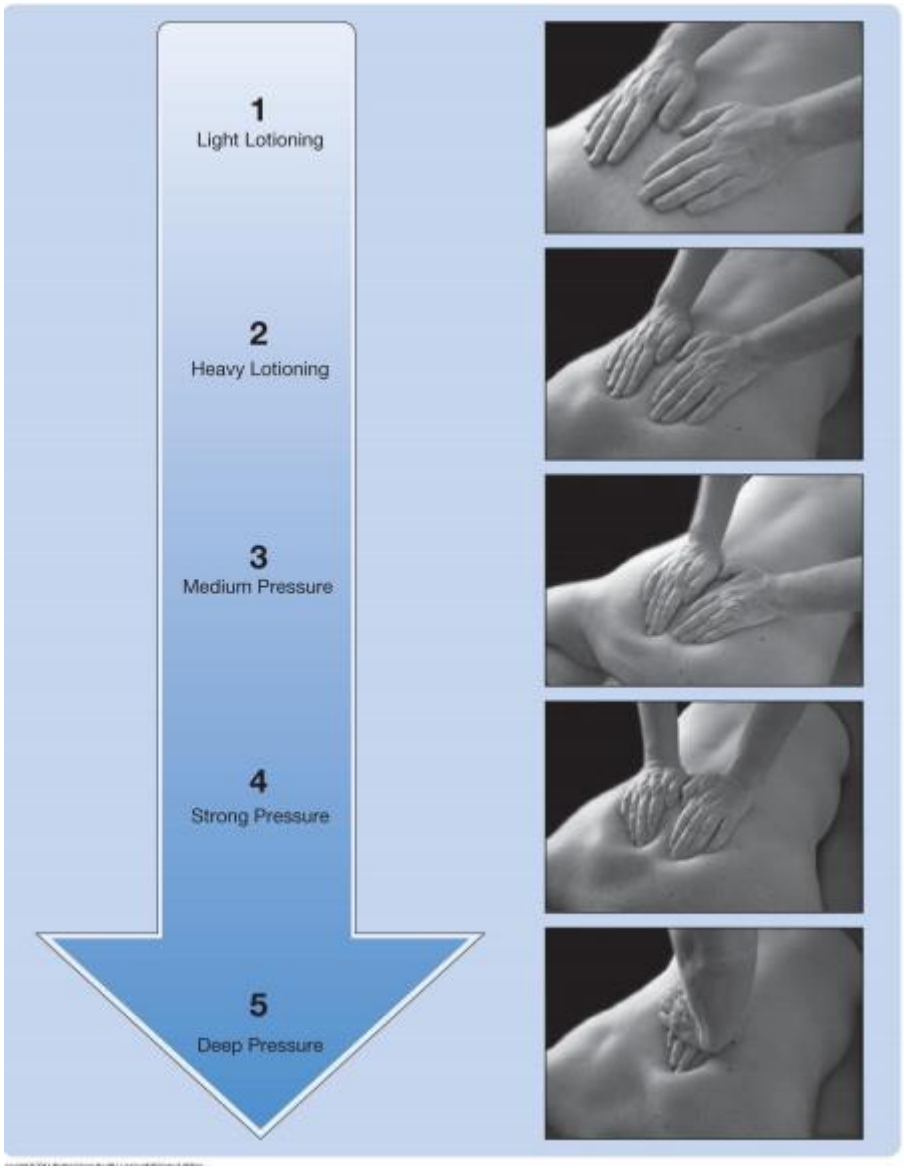

Figure 2.1 Massage Therapy Pressure Scale

2.3.2.3 Benefits

Studies on the effects of massage on power-griped performance after maximum exercise in healthy adults by Brooks, Woodruff, Wright, and Donatelli. (2005). The studied showed Massaged intervention to be strongly superior and efficient to post-exercise griped performance non-massage interventions. The most clinically relevant finding was that massaged therapy showed better results than the control group participants ' natural recovery.

Poppendieck, Wegmann, and Ferrauti, (2016) reported massage impacts on female college athletes at the beginning of the basketball and volleyball seasons (pre-season). The authors found that the massaged technique helped to improve the vertical jumping performance significantly, resulting in a significant increase in shuttle run times and significantly reduced the perceived soreness of the athlete.

(Hemmings, 2001) found that massaged while not improving physiological regeneration, it certainly helped to regenerate the psychological aspects of recovery. High-intensity exercise or competition was highly associated with mental fatigue and widespread deterioration in the state of mind. Massaged after exercise may create a sense of peace and well-being, decreased anxiety and improved mood and perceived relaxation as well as recovery (Arroyo-Morales et al., 2008). Therefore, even if the massage may not influence the physiological aspects of rehabilitation, there may be many positive effects from altering the athlete's psychological state and performing well. The discovery that recovery expectations showed significant positive improvements after massage presents some scientific support for the use of massage as a tool of recovery (Hemmings, 2001). (Arroyo-Morales et al., 2008) found less vigour and a tendency to confusion after a massaged sport could indicate a subjective perception of the relaxing state of massage therapy. Normally, a person was able to forget the stresses and tense muscles when relaxation occurs. It enables the release of muscle tension, thereby creating a better sense of well-being.

2.3.2.4 Differences in Sports Massage Methods

Sports massage protocols in previous studies vary a great deal, thus, determining the actual true effects becomes a daunting task. (Robertson, Watt, & Galloway, 2004) recommend that a leg massage last 10 min, with most massages requiring 10-30 min for effectiveness. However, increased times have also been found to have the greatest benefits to the physiological outcomes of massage intervention. A 30 min therapeutic massage of one leg two hours after a downhill running was effective in decreasing DOMS compared with no treatment (Nelson, 2013). Varying times causing varying effects on DOMS as well as muscle performance yet a standardized post-event massage protocol has not been established. Sports massage is a method of massage designed to enhance an athlete's performance, and is achieved through specialized manipulations that stimulate circulation of the blood and lymph (Beck, 2012).

2.3.2.5 Reliability of Sports Massage Protocol

Athletes have been shown to benefit from massages in the form of performance enhancement recovery, and relaxation through biomechanical, physiological, neurological and psychological mechanisms. Despite the general belief of the benefits of massage, there are limited equivocal and scarce studies on possible mechanisms of massage. One study reported poor effects of massage (effleurage technique) on dynamic flexibility as measured by passive stiffness (Stanley et al., 2001). Studies on physiological mechanisms such as the changes of blood circulation, (Tiidus & Shoemaker, 1995) and psychophysiological parameters (e.g. blood pressure and heart rate) are still inconclusive. However, results were limited to the petrissage technique. In other studies, massage has been reported to promote relaxation by improving psychophysiological

response. Therefore, further studies are needed to investigate the biomechanical, physiological, neurological and psychological mechanisms for each massage technique. The results were to provide appropriate massage applications for specific sports purposes.

The lack of studies on the mechanical effects of massage on muscle properties such as active and passive stiffness provides unclear information on the biomechanical mechanisms of massage. By understanding the mechanism of exercise-induced muscle soreness, as well as the mechanisms of massage, practitioners will be able to select the appropriate massage techniques, duration of massage application and when to apply the massage (Weerapong, Hume, & Kolt, 2005). Therefore, more research on the effects of massage is needed to clarify whether massage is beneficial for enhancing performance, enhancing recovery from injury or reducing the risk of muscular injury. A study carried out by (Thomson, Gupta, Arundell, & Crosbie, 2015) showed that there was no significant change in calf muscle stiffness or ankle dorsiflexion range of motion with or without the application of calf massage.

2.3.2.6 Sports Massage in Relation to Muscle Fatigue and Recovery

Fatigue is associated with muscle fiber changes that reflect the increased effort required to maintain a given level of mechanical performance (Arroyo-Morales et al., 2008). The relaxation produced by massage therapy has proved capable of reducing local fatigue rate and muscular excitability by inducing (Arroyo-Morales et al., 2008).

Athletes must be able to recover from physical stressors during some sporting competitions or during physical preparation within the training cycles. Massage therapy may be an appropriate counter to fatigue onset due to an ability to influence fluid movement in deep tissue and thereby improving nutrient flow or waste removal, or by facilitating relaxation to promote normal recovery.

Methodologically, research studies involving massage as a recovery intervention typically employ a test, intervention and retest format. Three research articles measured the effort of massage on a second maximal force effort (Robertson et al., 2004). Collectively, those studies conclude that massage does not alter force generation of the second effort. Few studies have been conducted on massage and muscle fatigue, and the research methodology has been varied, which makes a general regarding the effectiveness of massage impractical and inconsistent. Furthermore, ambiguous and unclear description of massage methods weakens the ability to evaluate the effectiveness of techniques for reducing muscle fatigue.

CHAPTER THREE
METHODOLOGY

This chapter have discussed and explained briefly about how the research was conducted. It included the research design, sampling technique, conceptual framework, ethical committee approval, description of sample, data collection procedure and data analysis. Location of this study conducted was according to the location of the training session.

3.1. RESEARCH CONCEPTUAL FRAMEWORK

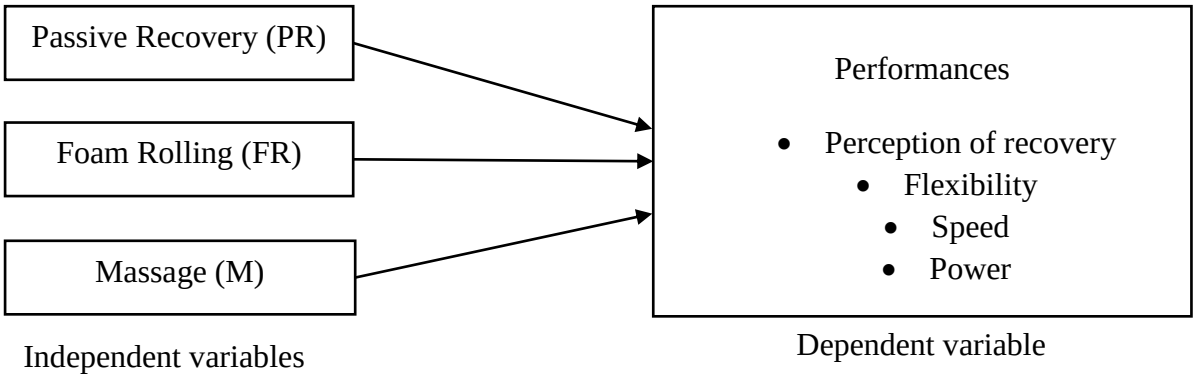

Figure 3.1 Research conceptual framework

3.2. RESEARCH DESIGN

This study involved quantitative research using an experimental design to compare the effects between UiTM Perlis FC footballers of two different intervention methods for the recovery process. The independent variables of this study were roller foam, massaged and passive recovery, while the dependent variable of this study was the process of recovery among UiTM Perlis FC footballers. This research used 3-group, randomized controlled trial design to compare the effect of 3 methods of rehabilitation after training. All participants were randomly assigned to the recovery methods. Participants was required to

perform the performance and physical outcomes 1) Total Quality Recovery, (2) sit and reach, (3) 20m sprint, (4) standing long jump. The experimental procedure was made up of familiarization, pre-testing and post-testing. All participants were expected to use the same athletic equipment during the test sessions. Participants carried out pre-testing and post-testing on two different days for all variables testing. Between pre-test and post-test, they get 24 hours rest. Measurements were performed simultaneously during the two experimental sessions to minimize the effect of diurnal variations on the selected parameters. Figure 3.2 shows the process of data collection of this study.

3.3. SAMPLING TECHNIQUE

Purposive sampling done for UiTM Perlis FC squad that joined in this study. Total of thirty (N=30) UiTM Perlis FC players participated in this study. Since all the players in the squad are average age at 21 so all the players in the team was chosen to accomplish the study with familiarization, pre-test and post-test.

3.4 ETHICAL COMMITTEE APPROVAL

This study was approved by UiTM ethic committee on 5th September 2019 after the title of this study and its purpose have been presented. Then, UiTM Perlis FC team approved this research study and agreed to be undertake among their players after a meeting was set up with the manager of the team.

3.5 PARTICIPANTS

For this experimental test, a sample of 36 UiTM Perlis FC footballers was adequate to detect a 20% difference between recovery tools to 80 power recovery and 0.05 significant level recovery process. The 20% difference indicates the contrast between roller foam, massage and passive recovery for football players (W. D. Dupont & Plummer, 1998). There is a utilization limit where there are only 30 players in the UiTM Perlis FC Team. Therefore, there was a shortage of 6 participants throughout the entire experimental phase. All participants were determined by completion of health history form (Physical Activity Readiness Questionnaire [PAR-Q]) and anthropometry data will be collected (Questions, 2019).

3.5.1 The Inclusion Criteria

i. Male aged 18-22 years
ii. UiTM students and attached with the team
iii. Training > 3 days per week

3.5.2 The Exclusion Criteria

i. Refuse to perform the test
ii. Lower body injury

3.6. STUDY PROCEDURE

All participants were divided into three different groups using a randomized controlled design according to the protocol of the fishbowl technique. This will take 3 different days for the experimental test. The participants should be reported during the first visit to familiarize themselves with the recovery methods. While during the second visit, all test variables were pre-tested by the participants. Finally, the participants execute the post-testing during the last visit. The participants had to obey the test rule where they were not allowed to eat, drink caffeine, smoke or drink alcohol for 6 hours before each test session. Figure 3.2 is data collection procedure might be helpful to for readers to understand it.

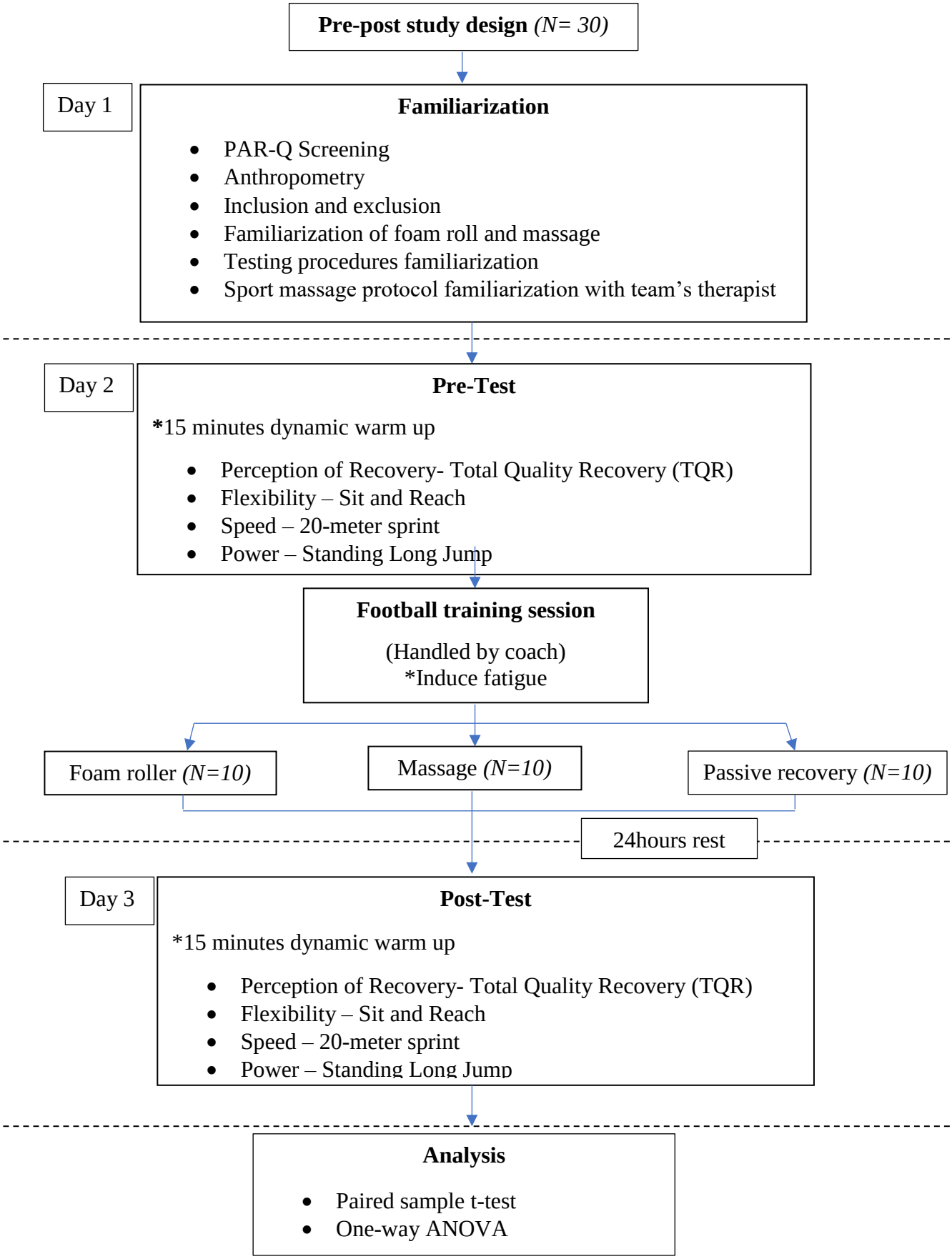

Figure 3.2 Data Collection Procedure

3.6.1 Visit 1: Familiarization

Around the same time, all participants were gathered around to complete the Par-Q+ screening before the experimental was started. For that day, the anthropometry data will also be collected. Then, the participants were explained about the inclusion and exclusion criteria needed to fulfil the experimental criteria. Eventually, all participants were generally clarified, including the methods of recovery to be done during pre- and post-testing. The use of the recovery methods was clarified and experienced by all participants before initiating the pre-testing and post-testing.

3.6.2 Visit 2: Pre-testing Session

The participants were required to carry out the experimental pre-testing on the day of the second visit. They were also asked to arrive at least 1 hour before the pre-testing. The warm-up was conducted before the pre-testing began. Next, the participants were required to complete to variable test that was given to them. Performance and physical outcomes of (1) total quality performance (2) sit and reach, (3) 20m sprint test (4) standing long jump will be measured on each of participants. Collection of data was taken for the pre-testing immediately after each of the variable tests was done. Once all the variable tests were done, all participants continued with the training session which was provided by their coaches. Right after the training end, all participants will apply the recovery modalities either foam rolling, massaged or passive recovery that will be given to each of them randomly. The participants will rest for 24 hours before they did the post-testing on the next day.

3.6.3 Visit 3: Post-testing Session

During the third visit of experimental, the participants was required to come exactly after 24 hours of rest. The warm-up was conducted before all participants perform the post-testing. Once they finished the warm-up, they were required to did the same variable testing as they did during the second visit. They performed the outcomes of (1) Total Quality Recovery (2) sit and reach, (3) 20m sprint test (4) standing long jump. Collection of data were taken for the post-testing immediately after each of the variable tests was done.

3.7. RECOVERY MODALITIES

3.7.1 Foam Rolling

Figure 3.3 shows the protocol used in this study, participants involved in the rolling of foam will use a high-density foam roller. When the foam roller was used, five different muscles were focused. All the muscle groups are the most commonly used muscles in football (quadriceps, hamstrings, adductors, gluteal and iliotibial band). The participants were advised to use the foam roller in the most distal part of the muscle and to place as much of their body as tolerable. Instructors instructed the participants to roll their body mass back and forth as smoothly as possible across the foam roller. The participants had to use the foam roller on both sides of their bodies. The participants needed 20 minutes of time to finish the rolling of the foam.

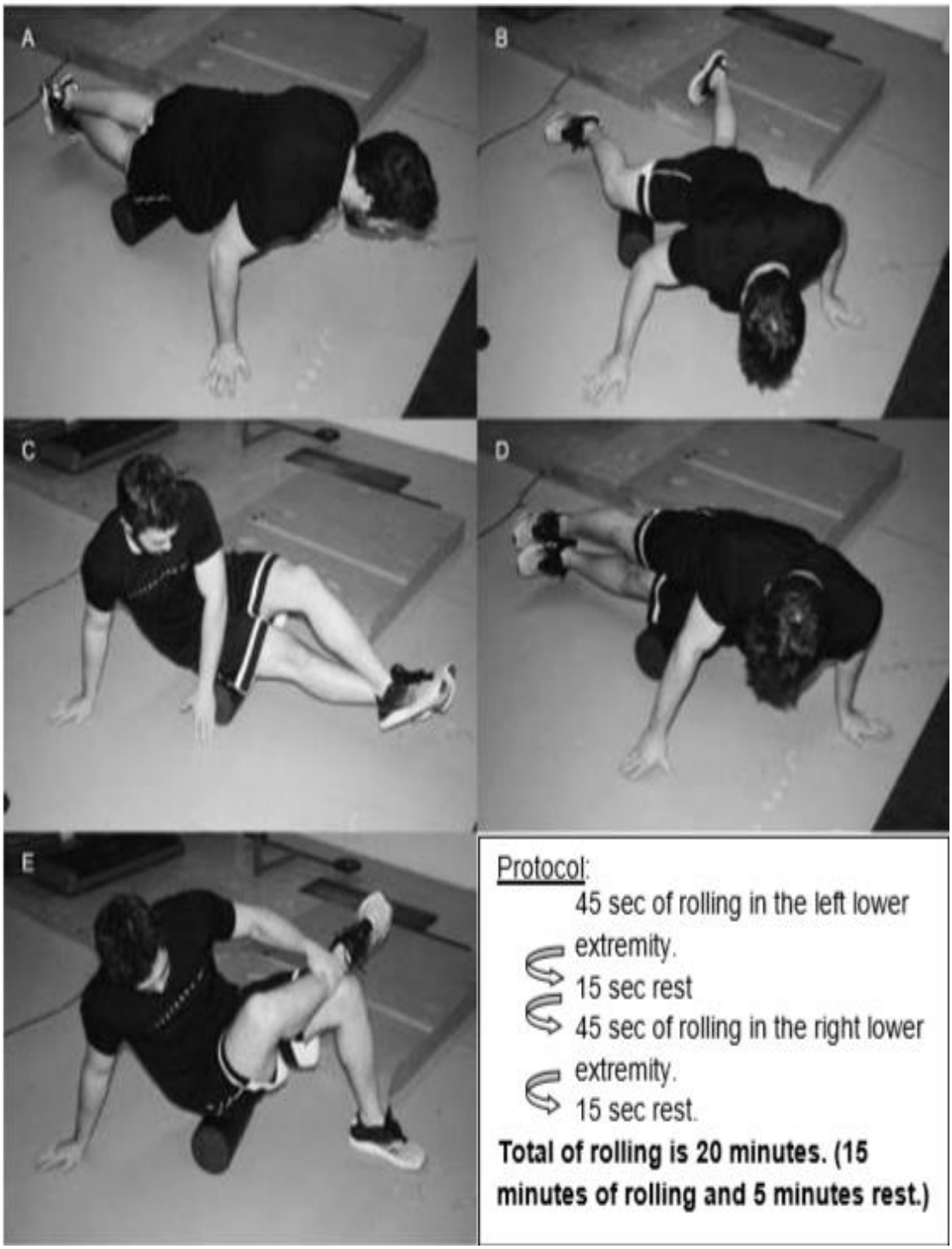

Figure 3.3 Foam Rolling Protocol Adopted from(Pearcey et al., 2015)

3.7.2 Massage

The massage protocol was adopted from the (Arabaci, 2008) in table 3.1. In order to ensure continuity and reliability, the massage procedure was performed chronologically on each participant. The massage technique that focuses on the front and back of both legs. The massage was applied at the same muscles group (quadriceps, hamstrings, adductors, gluteal and iliotibial band) same as doing on foam rolling. The lubrication allows the sports massage therapist to quickly move the hands on the surface of the skin and reduce friction that can agitate the skin of the participant. According to the (Arabaci, 2008) the quantity of oil applied to each participant is adequate to provide relief during the vigorous massage without skin or hair discomfort on the leg.

Right Side		**Left Side**	
Minutes	**Techniques**	**Minutes**	**Techniques**
0:00 – 2:00	**Massage of hamstrings**	**6:00 – 8:00**	**Massage of hamstrings**
	Effleurage		Effleurage
	Petrissage		Petrissage
	Friction		Friction
	Tapotement		Tapotement
2:00 – 4:00	**Massage of iliotibial band**	**8:00 – 10:00**	**Massage of iliotibial band**
	Effleurage		Effleurage
	Petrissage		Petrissage
	Friction		Friction
	Tapotement		Tapotement
4:00 – 6:00	**Massage of gluteal**	**10:00 – 12:00**	**Massage of gluteal**
	Effleurage		Effleurage
	Petrissage		Petrissage
	Friction		Friction
	Tapotement		Tapotement
12:00 – 14:00	**Massage of quadricep**	**16:00 – 18:00**	**Massage of quadricep**
	Effleurage		Effleurage
	Petrissage		Petrissage
	Friction		Friction
	Tapotement		Tapotement
14:00 – 16:00	**Massage of adductor**	**18:00 – 20:00**	**Massage of adductor**
	Effleurage		Effleurage
	Petrissage		Petrissage
	Friction		Friction
	Tapotement		Tapotement

Table 3.1 Modified Sports Massage Protocol from(Arabaci, 2008)

3.7.3 Passive Recovery

During passive recovery, the participants were instructed to sit on a bench. Similar to the duration of foam rolling and massage, 20 minutes of passive recovery time was provided. The participants were allowed to do whatever they like (i.e. play phone, watch the video, etc.), but the participants are not allowed to engage in any recovery procedure (i.e., massage, foam rolling, cold water immersion, etc.) for 20 minutes during both pre-testing and post-testing sessions.

3.8. TEST VARIABLES

3.8.1 Total Quality Recovery

Total Quality Recovery scale adopted by (Kenttä & Hassmén, 1998) was used to gauge player's general perception of recovery.

3.8.2 Sit and Reach

This test was used to assess the progress within the body part and hamstring flexibility. The sit and reach test was performed according to the procedure (F. Wells & K. Dillon, 2013). Two trials were completed, with an intermission of 30 seconds between trials.

3.8.3 20-m Sprint Test

This test involves running over 20 meters of a single maximal sprint, with recorded time. participants were given to practice before the test started. Start with one foot in front of the other from a stationary position. The front foot has to be either on or behind the start line. This starting position should be held for 2 seconds before starting and there should be no rocking movements are required. This test was using the stopwatch to record the timing of the

participants and participants were given 3 trials. The timing started after the participants from the first movement and the timing stopped after the chest of the participants were passed the finishing line (Robert. W, 2008).

3.8.4 Standing Long Jump

The participants stand at the back of a line marked of the ground together with feet slightly apart. A pair foot take -off and landing is used, together with arms yet bending regarding the knees in imitation of provide foregoing drive. The participants attempt in conformity with jump as far as possible, landing with both feet without falling backwards. The participants were given three attempts for this trial (Robert. W, 2008).

3.9. INSTRUMENTIONS

Below is all the equipment that have been used in this experimental:

3.9.1 Height Scale

(Height Scale OEM pou431, China) used to measure height of participants for anthropometrics data.

Figure 3.4 Height Scale

3.9.2 Weight Scale

(TANITA UM-050) used to measured weight of participants for anthropometrics data.

Figure 3.5 Weight Scale

3.9.3 Stop Watch

A (Casio Stopwatch HS-3V-1, Japan) used to measure the duration of 20-m sprint test, foam rolling, massage and passive recovery interventions.

Figure 3.6 Stop Watch

3.9.4 Measuring Tape

Fibreglass Open Frame Measuring Tape (30m, height 260mm x width 170mm x diameter 40mm) will use to measure the distance of 20-m sprint test and standing long jump.

Figure 3.7 Measuring Tape

3.9.5 Mini Cone

Plastic mini cones (Mini Agility Cone, China) will use to marks the distance in 20m sprint test and standing long jump.

Figure 3.8 Mini Cone

3.9.6 Total Quality Recovery Scale

Scale of total quality recovery print out and participant's rate recovery perception.

Total quality recovery (TQR)
6
7 Very, very poor recovery
8
9 Very poor recovery
10
11 Poor recovery
12
13 Reasonable recovery
14
15 Good recovery
16
17 Very good recovery
18
19 Very, very good recovery
20

Figure 3.9 Total Quality Recovery

3.9.7 Sit and Reach Box

(Sit and Reach Box, Malaysia, 60cm length) used to measure the flexibility among participants.

Figure 3.10 Sit and Reach

3.9.8 Foam Roller

The Grid Foam Roller (ATF standard density, 13 inches x 5.5 inches) used in foam rolling intervention.

Figure 3.11 Foam Roller

3.9.9 Massage Table

Massage table (M7456 portable lightweight folding massage table) used in massage intervention.

Figure 3.12 Massage Table

3.9.10 Massage Oil

Massage oil (Perfume Generics sunflower essence massage oil, Earth Nature Biotech, Malaysia - NOT150802216K) used by the masseur in massage intervention.

Figure 3.13 Massage Oil

3.10. STATISTICAL ANALYSIS

All findings were identified as mean ± standard deviation in this study. The ANOVA method was used to compare each of the test variables with three separate recovery processes among UiTM Perlis FC footballers. Pre-testing and post-testing between groups were evaluated using the paired sample t-test, where $p<0.05$ was accepted statistical significance. Analysis of the data collected during the experiment using the IBM SPSS Statistic version 25. 0.

CHAPTER FOUR
RESULT AND ANALYSIS

4.1 INTRODUCTION

The goal of this study was to compare the effect of myofascial release of foam rolling, massage and passive recovery tools on UiTM Perlis FC footballers. In particular, these studies used experimental records from four different variables which are (1) Total Quality Recovery, (2) sit and reach, (3) 20m sprint test and (4) standing long jump. The experimental procedures have all been completed by the participant. All variables were evaluated using descriptive statistics, paired sample t-test and One-way ANOVA.

4.2 PHYSICAL CHARACTERISTICS OF PARTICIPANTS

Variables	Foam Roller (N=10) Mean ± SD	Massage (N=10) Mean ± SD	Control Group (N=10) Mean ± SD
Age (y/o)	21 ± 1.07	20 ± 1.3	20 ± 1.1
Height (cm)	171 ± 4.9	170 ± 6.08	171 ± 4.5
Weight (kg)	65 ± 7.4	64 ± 7.5	66 ± 8.2
BMI ($kg.m^{-2}$)	22 ± 1.7	22 ± 2.4	23 ± 2.3

Table 4.1 Demographic Data of Participants

Based on descriptive statistic, show the data from the participants for the mean age, height, weight and BMI for different group of interventions. Foam roller group shows more senior players on that group compare to other groups. While, the height of the foam roller and control group can be categorized as same height which 171, where massage group slightly decrease in height. In this modern era, where all the coaches would like to have more height players to win height ball and make their team more confident to fight against opponents. Moreover, weight for massage group is more light compared to other groups and their BMI indicates that all the groups have normal which is good for the athletes.

4.3 PERCEPTION OF RECOVERY

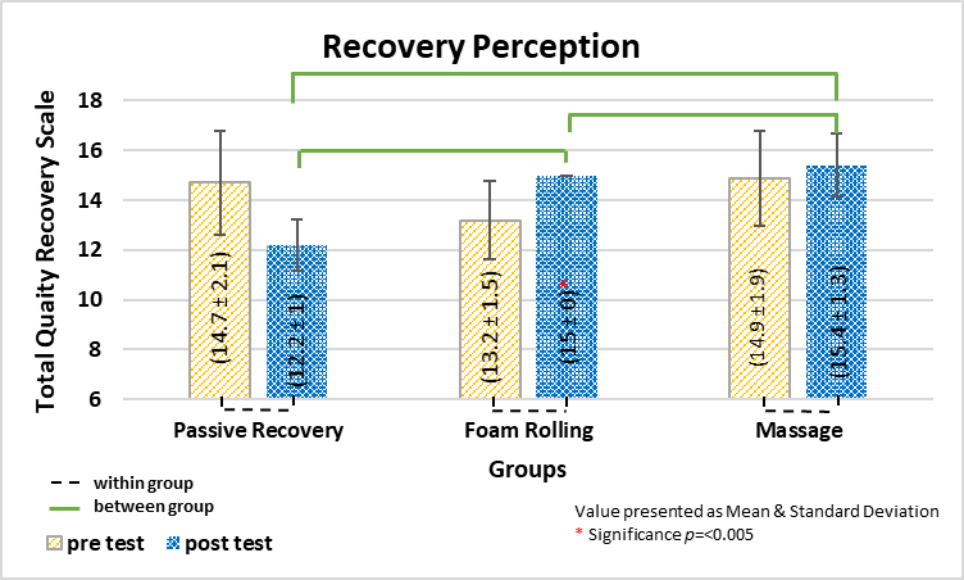

Figure 4.2 Results of Total Quality Recovery

Figure 4.2 shows result for perception of recovery. Total Quality Recovery was used to measure the perception of recovery of all participants. A paired sample t-test was conducted to compare the perception of recovery on passive recovery, foam rolling and massage between pre-test and post-test. From the result, only foam rolling was showing a significance different in pre-post test which p=.005. Meanwhile, massage and passive recovery did not show significance different in pre-post test ($p > 0.05$).

One-way ANOVA was run to compare the recovery modalities within group for every variable. The comparison between recovery modalities has shown a significance different p=.000. From the results, all recovery modalities did show a positive effect when compare the recovery modalities within groups.

4.4 FLEXIBILITY

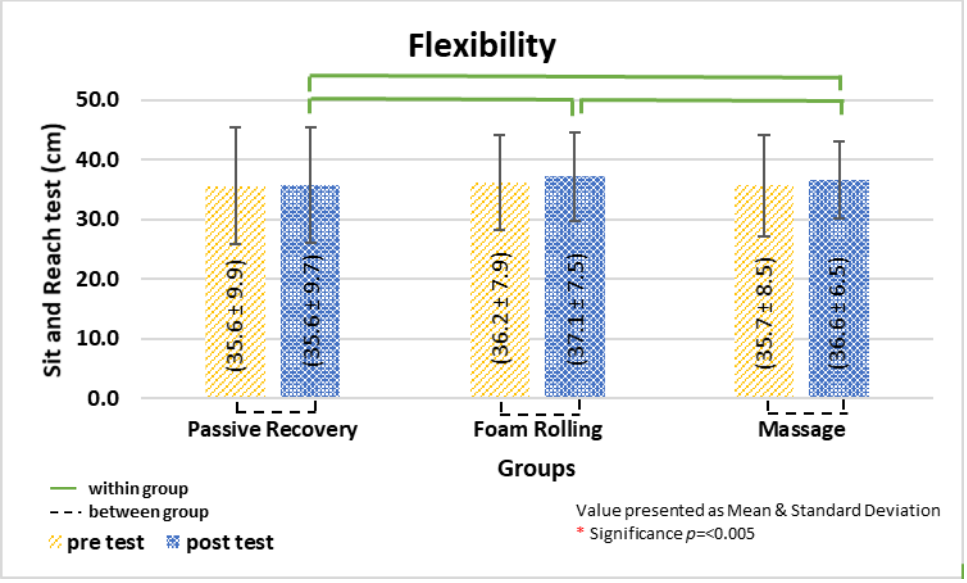

Figure 4.3 Results of Sit and Reach

Figure 4.3 shows result for flexibility. Sit and reach test was used to measure the flexibility of all participants. A paired sample t-test was conducted to compare the flexibility on passive recovery, foam rolling and massage between pre-test and post-test. From the result, none of the recovery modalities was showing a significance different in pre-post test which (p > .005).

One-way ANOVA was run to compare the recovery modalities within group for every variable. The comparison between recovery modalities has shown a significance different p=.000. From the results, all recovery modalities did not show a positive effect when compare the recovery modalities within groups.

4.5 SPEED

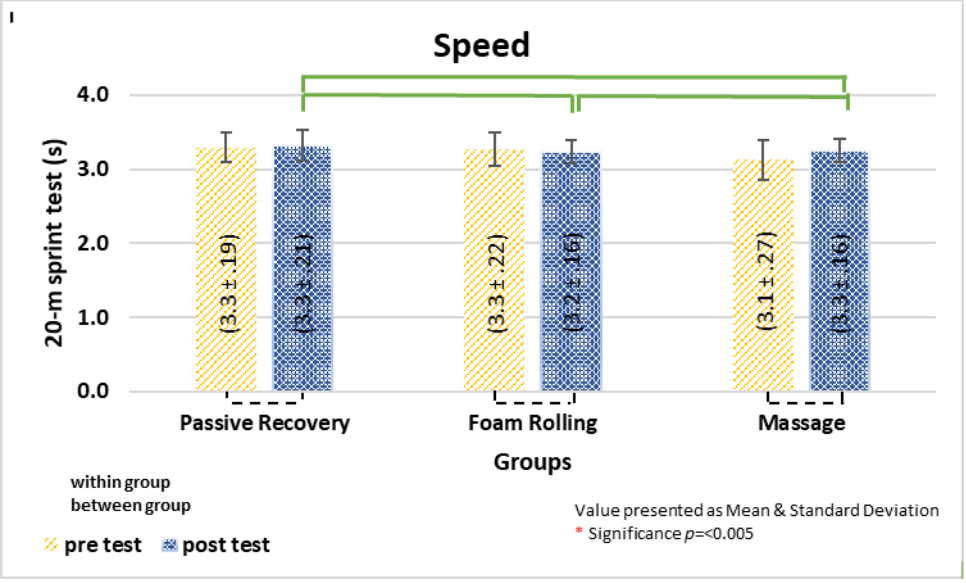

Figure 4.4 Results of 20-meter Sprint

Figure 4.4 shows result for sprint. 20-meter sprint test was used to measure the sprint of all participants. A paired sample t-test was conducted to compare the sprint on passive recovery, foam rolling and massage between pre-test and post-test. From the result, none of the recovery modalities was showing a significance different in pre-post test which (p > .005).

One-way ANOVA was run to compare the recovery modalities within group for every variable. The comparison between recovery modalities has shown a significance different p=.000. From the results, all recovery modalities did not show a positive effect when compare the recovery modalities within groups.

4.6 POWER

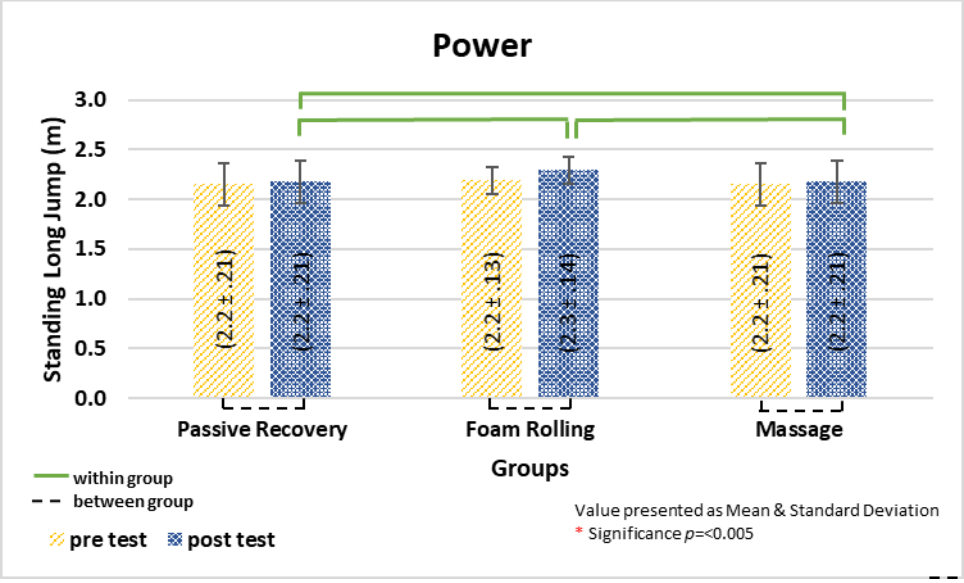

Figure 4.5 Results of Standing Long Jump

Figure 4.5 shows result for power. Standing long jump test was used to measure the power of all participants. A paired sample t-test was conducted to compare the power on passive recovery, foam rolling and massage between pre-test and post-test. From the result, none of the recovery modalities was showing a significance different in pre-post test which (p > .005).

One-way ANOVA was run to compare the recovery modalities within group for every variable. The comparison between recovery modalities has shown a significance different p=.000. From the results, all recovery modalities did not show a positive effect when compare the recovery modalities within groups.

CHAPTER FIVE
DISCUSSION, CONCLUSION AND RECOMMENDATION

Discussion

5.1 Introduction

The aim of this study was to investigate the effects of foam rolling vs massage as recovery tools among UiTM Perlis FC footballers. Objectives of this study were 1) to investigate whether foam roller was an effective tool aid for the recovery process among UiTM Perlis FC footballers and 2) to investigate specifically the effect of foam rolling on the perception of performance and physical outcomes.

This study was were measured Total Quality Recovery (TQR) as perception of recovery, sit and reach as flexibility, 20-meter sprint as speed and standing long jump as power and categorized as dependent variables, while the independent variables are foam rolling, massage and passive recovery(control). 20 minutes were required in every single intervention.

The main findings of this study were that foam rolling, massage and passive recovery as recovery tools did not have a positive effect on sit and reach, 20-meter sprint and standing long jump performance ($p > 0.05$). Application of foam rolling after football training session have a positive effect on Total Quality Recovery (TQR) compared with massage and passive recovery ($p < 0.05$). Generally, although there were several differences related to experimental protocol, sample or design, the results of the present investigation are in line with those of previous studies (Casanova et al., 2018; Macdonald et al., 2014; Nedelec et al., 2014; Rey et al., 2017) in which foam rolling was used as a recovery tool after exercise.

5.2 Perception of Recovery

Perception has defined as the result or product of perceiving. From this study, TQR was used to measure the perception of recovery toward participants after 24hours of rest. According to the result of this study, it showed that there was a significance in foam rolling compared with another two different recovery interventions; massage group and control group by measured the recovery perception towards the participants.

Prior study by (Rey et al., 2017) showing that there's a significance result on recovery perception towards young footballers after training session with the recovery modalities are foam rolling and passive recovery. Moreover, lack of studies was found that perception can be increase after application of recovery interventions. However, lack of study using TQR scale to asses recovery status after application of different recovery strategies in soccer players. Study from (Kinugasa & Kilding, 2009) examined effects of 3 post match recovery modalities (contrast water immersion, passive recovery and cold-water immersion) on physical performance, physiological measures and perceptions of recovery using TQR in young players after soccer match. The result indicates none of the 3 recovery strategies had substantial effect on TQR values.

5.3 Flexibility

Flexibility is defined as range of motion (ROM) of a joint, or group of joints, as per the skeletal muscles and not any external forces. This study measured flexibility test whereby the participants had to performed sit and reach. Result stated that there was no significance difference in 3 groups of intervention; foam rolling, massage and control group.

Previous study by (Rey et al., 2017) was proven that sit and reach test among the footballer did not have positive effect comparing with 2 different recovery tools; foam rolling and passive recovery after training session within 24hours. Next, another study by (Miller & Rockey, 2006) supported the data which was their study measure active knee extension determined by using an inclinometer and a Flexometer. Their analysis showed that no significance different between the treatment and control group. Miller & Rockey, (2006) indicated that stretching the hamstring with foam roller may not impact the flexibility. However, many studies show

In the other hands, studied by (Barlow et al., 2004) the treatment consisted of either hamstring muscle massage (both legs, total time approximately 15 minutes) or supine rest without massage. (Barlow et al., 2004) concluded that no big variations between the massage and no massage groups were noticed.

5.4 Speed

The ability to perform a movement within short period of time is known as speed. The test of this study regarding on speed parameter was 20-meter sprint test that have been done by the participants. The data showed a significance worsening between all the recovery interventions.

Other study by (Rey et al., 2017) showing the comparison between passive recovery and foam rolling towards young footballers there is no difference on the result after 24hours rest. Moreover, studies by (Wiewelhove et al., 2019) conclude that in their systematic review regarding seven studies of roller massage indicate that there is reduction in performance of speed after the application of roller massage during recovery session.

Next, a study was carried out by (Arabaci, 2008) to investigate the acute effects of lower limb massage after warming up on explosive and high-speed motor power and flexibility. The data of (Arabaci, 2008) studied showed that significant degradation in the vertical jump and leg reaction time after massage and stretching intervention.

5.5 Power

Power is the product of force and velocity and represents the amount of work muscle can produce per unit of time. In this study, participants were required to test power by performing standing long jump, since the data showed that there was no significance difference among 3 interventions.

Few studies reported their studies have the same result which not have significance. Here's the supporting evident study by Behara & Jacobson, (2017) claimed that there have been no noticeable improvements in strength or power improved flexibility after deep tissue roller (DTR) can be used interchangeably with conventional stretching exercises. Meanwhile, according to the study of (Wiewelhove et al., 2019) regarding fourteen studies of foam roller during warm-up activity indicate that decrease in power or jump performance.

Furthermore, studied by (McKechnie, Young, & Behm, 2007) to determine if three minutes of massage petrissage and tapotement types would affect the strength and muscle power of plant flexors. At the end of the result (McKechnie et al., 2007), claimed that massage has not adversely affected the tests of jump power.

5.6 Conclusion

In conclusion, the aim of this study is to investigate the effects of foam rolling vs massage as recovery tools towards perception or recovery, flexibility, speed and power performance among UiTM Perlis FC footballers. According to FITT principle, participants trained more than 3 days per week based on their periodization. During pre-test session is suitable since their intensity of training is high intensity with the duration of training more than 60 minutes. According to result from this study, only perception of recovery has shown a significance different when comparing with 3 modalities within groups after 24hours of rest. However, there is no significance different in flexibility, speed and power performances comparing all 3 different recovery modalities after 24hours of rest.

5.7 Recommendation

Below are the recommendation to be considered by the future researchers in this area of study based on the finding of the current study:

a) This study should be applied to another team sports whether it's effective to their nature of sports.
b) Further researcher may try to applied to young footballers since their physiological and recovery might be shorter time.
c) The used of latest equipment are recommended to get an accurate data.
d) Further research is needed to explore the amount of force exerted in foam roller to be applied to the athletes.
e) Future researcher should try to add more set on foam rolling intervention.
f) The used of another recovery methods to get the better recovery and performance.
g) Try to applied foam rolling and massage intervention at gastrocnemius muscle.

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APPENDICES

APPENDIX A

Ethics Approval

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Institut Pengurusan Penyelidikan & Inovasi
Institute of Research Management & Innovation

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Reference : 600-IRMI (5/1/6)
Our reference : REC/448/19
Date : 3 SEP 2019

Madam Nurul Afiqah Bakar
Faculty of Sports Science and Recreation
Universiti Teknologi MARA
Arau Campus, 02600 Arau
PERLIS

Dear Madam Nurul Afiqah Bakar,

ETHICS APPROVAL BY UiTM RESEARCH ETHICS COMMITTEE

Title: The Effects of Foam Rolling vs Massage as Recovery Tool among Youth Footballer.

Trial Site: Darul Aman Stadium, Alor Setar, Kedah

Thank you for your research ethics application on 20 August 2019. We would like to inform that the UiTM Research Ethics Committee had deliberated your proposal.

It is our pleasure to inform you that the Research Ethics Committee has agreed to grant an ethics approval for the said study. This ethics approval is valid from 20 August 2019 until 30 November 2019.

Please submit progress report of the study to the REC Secretariat 6 months after the date of approval letter and annually until the study has completed. Please kindly notify the REC for any amendments to the relevant documents for this study. Notification should be made to the REC for any protocol deviation and in case of serious adverse event, please notify the REC within 48 hours from the time known. A summary of the final report should be submitted at the end of your study.

The UiTM Research Ethics Committee operates in accordance to the ICH Good Clinical Practice Guidelines, Malaysia Good Clinical Practice Guidelines and the Declaration of Helsinki.

Thank you.

Yours truly,

ASSOCIATE PROFESSOR DATIN DR HAJAH SARINA MD YUSOF
Deputy Chairman of UiTM Research Ethics Committee

APPENDIX B

Informed Consent for Exercise Testing

Borang REC 2/2016 BI

Subjects Information Sheet

(The Effects of Foam Rolling Vs. Massage as Recovery Among Youth Footballer**)**

Introduction of Study

Human body system will be stressed during the continuous activities. It may lead to the acute fatigue. In football concept, a continuous training and match may predispose footballers to suffer acute fatigue at the same time overload injuries may occur to the footballer due to the continuous training and match.

Purpose of Study

The purpose of this study is to investigate whether foam rolling, massage or passive recovery is an effective tool aid in recovery among youth footballer.

Study Procedure

The experimental will be doing right after the subjects done with their training session. 3 visits will be do where during the first visit, the familiarization of the experimental will be clearly explained to all subjects. During second visits, all the subjects will perform the pre-testing of the recovery intervention and will be perform a test that was already selected. Lastly, on third visit, all the subjects will perform post-testing and the same time intervention and will perform the same test as during the second visit.

Participation in Study

Your participation in this study is entirely voluntary. You may refuse to take part in the study or you may withdraw yourself from participation in the study at any time without penalty.

Benefit of Study

Information obtained from this study will benefit the researchers, Government of Malaysia, doctors and individuals for the advancement of knowledge and practice of medicine in future.

Benefit to participant if any.

If you have any question about this study or your rights, please contact the investigator at telephone number

(Nurul Afiqah bt Bakar 013-4161355)

Study Risk

The risk of this study will minor discomfort on the muscle due to the acute fatigue that the subject gets from the training session.

Confidentiality

Your medical information will be kept confidential by the investigators and will not be made public unless disclosure is required by law.

By signing this consent form, you will authorize the review of records, analysis and use of the data arising from this study.

Consent Form

To become a subject in the research, you or your legal guardian is advised to sign this Consent Form.

I herewith confirm that I have met the requirement of age and am capable of acting on behalf of myself /* as a legal guardian as follows:

1. I understand the nature and scope of the research being undertaken.
2. I have read and understood all the terms and conditions of my participation in the research.
3. All my questions relating to this research and my participation therein have been answered to my satisfaction.
4. I voluntarily agree to take part in this research, to follow the study procedures and to provide all necessary information to the investigators as requested.
5. I may at any time choose to withdraw from this research without giving reasons.
6. I have received a copy of the Subjects Information Sheet and Consent Form.
7. Except for damages resulting from negligent or malicious conduct of the researcher(s), I hereby release and discharge UiTM and all participating researchers from all liability associated with, arising out of, or related to my participation and agree to hold them harmless from any harm or loss that may be incurred by me due to my participation in the research.

_____

___ Name of Subject/Legal Guardian Signature

_____

___ I.C No Date

_____

___ Name of Witness Signature

_____

___ I.C No Date

_____

___ Name of Consent Taker Signature

_____

___

I.C No Date

APPENDIX C

Score Sheet Form

Testing / Data Collection Form

Name : _____ **Dominant Leg** : _____
Date of Birth : _____ **Position** : _____
NRIC : _____ **Injury** : Yes / No

Height:	Body Mass Index (BMI):	Water Percentage (%)	Fat Percentage (%)
Weight:			

1. Total Quality Rest (TQR)

Pre – Testing	
Post – Testing	

2. Sit and Reach

Pre – Testing			
Trial 1	Trial 2	Trial3	Mean

Post – Testing			
Trial 1	Trial 2	Trial3	Mean

3. 20-m Sprint

Pre – Testing			
Trial 1	Trial 2	Trial3	Mean

Post – Testing			
Trial 1	Trial 2	Trial3	Mean

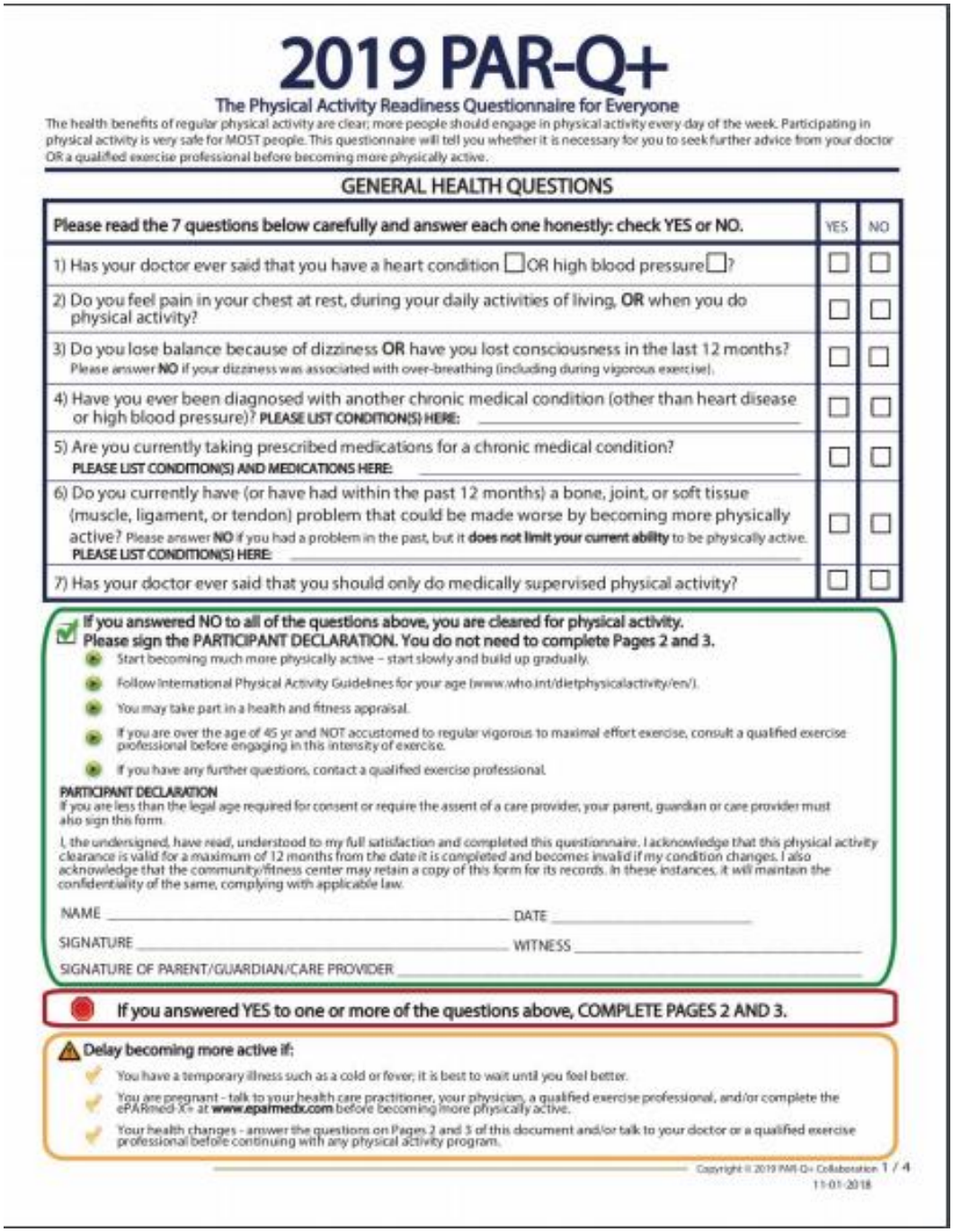
4. Standing Long Jump

Pre – Testing			
Trial 1	Trial 2	Trial3	Mean

Post – Testing			
Trial 1	Trial 2	Trial3	Mean

APPENDIX D

Physical Activity Readiness Questionnaire



2019 PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

The health benefits of regular physical activity are clear; more people should engage in physical activity every day of the week. Participating in physical activity is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

GENERAL HEALTH QUESTIONS

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	YES	NO
1) Has your doctor ever said that you have a heart condition ☐ OR high blood pressure ☐?	☐	☐
2) Do you feel pain in your chest at rest, during your daily activities of living, **OR** when you do physical activity?	☐	☐
3) Do you lose balance because of dizziness **OR** have you lost consciousness in the last 12 months? Please answer **NO** if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)? **PLEASE LIST CONDITION(S) HERE:**	☐	☐
5) Are you currently taking prescribed medications for a chronic medical condition? **PLEASE LIST CONDITION(S) AND MEDICATIONS HERE:**	☐	☐
6) Do you currently have (or have had within the past 12 months) a bone, joint, or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active? Please answer **NO** if you had a problem in the past, but it **does not limit your current ability** to be physically active. **PLEASE LIST CONDITION(S) HERE:**	☐	☐
7) Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

If you answered NO to all of the questions above, you are cleared for physical activity.
Please sign the PARTICIPANT DECLARATION. You do not need to complete Pages 2 and 3.

- Start becoming much more physically active – start slowly and build up gradually.
- Follow International Physical Activity Guidelines for your age (www.who.int/dietphysicalactivity/en/).
- You may take part in a health and fitness appraisal.
- If you are over the age of 45 yr and NOT accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.
- If you have any further questions, contact a qualified exercise professional.

PARTICIPANT DECLARATION

If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that the community/fitness center may retain a copy of this form for its records. In these instances, it will maintain the confidentiality of the same, complying with applicable law.

NAME _____ DATE _____

SIGNATURE _____ WITNESS _____

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER _____

If you answered YES to one or more of the questions above, COMPLETE PAGES 2 AND 3.

Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ at **www.eparmedx.com** before becoming more physically active.
- Your health changes - answer the questions on Pages 2 and 3 of this document and/or talk to your doctor or a qualified exercise professional before continuing with any physical activity program.

 1 / 4

11-01-2018

2019 PAR-Q+

FOLLOW-UP QUESTIONS ABOUT YOUR MEDICAL CONDITION(S)

1. Do you have Arthritis, Osteoporosis, or Back Problems?

If the above condition(s) is/are present, answer questions 1a-1c If **NO** ☐ go to question 2

1a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
1b.	Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)?	YES ☐ NO ☐
1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	YES ☐ NO ☐

2. Do you currently have Cancer of any kind?

If the above condition(s) is/are present, answer questions 2a-2b If **NO** ☐ go to question 3

2a.	Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and/or neck?	YES ☐ NO ☐
2b.	Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)?	YES ☐ NO ☐

3. Do you have a Heart or Cardiovascular Condition? This includes Coronary Artery Disease, Heart Failure, Diagnosed Abnormality of Heart Rhythm

If the above condition(s) is/are present, answer questions 3a-3d If **NO** ☐ go to question 4

3a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
3b.	Do you have an irregular heart beat that requires medical management? (e.g., atrial fibrillation, premature ventricular contraction)	YES ☐ NO ☐
3c.	Do you have chronic heart failure?	YES ☐ NO ☐
3d.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?	YES ☐ NO ☐

4. Do you have High Blood Pressure?

If the above condition(s) is/are present, answer questions 4a-4b If **NO** ☐ go to question 5

4a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
4b.	Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer **YES** if you do not know your resting blood pressure)	YES ☐ NO ☐

5. Do you have any Metabolic Conditions? This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes

If the above condition(s) is/are present, answer questions 5a-5e If **NO** ☐ go to question 6

5a.	Do you often have difficulty controlling your blood sugar levels with foods, medications, or other physician-prescribed therapies?	YES ☐ NO ☐
5b.	Do you often suffer from signs and symptoms of low blood sugar (hypoglycemia) following exercise and/or during activities of daily living? Signs of hypoglycemia may include shakiness, nervousness, unusual irritability, abnormal sweating, dizziness or light-headedness, mental confusion, difficulty speaking, weakness, or sleepiness.	YES ☐ NO ☐
5c.	Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, **OR** the sensation in your toes and feet?	YES ☐ NO ☐
5d.	Do you have other metabolic conditions (such as current pregnancy-related diabetes, chronic kidney disease, or liver problems)?	YES ☐ NO ☐
5e.	Are you planning to engage in what for you is unusually high (or vigorous) intensity exercise in the near future?	YES ☐ NO ☐

11-01-2018

2019 PAR-Q+

6. **Do you have any Mental Health Problems or Learning Difficulties?** This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome

If the above condition(s) is/are present, answer questions 6a-6b If **NO** ☐ go to question 7

6a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
6b.	Do you have Down Syndrome **AND** back problems affecting nerves or muscles?	YES ☐ NO ☐

7. **Do you have a Respiratory Disease?** This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure

If the above condition(s) is/are present, answer questions 7a-7d If **NO** ☐ go to question 8

7a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
7b.	Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?	YES ☐ NO ☐
7c.	If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?	YES ☐ NO ☐
7d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?	YES ☐ NO ☐

8. **Do you have a Spinal Cord Injury?** This includes Tetraplegia and Paraplegia

If the above condition(s) is/are present, answer questions 8a-8c If **NO** ☐ go to question 9

8a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
8b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?	YES ☐ NO ☐
8c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?	YES ☐ NO ☐

9. **Have you had a Stroke?** This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event

If the above condition(s) is/are present, answer questions 9a-9c If **NO** ☐ go to question 10

9a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	YES ☐ NO ☐
9b.	Do you have any impairment in walking or mobility?	YES ☐ NO ☐
9c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?	YES ☐ NO ☐

10. **Do you have any other medical condition not listed above or do you have two or more medical conditions?**

If you have other medical conditions, answer questions 10a-10c If **NO** ☐ read the Page 4 recommendations

10a.	Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months **OR** have you had a diagnosed concussion within the last 12 months?	YES ☐ NO ☐
10b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?	YES ☐ NO ☐
10c.	Do you currently live with two or more medical conditions?	YES ☐ NO ☐

PLEASE LIST YOUR MEDICAL CONDITION(S) AND ANY RELATED MEDICATIONS HERE: _____

_____

GO to Page 4 for recommendations about your current medical condition(s) and sign the PARTICIPANT DECLARATION.

11-01-2018

2019 PAR-Q+

If you answered NO to all of the FOLLOW-UP questions (pgs. 2-3) about your medical condition, you are ready to become more physically active - sign the PARTICIPANT DECLARATION below:

- It is advised that you consult a qualified exercise professional to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually - 20 to 60 minutes of low to moderate intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate intensity physical activity per week.
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.

If you answered **YES** to **one or more of the follow-up questions** about your medical condition:

You should seek further information before becoming more physically active or engaging in a fitness appraisal. You should complete the specially designed online screening and exercise recommendations program - the **ePARmed-X+ at www.eparmedx.com** and/or visit a qualified exercise professional to work through the ePARmed-X+ and for further information.

Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ **at www.eparmedx.com** before becoming more physically active.
- Your health changes - talk to your doctor or qualified exercise professional before continuing with any physical activity program.

- You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.
- The authors, the PAR-Q+ Collaboration, partner organizations, and their agents assume no liability for persons who undertake physical activity and/or make use of the PAR-Q+ or ePARmed-X+. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.

PARTICIPANT DECLARATION

- All persons who have completed the PAR-Q+ please read and sign the declaration below.
- If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that the community/fitness center may retain a copy of this form for records. In these instances, it will maintain the confidentiality of the same, complying with applicable law.

NAME _____ DATE _____

SIGNATURE _____ WITNESS _____

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER _____

For more information, please contact

www.eparmedx.com

Email: eparmedx@gmail.com

Citation for PAR-Q+

Warburton DER, Jamnik VK, Bredin SSD, and Gledhill N on behalf of the PAR-Q+ Collaboration. The Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) and Electronic Physical Activity Readiness Medical Examination (ePARmed-X+). Health & Fitness Journal of Canada 4(2):3-23, 2011.

Key References

1. Jamnik VK, Warburton DER, Makarski J, McKenzie DC, Shephard RJ, Stone J, and Gledhill N. Enhancing the effectiveness of clearance for physical activity participation: background and overall process. APNM 36(3):553-573, 2011.

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3. Chisholm DM, Collis ML, Kulak LL, Davenport W, and Gruber N. Physical activity readiness. British Columbia Medical Journal. 1975;17:375-378.

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11-01-2018

APPENDIX E

Pictures of Research Variable

Consent form and PAR-Q+ distributed

Participants performed 20-meter sprint

Participants performed sit and reach

Participants performed standing long

APPENDIX F

Picture of Interventions

Group of passive recovery

Group of massage intervention

Group of foam rolling intervention

APPENDIX G

Picture of Sample Size

Table. Raw Data for All Dependent Variables Throughout the Experimental Conditions

Test	Time Point, Mean ± SD			
	Before Delayed-Onset Muscle Soreness	24	48	72
Foam roll				
1-Repetition maximum squat, kg	145.41 ± 31.50	NA	NA	NA
Pressure-pain threshold, kPa	940.78 ± 215.82	767.14 ± 168.73	758.31 ± 240.35	832.87 ± 205.03
30-m Sprint time, s	4.39 ± 0.18	4.49 ± 0.20	4.53 ± 0.22	
Broad-jump distance, cm	226.75 ± 28.36	217.75 ± 22.11	219.00 ± 21.97	222.13 ± 20.79
Change-of-direction speed, s	10.28 ± 0.60	10.62 ± 0.62	10.44 ± 0.55	
Squat repetitions, No.	17.00 ± 6.59	13.88 ± 6.90	17.75 ± 6.69	17.38 ± 8.07
Control				
1-Repetition maximum squat, kg	142.58 ± 33.73	NA	NA	NA
Pressure-pain threshold, kPa	934.90 ± 247.21	691.61 ± 190.31	650.4 ± 214.8	821.10 ± 253.10
30-m Sprint time, s	4.38 ± 0.14	4.54 ± 0.17	4.51 ± 0.26	4.51 ± 0.22
Broad-jump distance, cm	233.88 ± 26.91	218.50 ± 26.76	215.00 ± 32.02	216.50 ± 29.25
Change-of-direction speed, s	10.40 ± 0.61	10.63 ± 0.43	10.60 ± 0.62	10.58 ± 0.52
Squat repetitions, No.	16.88 ± 5.64	13.50 ± 7.05	15.25 ± 6.48	16.63 ± 7.87

Abbreviation: NA, not applicable.