COMPARISON BETWEEN COLD WATER IMMERSION AND ACTIVE RECOVERY ON PERCEIVED PAIN RELIEVE AMONG MALE FOOTBALL PLAYERS

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SULTAN IDRIS EDUCATION UNIVERSITY
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ABSTRACT

The purpose this study was to investigate the comparison between Cold Water Immersion (CWI) and Active Recovery (AR) on perceived pain relieve after performing High Intensity Interval Training (HIIT) among male football players. The study used a quasi-experimental method as its research design. A random sample of 36 footballers from a public university age ranging from 18 to 23 years old was selected for the study. They were assigned to two groups, namely CWI (n=18) and AR (n=18). All participants performed "Tabata Training" for 20 minutes before undergo recovery intervention. Recovery intervention using CWI was conducted for 10 minutes with temperature of 15°C, while AR was conducted for 10 minutes by cycling on cycle ergometer with speed of 60 RPM, load 50w with moderate intensity of 50%-60%. Both recovery interventions were performed immediately, after 24 hours and 48 hours. Visual Analog Scale was used to measure perceived pain relieve on 24 hours, 48 hours and 72 hours. Repeated Measure One-way ANOVA was utilized for data analysis. ANOVA result revealed there was no significant difference between CWI and AR after 24 hours of recovery [$F(1,34) = 0.507$; $p>0.05$]. However, there was a significant difference on perceived pain relieve between CWI and AR during 48 hours [$F(1,34) = 92.53$; $p<0.05$] and 72 hours [$F(1,34) = 326.96$; $p<0.05$]. In addition, the finding also showed that there was a significant interaction among CWI during 24 hours, 48 hours and 72 hours [$F(2,34)= 2332.60$; $p<0.05$]. Besides, there was a significant interaction among AR during 24 hours, 48 hours and 72 hours [$F(2,34)=1051.91$; $p<0.05$]. In conclusion, the data revealed that there was a significant effect for perceived pain relieve after performing HIIT for both interventions. The implication of the study highlights that both methods of recovery process could be used by football players for pain relieve after training and competition.

PERBANDINGAN ANTARA RENDAMAN AIR SEJUK DAN PEMULIHAN AKTIF TERHADAP KEREDAAN RASA SAKIT KALANGAN PEMAIN BOLA SEPAK LELAKI

ABSTRAK

Tujuan kajian ini adalah untuk mengkaji perbandingan antara Rendaman Air Sejuk (CWI) dan Pemulihan Aktif (AR) terhadap keredaan rasa sakit setelah menjalani Latihan Selang Intensiti Tinggi (HIIT) dalam kalangan pemain bola sepak lelaki. Kajian ini menggunakan kaedah kuasi-eksperimen sebagai reka bentuk kajian. Sampel rawak 36 pemain bola sepak daripada sebuah universiti awam yang berumur antara 18 hingga 23 tahun dipilih dalam kajian ini. Mereka dibahagikan kepada dua kumpulan, iaitu CWI (n=18) dan AR (n=18). Semua peserta melakukan "Latihan Tabata" selama 20 minit sebelum menjalani intervensi pemulihan. Intervensi pemulihan CWI dilakukan selama 10 minit dengan suhu 15°C, sementara AR dilakukan selama 10 minit dengan mengayuh ergometer kitaran dengan kelajuan 60 RPM, memuatkan 50w dengan intensiti sederhana 50%-60%. Kedua-dua intervensi pemulihan dilakukan dengan segera, setelah 24 jam dan 48 jam. Skala *Analog Visual* digunakan untuk mengukur rasa sakit pada 24 jam, 48 jam dan 72 jam. Pengukuran berulang ANOVA satu-hala digunakan untuk menganalisis data. Dapatan ANOVA menunjukkan bahawa tiada perbezaan yang signifikan antara CWI dan AR semasa 24 jam pemulihan [$F(1,34) = 0.507$; $p>0.05$]. Walau bagaimanapun, terdapat perbezaan yang signifikan pada keredaan rasa sakit antara CWI dan AR semasa 48 jam [$F(1,34) = 92.53$; $p<0.05$] dan 72 jam [$F(1,34) = 326.96$; $p<0.05$]. Sebagai tambahan, dapatan kajian menunjukkan terdapat perbezaan interaksi yang signifikan antara CWI semasa 24 jam, 48 jam dan 72 jam [$F(2,34)= 2332.60$; $p<0.05$]. Selain itu, terdapat perbezaan interaksi yang signifikan antara AR semasa 24 jam, 48 jam dan 72 jam [$F(2,34)=1051.91$; $p<0.05$].Kesimpulannya, hasil kajian menunjukkan terdapat kesan yang signifikan untuk keredaan rasa sakit setelah melakukan HIIT untuk kedua-dua intervensi. Implikasi kajian ini menunjukkan bahawa kedua-dua kaedah proses pemulihan boleh digunakan oleh pemain-pemain bola sepak untuk meredakan rasa sakit selepas latihan dan pertandingan.

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LIST OF ABBREVIATIONS

AR	Active Recovery
ATP	Adenosine Triphosphate
BL	Blood Lactate
CK	Creatine Kinase
CRP	C - reactive protein
CWI	Cold Water Immersion
DOMS	Delay Onset Muscle Soreness
GI	Glycaemic Index
H^+	Hydrogen Ion
HIIT	High Intensity Interval Training
HR	Heart Rate
MVC	Maximal Voluntary Contraction
PARQ	Physical Activity Readiness Questionnaire
PNF	Proprioceptor Neuromuscular Facilitation
ROM	Range of Motion
SIT	Sprint Interval Training
UiTM	Universiti Teknologi Mara
VAS	Visual Analog Scale
VO2max	Maximum Oxygen Consumption

APPENDIX LIST

CHAPTER 1

INTRODUCTION

1.1 Background of Study

In recent year, 'Tabata Training' become common people choose as an exercise program that introduce by Japanese scientist known as "Izumi Tabata" (Tabata, 1996). 'Tabata Training' also known as a High Intensity Interval Training (HIIT) program that involved short duration of exercise. By using the interval training a higher metabolic demand will be placed in our body in a shorter period of time (Baechle & Earle, 2008). The demand of an individual exercise and rest interval duration during training mimics that of to a sport activity (Cissik, 2012). According to Pointon, M., Duffield, R., Cannon, J., and Marino, F.E. (2012), stated that different level intensity of exercise may lead to several types of chances for example musculoskeletal fatigue, nervous and metabolic systems. According to Bleakley et al. (2012), it was also reported that Delay Onset Muscle Soreness (DOMS) will happens

after some microscopic tears in area of muscle tissues in 48 hours after performing an exercise. According to Barnett et al. (2006); Vaile (2007), process of recovery was the body restoring physiological aspect and will allows athletes to return in sport event with the best performance level. Critical part of recovery it was used to minimize the risk of injury and to avoid symptom of overtraining. Athlete that train hard without having enough rest may lead to the symptoms such as overtraining, mental burnout and poor performance (Cochrane, 2004). Reduction of heart rate, respiratory rate and ventilation, restoration of energy and ion balance, waste products removal of metabolism, decrease level of muscle stress and reduction of the activity of the central nervous system it was several indicator that should be measure for degree of recovery (Bleakley & Davison, 2010).

In addition, recovery was important because it increases the level regeneration of energy, maintaining individual performance, maintaining acid base balance and decrease level of fatigue (Bogdanis et al., 2004). The importance of recovery was now widely used by the team sports such as cycling event, football, rugby, and track events where the qualifying and final events occur in same day. The combination of short period recovery and high intensity event has been identified as a key of factor performance (Jones & Cooper, 2014). To improve body recovery from exercise, there were several methods of recovery strategies has been used for example massage therapy, compression garments, stretching, rolling foam, electrical stimulation and water immersion therapy. However, there were conflicting evidences about what kind recovery intervention were applied between Cold Water Immersion and Active Recovery that may give the best result to coaches, therapists and athletes to recover from the high intensity activity.

Cold Water Immersion (CWI) other type of hydrotherapy was higher recommended method to improve recovery process from training and competition for elite athletes. It was been supported by several authors from Ascensao et al. (2011); Leeder et al. (2012), that CWI has a chosen process of recovery that was used to improved recovery process after perform the exercise. There were some evidences that shows the positive result from CWI from Enwemeka et al. (2002), it decreases the injury by stimulated the cutaneous receptors to produce process of vasoconstriction which decrease swelling and decreases tissue temperature. Bleakley and Davison (2010) also stated that with CWI, it may restore level of hydrogen ion (H^+), decrease level of muscle tension and removes the waste products. Furthermore, it also has been supported in the study from Leeder et al. (2012), stated that effect of CWI process to decrease level of DOMS after performing high intensity exercises but it was has no effect on eccentric exercise.

In addition to that, other studies by Ascencao (2011), on comparison between groups that used CWI and did not used indicated reduction level of Creatine Kinase (CK), myoglobin, and C- reactive protein (CRP) concentration is the effects of CWI recovery process on a junior football players. Besides that, according to Wilcock et al. (2006), CWI also shows positive result on muscle stiffness that reduces level of an inflammation, force of generation and pain. Likewise, Howatson and Someren (2009), revealed that CWI was the effective technique to decrease level of muscle injury (DOMS). In addition, recovery with cold water also enhances the process of maintaining body temperature level, increase oxygen consumption, muscle spasm and local vasoconstriction (Wilcock et al., 2006). Moreover, water immersion also shows a significant result on muscle soreness and the decrease in isometric leg flexion and

extension performance in 10°C temperature (Ingram et al., 2009).

The result also has been supported by Baily et al. (2007) that a 10 minutes water immersion at 10°C decreases the level of muscle soreness, myoglobin concentration and decrease in knee flexor maximal voluntary contraction (MVC) after performing interval shuttle run. To start in an active recovery procedure, intensity needs to be kept in moderate (Cochrane, 2004; Mcardle and Katch, 2001**)**. According to Dabedo et al. (2004), active recovery was used for cooling down after training and game in professional football players. Active recovery helps to improve sport performance and physiological, sprint interval, maintaining blood flow to active muscle and removal of byproduct. According to Dorado, Sanchis and Calbet (2004), active recovery allows oxidative pathway to activate muscle work, and allowing adenosine triphosphate (ATP) to contribute during exercise in bout. The ability can maintain high rate of ATP and blood flow was very important to reduce level of muscle fatigue during exercise in high intensity (Girard, Mendez-Villanueva and Bishop, 2011).

According to Spierer et al. (2004), finding, active recovery has an advantage if compare with a passive recovery during conducting Wingate test protocol. Active and passive recovery beneficial to control the blood flow to the heart (Crisafulli et al., 2003), and many researchers stated that during performing active recovery it will helps to remove level of blood lactate and hydrogen ion (Bogdanis et al., (1996)., Mcainch, A.J. et al., (2004) and Spierer, D.K. et al., (2004) Dupont et al., (2007). Furthermore, others finding shown from Menzies et al. (2010), by using active recovery also help to increase recover of blood lactate, muscle lactate compare with

passive recovery. Thus, the results from the all findings shows that active recovery was more positively compare with passive recovery. Therefore, the objective of this study was to determine the comparison between methods of recovery phase which were cold water immersion and active recovery on perceive pain relieve afterward performing High Intensity Interval Training (HIIT) among UiTM Pahang male football players. This study also will measure which method of recovery provide beneficial effect on perceived pain relieve after performing HIIT among UiTM Pahang male football players.

1.2 Problem Statement

Recovery phase was very important for any athlete who was involved in sports activities, during competitions or training. Athletes were always exposed to consecutive back to back competition schedules that which required them to perform repeated movement involved high intensity movement for several time per week (King & Duffield, 2009). In that, the important of recovery from high intensity exercise and competition was considered an important to avoid negative effect on performance to athlete maintain their ability during involve in competition (Odetoyinbo et al., 2009). To enhance recovery phase after training, there were several method of recovery that can be divided between active recovery and passive recovery such as, compression garments, massage, vibration, ice recovery and stretching which were the most recovery phase use to by the athletes to improve their performance after training session and competition.

Water immersion was the most popular methods that used from athlete and

coach to recover their body from training and competition. According to Dabedo et al. (2004), these recoveries were always used by athletes and mostly were used for improving body recovery during cool down after training and competition. One study conducted by Dorado et al. (2004), active recovery allowing Adrenaline Triphosphate (ATP) to working muscle during exercise and also promotes energy to remain muscle become active. The process to maintain blood flow and high rate of ATP production was important to reduce muscle fatigue during performs muscle contraction during bouts exercise (Girard et al., 2011). Besides, studies shown by Torres et al. (2007), using active recovery revealed that also a reduce pain sensation, swelling, muscle spasm and as well decrease muscle damage from eccentric exercise. Interestingly, nowadays ice recovery becoming popular method has been used to improve body recovery after performing training or competition (Ledder et al., 2012). Based on Howatson et al. (2009), to relief the Delay Onset Muscle Soreness (DOMS) effect was by using cold water immersion technique, it because contribute to reduce local swelling, soreness, allowing blood flow through body and muscle spasm.

However, conclusive evidence to support the use of any of this recovery phase was still has been conflict. Hence, the purpose of this study was to determine the effect of cold water immersion (CWI) and active recovery on levels perceive pain relieve among football players following acute bouts of High Intensity Interval Training (HIIT). During this study conducted the two measurements which were Heart Rate (HR) and Blood Lactate (BL) will measured which methods of recovery release both physiological effect after performing HIIT and after performing recovery intervention. Furthermore, it was an attempt to clarify which method of recovery process the most effective influence has pain relieve on muscle in three days

measurement between 24 hours, 48 hours and 72 hours after performing HIIT among UiTM Pahang male football players.

1.3 Purpose of Study

The aim of this study was to determine the differences between the effectiveness of two types of recovery process Cold Water Immersion (CWI) and Active Recovery (AR) on perceived pain relieve between 24 hours, 48 hours, and 72 hours after performing High Intensity Interval Training (HIIT) among UiTM Pahang football male players. Then, this study tried to identify which methods of recovery was the most effective influence on enhancing pain relieve among UiTM Pahang male football players. Furthermore, this study also measure the physiological effect on Heart Rate (HR) and Blood Lactate (BL) immediately after HIIT to measure the level the lactate clearance and the level of HR reading after recovery process.

1.4 Objectives of Study

1.4.1 To identify the effectiveness perceived pain relieve after applying Cold Water Immersion and Active Recovery at 24 hour after performing HIIT among UiTM Pahang male football players.

1.4.2 To identify the effectiveness perceived pain relieve after applying Cold Water Immersion and Active Recovery at 48 hour after performing HIIT among UiTM Pahang male football players.

1.4.3 To identify the effectiveness perceived pain relieve after applying Cold Water Immersion and Active Recovery at 72 hour after performing HIIT among UiTM Pahang male football players.

1.4.4 To clarify which methods of recovery provide effectiveness between CWI and Active Recovery on perceived pain relieve after performing HIIT among UiTM Pahang male football players.

1.4.5 To measure the physiological effect on recovery Heart Rate (HR) before and after applied cold water immersion and active recovery on HIIT program among UiTM Pahang football players.

1.4.6 To measure the physiological effect on recovery Blood Lactate (BL) before and after applied cold water immersion and active recovery on HIIT program among UiTM Pahang football players.

1.5 Research Hypothesis

H_0 1: There was no significant difference on perceived pain relieve after applying of cold water immersion and active recovery at 24 hours following HIIT among UiTM Pahang male football players.

H_0 2: There was no significant difference on perceived pain relieve after applying of cold water immersion and active recovery at 48 hours following HIIT among UiTM Pahang male football players.

H_0 3: There was no significant difference on perceived pain relieve after applying of cold water immersion and active recovery at 72 hours following HIIT among UiTM Pahang male football players.

H_0 4: There was no significant difference on physiological effect (heart rate) before and after applying cold water immersion and active recovery among UiTM Pahang male football players.

H_0 5: There was no significant difference on physiological effect (blood lactate) before and after applying cold water immersion and active recovery among UiTM Pahang male football players.

1.6 Significant of Study

The effects of Delay Onset Muscle Soreness (DOMS) on individual performance rely due to increase muscle stiffness and reduce range of motion (Proske et al., 2001). Several strategies have been used in order to speed up recovery after exercise to reduce level of DOMS. According to Ronglan et al. (2006) with time recovery for physiological between matches was limited, it will reduce the physical performance of the athlete. Furthermore, with residual fatigue with over successive matches also will affect team sport performance without apply proper recovery method (Spencer et al., 2005). The outcome from this study to provide adequate information to the coaches, athletes, and physiotherapist which were the best recovery method that they can apply for their athletes, particular football players training session and competition to maintain or enhance their performance. Thus, athletes who participate in back to back training and tournament will benefit from this intervention that may enhance recovery from previous competition.

1.7 Conceptual Framework

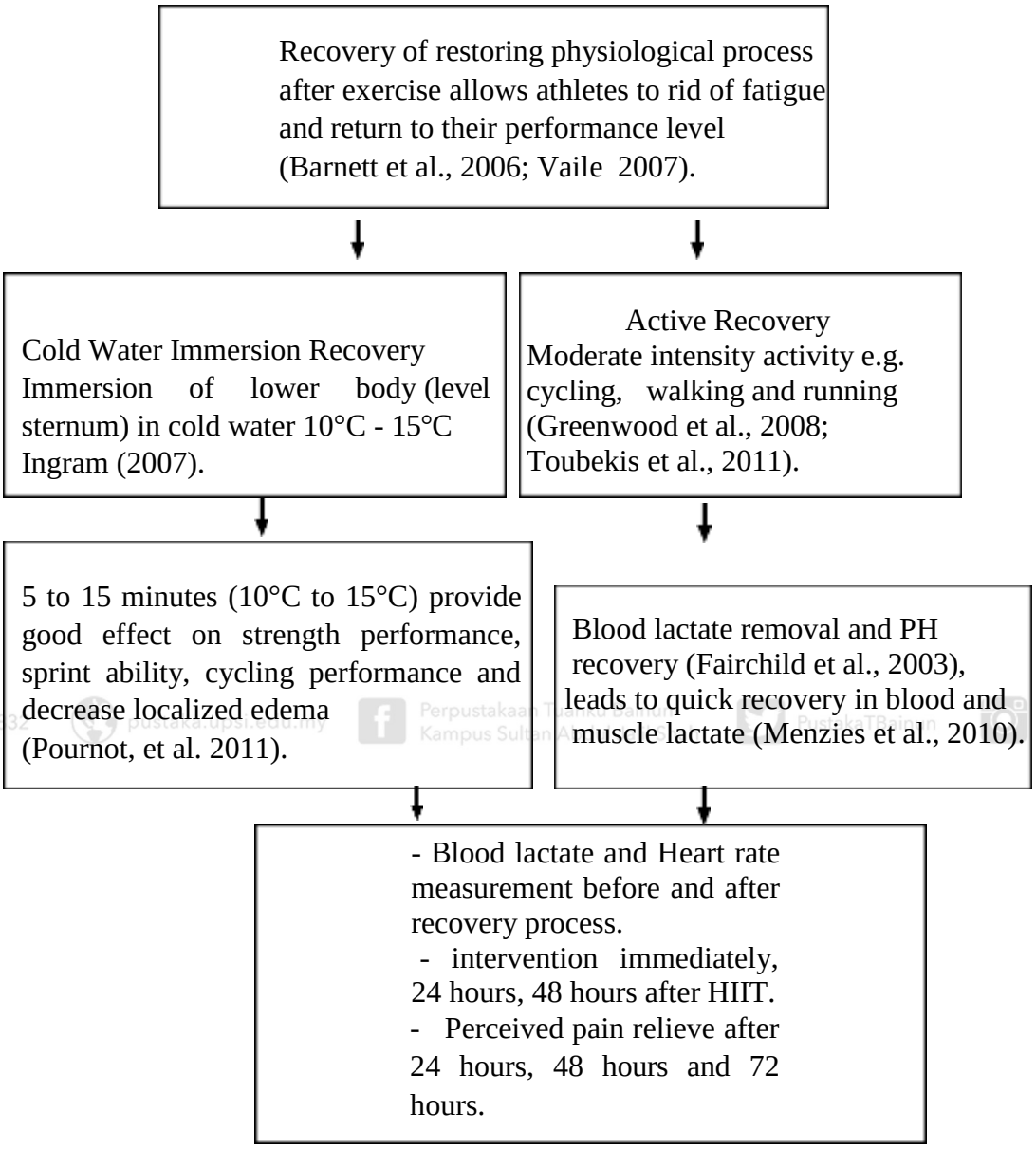

Figure 1.1. Conceptual Framework

1.8 Limitations

This study was focused on the comparison between two types of recovery process consist of were cold water immersion and active recovery and also to determine the effectiveness methods of recovery on perceived pain relieve among UiTM Pahang male football players after performing High Intensity Interval Training (HIIT). There were several factors beyond the researcher's control. However, generally researcher has some degree of control on the limitation that affected the study. The present study has the following limitations:

1.7.1 The external factors during conducting this study were such as mood of participants during perform the HIIT.

1.7.2 The participants were male football players from UiTM.

1.7.3 The limited numbers of equipment and tools for conducting this study delayed the study process.

1.9 Delimitation

This study was delimited to the following:

i. For inclusion in the study, participants were required to be male age ranging from 18 to 23 years old. Participants were currently University Teknologi Mara,

(UiTM) Pahang football players. All participants had similar training program and competition that represent UiTM Pahang football team.

ii. The participant also had the experience in high intensity exercise and free from any injuries during involving in this study.

iii. The anthropometric of the participant was delimited to Body Mass Index (BMI) range below than 25.

iv. HIIT program was conducted with eight exercises, 20 seconds all out bouts exercise, and ten seconds rest, within four minutes of exercise.

v. Instruments applied during the study were controlled, such as biological impedance analysis, blood lactate analysis and polar heart rate already in good condition before start the study.

1.10 Operational Definition

Active Recovery

"Cooling down or warming down" as a general term that referred to active recovery currently performed immediately after training or match by the athletes. This recovery strategy was implemented mostly by athletes that involves of movement for examples running, walking, cycling and swimming at low intensity activity for short duration of time during recovery (Greenwood et al., 2008; Toubekis et al., 2011).

Blood Lactate

Blood lactate measurement was conducted as an indicator and assist with identification of optimal training intensity. It commonly used by sport physiology. It was used to monitor training intensity the exercise on individual to specific training session that involves aerobic or anaerobic exercise (Pyne, 1989; Weltman 1993).

Cold Water Immersion (CWI)

Cold Water Immersion (CWI) and others form of cryotherapy methods that popular used by many athletes after training or match various form of exercise. The rational used CWI for treatment of soft tissue injury and core temperature (Bleakley, 2004). The method of recovery involve body will immerse in a pool or tab with cold water. The level of the water was at sternum and lower body was put on the cold water 10°C to 15°C (Ingram et al., 2009).

Delay Onset Muscle Soreness (DOMS)

DOMS was classified as a muscle strain injury that occur on muscle tissue results with tenderness or stiffness to palpation or movement after performing any physical activities for example jogging, running, swimming, and weight exercise. Pain stimulus related with DOMS related with lactic acid, muscle spasm, inflammation and connective tissue damage, this pain and soreness around the muscle also known as DOMS (Vanderthommen et al., 2007).

Heart Rate (HR)

Heart was specialized pump that function by regular and continue contraction for delivery blood throughout whole body (Boudoula et al., 2014). The pumping action was caused by flow of electricity through the heart that repeats itself cycle was also known as Heart Rate (HR). The number of heartbeat per unit of time, usually measured by per minute based on number contraction by ventricle. HR was used during exercise or training to measure the level of intensity of involved in training.

High Intensity Interval Training (HIIT)

Method of training that increases the volume of high intensity physical work through the control of work-to-rest ratios, while reducing exercise duration and fatigue, in order to increase performance during individual exercise bouts (Baechle & Earle, 2008).

Recovery Phase

According to Cochrane, (2004), athletes who train extremely hard without giving their body proper recovery will lead to burnout or poor performance. During recovery, adequate blood flow was the common regulator for regeneration of energy, acid based balance and decreased fatigue (Coffey et al., 2004).

Tabata Protocol

Originate from Japanese scientist 'Izumi Tabata' that describe as tabata training was one of High Intensity Interval Taining (HIIT) that consist minimal time during rest duration. Tabata training protocol that consist of work ratio 20 second exercise, 10 second rest that consist of eight exercise bouts, for total duration four minutes (Izumi et al., 1996). According to (Izumi et al., 1996) the number of repetition during tabata training was as many repetition that athlete can perform with their maximal effort during 20 second of exercise duration.

UiTM Football Male Players

The participants were males football players age ranging between 18 to 23 years old that represent UiTM Pahang football team competing in 'Liga Bola Sepak Kementerian Pendidikan Tinggi' in division one.

1.11 Summary

Recovery was one of the processes to allow athletes to rid their fatigue. There were several recovery methods have been proposed, for example massage therapy, compression garments, stretching, electrical stimulation and passive recovery. According to previous studies stated that the most popular method of recovery phase nowadays was cold water immersion (CWI). It shows the positive results after apply the CWI as a recovery phase after exercise. Besides, active recovery also was one of the popular recovery phases that apply after exercise. Active recovery was used for cooling down after exercise with moderate intensity of exercise for example walking, running and cycling. Thus, this study aimed to identify the different recovery phase between CWI and active recovery on perceived pain relieve after 24 hours, 48 hours and 72 hours of performing high intensity interval training (HIIT) among UiTM Pahang male football players. Furthermore, the outcome of this study may provide adequate information to athletes and coaches who tried to apply more effective recovery process during training and competition.