# EFFECTS OF HIGH INTENSITY INTERVAL TRAINING (HIIT) WITH MUSIC ON EXERCISE MOTIVES AND QUALITY OF LIFE (QoL) IN PHYSICALLY INACTIVE YOUNG ADULTS

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**by**

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| | |
|---|---|
| HIIT | High Intensity Interval Training |
| HIIT-M | High Intensity Interval Training- Music |
| HIIT-NM | High Intensity Interval Training- non-Music |
| QoL | Quality of Life |
| PA | Physical Activity |
| BPM | Beats Per Minutes |
| BGM | Background Music |
| RPE | Rating of Perceived Exertion |
| IPAQ | International Physical Activity Questionnaire |
| BMI | Body Mass Index |
| MPAM-R | Motive for Physical Activities Measure |
| BMRI-3 | Brunel Music Rating Inventory-3 |
| ERQ | Exercise Readiness Questionnaire |

## ABSTRAK

**Kesan *High Intensity Interval Training (HIIT)* dengan muzik terhadap motif senaman dan kualiti hidup (QoL) dalam kalangan individu dewasa muda yang tidak aktif fizikal**

Faktor penyebab ketidakaktifan fizikal adalah kekurangan masa dan motivasi yang tidak mencukupi untuk melakukan senaman. Strategi yang memfokuskan kepada program senaman yang menyeronokkan dan menjimatkan masa mampu memberikan kesan positif kepada fizikal dan psikologi individu. Kajian ini bertujuan untuk mengkaji kesan latihan *High Intensity Interval Training* (HIIT) bersama muzik terhadap motif senaman dan kualiti hidup (QoL) dalam kalangan individu dewasa muda yang tidak aktif. Kajian ini adalah kajian intervensi menggunakan reka bentuk pra- dan pasca- ujian. 20 peserta lelaki dan wanita yang telah menyertai kajian ini, yang berumur antara 22 hingga 35 tahun (M = 25.5, SD = 3.0). Peserta telah dibahagikan kepada dua kumpulan yang sama rata terdiri dari sepuluh peserta setiap kumpulan, iaitu Kumpulan HIIT-Music (HIIT-M) dan Kumpulan HIIT-No Music (HIIT-NM). Kumpulan HIIT-M telah melakukan 12 sesi latihan dengan mendengar muzik bermotivasi manakala kumpulan HIIT-NM melakukan 12 sesi latihan tanpa mendengar muzik. Keputusan bagi kualiti hidup (QoL) menunjukkan tiada perbezaan yang signifikan antara kumpulan HIIT-M dan kumpulan HIIT-NM. Keputusan bagi lima komponen motif senaman juga menunjukkan tiada perbezaan yang signifikan antara kumpulan HIIT-M dan kumpulam HIIT-NM. Kesimpulannya, mendengar muzik bermotivasi semasa HIIT tidak menunjukkan kesan yang ketara, namun terdapat peratusan peningkatan bagi kualiti hidup dan tiga komponen motif senaman antara pra- dan pasca intervensi.



Kata kunci: kualiti hidup, motif senaman, HIIT, motivational music

## ABSTRACT

**Effects of High Intensity Interval Training (HIIT) with music on exercise motivation and quality of life in sedentary young adults**

Factors that contribute to physical inactivity are lack of time and insufficient motivation to engage in exercise. Strategies focusing on exercise programme that are fun and timesaving can bring positive effects to physical and psychology of individuals. The study aims to examine the effect of High Intensity Interval Training (HIIT) with music on exercise motivation and quality of life (QoL) among sedentary young adults. This study employed an interventional, pre- and post-study design. Participants were 20 male and female, aged between 22 to 35 years old ($M$ = 25.5, $SD$ = 3). Participants were divided into two equal groups consist of ten participants, HIIT-Music (HIIT-M) group and HIIT-No Music group (HIIT-NM). Participants in the HIIT-M group performed 12 sessions of exercise while listening to the motivational music, whereas HIIT-NM group performed 12 sessions of exercise without listening to music. The result for QoL indicates that there was no significant difference between the HIIT-M and HIIT-NM. Also, the result on five components of exercise motive shows no significant difference between the HIIT-M and HIIT-NM. To summarize, listening to music during HIIT did not produce significant effects, however there were increment in term of percentage for QoL and five components of exercise motive between pre- and post-test.



*Keywords*: quality of life, exercise motive, HIIT, motivational music

# CHAPTER 1

# INTRODUTION

## 1.1 Background of study

The rate of physical inactivity is rising globally that leads to increment of chronic diseases cases. According to Dumith, Hallal, Reis and Kohl (2011), one out of five people is physically inactive around the world. People who are being physically inactive may suffer non-communicable diseases such as diabetes, cancer and cardiovascular disease (Booth, Roberts & Laye, 2014). Involvement in physical activity (PA) is one of the best approache to improve physical, mental, and social health and well-being.

According to the World Health Organization (WHO; 2016), people need to engage in at least 150 minutes of moderate intensity of PA every week to maintain their health (Oja & Titze, 2011). However, people who do not follow the recommendation of PA is considered high (Dumith, Hallal, Reis & Kohl, 2011). Mullahy & Robert (2010) highlighted several reasons that describe why people do not engage in sufficient amount of PA, that include lacking of time, support equipment, cost and individual motivation. Therefore, applying strategies to make exercise as an enjoyable activity may increase people's interests to start exercise, which can be done by introducing different types of exercise. In addition, an exercise activity must be performed by applying a correct exercise guideline by taking into account the benefits to fitness and health.

With regards to the exercise activity, high intensity interval training (HIIT) is a type of exercise that consists of high intensity workout and a short period of recovery time (Alansare, Alford, Lee, Church & Jung, 2018). This type of exercise

can improve general health, such as reduced risk factors of cardiovascular diseases and improved physiological and psychological functions (Cobbold, 2018). HIIT is a time-efficient programme because it involves a short duration, but the activity is normally performed at moderate to the highest level of the exercise intensity. HIIT training provides the same or more positive effects than those vigorous or moderate continuous training (Bailey, Bryce & Jinger, 2016). Kong, Fan, Sun, Song, Shi & Nie (2016) reported that, in comparison to the vigorous and moderate continuous exercise, participants who are physically inactive chosen HIIT as the most enjoyable exercise programme as compared to other high or moderate intensity exercises. The reason is that HIIT is perceived to be more enjoyable because HIIT involve various types of exercise movement, rather than performing the same action throughout the whole duration, such as in jogging and cycling (Barlett, Close, Maclaren, Gregson, Drust & Morton, 2011).

Listening to music during exercise is a common practice nowadays. This strategy can provide ergogenic effects to improve performance by either increasing work capacity or delaying fatigue. According to Karageorghis and Priest (2012), listening to motivational music is able to raise spirits, captures attention, regulates and alters mood, triggers a range of emotion, evokes memories, heightens arousal, increase work output, induces states of higher functioning, encourages rhythmic functioning and reduces inhibitions. Previous researchers acknowledged that music is a powerful tool that can increase exercise performance because of its effects in distracting individuals focus from the internal sensation (e.g., pain, discomfort) towards external sensation, which is the music (Karageorghis & Priest, 2012; Terry & Karageorghis, 2011). According to Mehta, Hande and Kale (2018), listening to music during exercise lowered the rate of perceive exertion (RPE) and improved the

exercise performance than individuals who are not listening to music. The possible reason is that the music provides positive effects on the feeling, in which it helps to replace the unpleasant feeling resulted from the physical exercise, thus improve the exercise performance (Rad & Hafezi, 2013).

Previous researches have reported the positive effects of HIIT on exercise performance, without manipulating any strategies to improve the effectiveness of the HIIT programme (Fajrin, Kusnanik & Wijono, 2018; Knowles, Herbert, Easton, Sculthorpe & Grace, 2015; Balbasi, Shabani & Nazari, 2016; Jabbal & Jones, 2017; Thakare, Mehrotra & Singh, 2017). Research that combined HIIT and music is considered scanty (Mehta, Hande & Kale, 2018; Maddigan, Sullivan, Halperin, Basset & Behm, 2019). In addition, most of studies focus on active individuals or athletes rather than inactive individuals. Therefore, the present study was designed to investigate the effect of HIIT with music on exercise motivation and QoL in physically inactive participants.

## 1.2 Problem Statement

According to World Health Organization (WHO, 2018), physical inactivity is one of the high-risk factors of death worldwide. Physical inactivity and sedentary lifestyle may lead to non-communication diseases (NCD) such as heart disease, cancer, stroke, diabetes and respiratory disease, in which it may cause mortality (Lian, Bonn, Han, Choo & Piau, 2016). Also, physical inactivity increases the prevalence of obesity (Lian et al., 2016). In order to improve fitness and maintain health, 150 minutes of moderate intensity of physical activity per week is the minimum requirement as recommended by World Health Organization (2016). However, the rate of physical inactivity is remaining high although many health

organizations emphasis the importance on engaging in physical activity. The most common reason is that people are difficult to find time to engage in exercise (Endozo & Oluyinka, 2019). Also, people have insufficient motivation to start the activity (Endozo & Oluyinka, 2019). In addition, boredom and tiredness from doing exercise are also the reasons that make people to easily give up in participating physical activities (Endozo & Oluyinka, 2019). Due to these reasons cause to physical inactive, health might be getting worse and worse until suffer from sickness and affect their quality of life. Thus, it is important to develop an enjoyable and time-saving exercise program to improve individuals' motive in exercise in order to promote their quality of life.

## 1.3 Significance of study

The present study emphasizes on combining the motivational music with HIIT and to see how involvement in the activity influences exercise motives and QoL in physically inactive participants. Because listening to the music are effective for exercise as being reported in existing literature, this study intends to enhance exercise experience, especially for people who are physically inactive, to make their perception about their life quality is more meaningful. In addition, the present study will also provide beneficial information for exercise instructors to emulate the same strategy and assess how the programme can enhance the psychological states of participants.

## 1.4 Research questions

What are the effects of HIIT with music on QoL and exercise motive in sedentary young adults?

## 1.5 Research objective

To examine the effects of HIIT with music on QoL and exercise motives in sedentary young adults.

## 1.6 Specific objectives

1. To examine the difference in QoL between HIIT-M and HIIT-NM during pre and post-test.
2. To examine the differences in fitness motive between HIIT-M and HIIT-NM groups during pre and post-test.
3. To examine the differences in appearance motive between HIIT-M and HIIT-NM groups during pre and post-test.
4. To examine the differences in competence motive between HIIT-M and HIIT-NM groups during pre and post-test.
5. To examine the differences in social motive between HIIT-M and HIIT-NM groups during pre and post-test.
6. To examine the differences in interest and enjoyment motive between HIIT-M and HIIT-NM groups during pre and post-test.

## 1.7 Hypotheses

$H_{A1}$: There is a significant difference between HIIT-M and HIIT-NM in QoL during pre and post-test.

$H_{A2}$: There is a significant difference between HIIT-M and HIIT-NM in fitness motive during pre and post-test.

$H_{A3}$: There is a significant difference between HIIT-M and HIIT-NM in appearance motive during pre and post-test.

$H_{A4}$: There is a significant difference between HIIT-M and HIIT-NM in competence motive during pre and post-test.

$H_{A5}$: There is a significant difference between HIIT-M and HIIT-NM in social motive during pre and post-test.

$H_{A6}$: There is a significant difference between HIIT-M and HIIT-NM in interest and enjoyment motive during pre and post-test.

## 1.8 Operational definition

**1.8.1 High intensity interval training.** An exercise training programme that involve period of relatively intense workout and the training is separated by periods of rest (Gillen & Gibala, 2014).

**1.8.2 Motivational music.** Music that can influence individuals during PA by heightening arousal, increasing work output and encouraging rhythmic movement (Chizewski, 2016). There are four main factors of motivational music including rhythm response, musicality, cultural impact, and association) (Karageorghis & Priest, 2012).

**1.8.3 Exercise motive.** The reason for behaving or acting in a particular way (Lai, 2011). Motivation can be categorized into extrinsic and intrinsic motivation.

**1.8.4 Quality of life.** The goodness on multiple aspects of their life including material and physical well-being, relationships with other people, social, community and civic activities, personal development and fulfilment and recreation (Theofilou, 2013).

**1.8.5 Physical inactivity.** Insufficient amounts of PA, in which people do not meet the PA recommendation to be considered as physical active (Zhou et. al., 2018). People are physically inactive if their physical activity involvement are less than 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75 minutes of vigorous-intensity physical activity, or a combination of 30 minutes of moderate and vigorous intensity physical activity on most, preferably all days of the week (ACSM, 1995).

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Quality of life (QoL)

QoL is a subjective multidimensional construct that can be defined as perception of individuals' life wellbeing within a sociocultural context related to the expectation, standards, goals and concerns (Moshibah, Almazarigeh, Dowan, Assiri, Shahrani & Assiri, 2015). QoL can be categorized into three aspects including physical, psychological and social (Fernandez, Baltar & Diaz, 2017). QoL is a key benefit of PA that motivates people to get active and stay in the activity (Gill et al., 2013). People may attribute to one or all aspects of QoL when participating in PA.

QoL from the physical aspect is regarded as an individual's perception of their own physical and health status in the absence of disease and symptoms that derived from disease (Fernandez, Baltar & Diaz, 2017). It is important for people to have a good perception of health in their life. A good perception of health will increase the PA level (Flanagan & Perry, 2018) and lead to a quality life. According to Moshibah, Almazarigeh, Dowan, Assiri, Shahrani and Assiri (2015), participants with high level of physical exercise scored higher for the QoL pertaining to physical health domain. Also, Sweegers et. al., (2018) showed that cancer patients who were in the exercise intervention group reported increased of self-reported QoL and self-reported physical function. The reason is that, PA is able to prevent illness and promote health, so individuals who engage in PA are able to achieve a quality life, especially, on the physical health domain (Moshibah, Almazarigeh, Dowan, Assiri, Shahrani & Assiri, 2015).

Other than physical aspect, QoL is also associated with psychological aspect that can be described as a state of cognitive process (Fernandez, Baltar & Diaz, 2017). QoL in psychological aspect typically consists of a wide range of changes in daily experience such as, emotional changes, meaning of life and spiritual and personal belief (Fernandez, Baltar & Diaz, 2017). According to Zboralski, Florkowski, Bogusz, Macander and Galecki (2008), there is a positive relationship between QoL and emotional functioning among individuals who suffered from illness. The finding showed that QoL scores were higher in patients with high emotional endurance and emotional control. Also, Gharael, Mostafavi & Alirezaei, (2011) reported that stress, anxiety and depression levels of parents with healthy children are lower than parents with children with phenylketonuria (PKU) disease. Parents with higher level of stress, depression and anxiety are scored lower on the quality of life. This finding suggested that psychological state will be affected by daily experience, thus lead to poor QoL.

In addition, social is an aspect of QoL that can be described as individuals' roles in life to develop and maintain or satisfy personal relationship (Fernandez, Baltar & Diaz, 2017). Social aspect in can be referred as a person's behavior in a relation with others or the roles that individuals play in his or her life (Fernandez, Baltar & Diaz, 2017). Involvement in PA is a medium for people to get engage with other people, for example when exercising in a group, it provides opportunity for talking and building relationship with others, thus develops their social wellbeing. Ottesen, Jeppesen and Krustrup (2010) examined the social interaction development among sedentary individuals in team sport and individual sport. The results showed that participants in a team sport had advantage over participants in an individual sport in term of social interaction development which resulting a better social aspect

of QoL (Ottesen, Jeppesen & Krustrup, 2010). In addition, Eime, Young, Harvey Charity and Payne (2013) showed that team sport seems to be related with improved health outcome including, physical, social and mental well-being, compared to individual activities.

To summarize, a quality life is an important aspect for all individuals in their life and it was positively related with physical activity level. Therefore, individuals should be involving more PA to improve their QoL.

## 2.2 Exercise motive

Motive can be referred to contents of one's goals particular domain of behavior (Marin, Polito, Foschini, Urtado & Otton, 2018). Exercise motive can be divided into intrinsic motives and extrinsic motives. Intrinsic motive refers to the act of doing something because of ongoing satisfaction to maintain well-being and optimal performance such as, personal growth, seeking affiliation, health and enjoyment (Marin, Polito, Foschini, Urtado & Otton, 2018). Extrinsic motive refers to the act of doing something that are not truly essential to personal growth and well-being, but the desire is to achieve rewards and reinforcement such as, appearance and social recognition (Marin, Polito, Foschini, Urtado & Otton, 2018).

There are a good number of studies that have examined the roles of motive in exercise participation. Investigating exercise motive can be considered as the first step to understand the exercise behaviour and how it can change from time to time (Duncan, Hall, Wilson & Jenny, 2010). In addition, it is well documented that knowing individuals' exercise motive helps to understand why people choose to be physically active, whereas others are not (Ingledew & Markland, 2008; Ingledew, Markland & Ferguson, 2009; Willem, Rycke & Theeboom, 2017). Previous research

confirmed that having higher intrinsic motivation is associated with higher adherence to exercise (Marin, Polito, Foschini, Urtado & Otton, 2018). However, having a high extrinsic motive is also an advantage for exercise participants.

Fraser, Munoz and MacRury (2019) examined the contribution of motivation in exercise participation and adherence. Fraser, Munoz and MacRury reported that both extrinsic and intrinsic motivation is important for exercise participation. Extrinsic motivation is usually emphasized at the beginning of the activity, whereas intrinsic motivation is more important to promote exercise adherence. In addition, Duncan, Hall, Wilson and Jenny (2010) investigated the different types of motivation to intensity, frequency and duration of exercises. The finding showed that intensity, frequency and duration of exercise in exercise were highly associated with intrinsic motivation than extrinsic motivation, in which individuals with intrinsic motivation are more likely to engage in exercise. It is because intrinsic motivation regulates individuals' behavior autonomously, which is engaging in activity itself for the satisfaction such as, experience of interest or enjoyment and competence (Cao, Lippke & Liu, 2011). By contrast, extrinsic motivation usually regulates behavior non-autonomously, which are performed because of to obtain rewards (Cao, Lippke & Liu, 2011). Therefore, when rewards are not provided, individuals that are regulated by extrinsic motivation will tend to dropout (short-term participation), but individuals with intrinsic motivation will continuously engage with the activity (long-term participation).

### 2.3 High intensity interval training (HIIT)

The application of HIIT as a method of physical training has been reported in a number of research (Garcia, Moro, Arias & Poyatos, 2019; Smith, Cox, Buchan,

Baker, Grace & Sculthorpe, 2020; Machado, Baker, Junior & Bocalini, 2017). Individuals who participated in four to eight weeks of HIIT programme can improve their physical fitness such as cardiorespiratory endurance and strength (Costigan, Eather, Plotnikoff, Taaffe & Lubans, 2015), and psychological such as mood state and feelings (Costigan, Eather, Plotnikoff, Hillman & Lubans, 2016). According to Knowles, Herbert, Easton, Sculthorpe and Grace (2015), performing HIIT can enhance motivation to exercise and encourage people to engage in the exercise activity. This might be due to various reasons associated with social integration, weight management and enjoyment (Knowles, Herbert, Easton, Sculthorpe & Grace, 2015). Also, HIIT is perceived as more enjoyable as compared to other exercise activities because individuals can apply different kinds of movement and manipulate the structure of exercise (e.g., number of set, number of repetitions). Because the HIIT can be performed individually, people can practice the exercise based on their own time arrangement and within a shorter duration, but the optimal results on fitness can be seen, which is similar to or better than other long-session exercises (Caru et. al., 2019).

Ulbrich et. al., (2016) showed that HIIT was as effective as moderate intensity continuous training in improving QoL among patients with chronic heart failure. Also, Martland, Mondeli, Gaughran and Stubbs (2020) showed that participants who participated in a group HIIT reported better QoL than participants in control group. Martland, Mondeli, Gaughran and Stubbs (2020) suggested that HIIT helps to improve functional ability of the participants, so they are able to carry out the activities in their daily living, which is perceived as a quality of life (Garcia, Moro, Arias & Poyatos, 2019). Another reason might be due to HIIT help to bring

fulfillment or personal development to participants such as obese individuals become more confident due to loss of fat through HIIT (Ouerghi et. al., 2017).

## 2.4 Music in Exercise

Music is considered as an external source that can be used to enhance or improve the exercise performance. The impact of music on various exercise parameters are widely researched, with most studies shown a consensus that music for exercise has to be carefully selected by considering its motivational components. According to the conceptual framework of motivation music in exercise by Karageorghis and Priest (2012), it is postulated that listening to the motivational music benefits psychophysiological and performance in exercise (Figure 2.1). This framework explains that listening to motivational music during exercise performance will unconsciously lead individuals to synchronize their movements with the music's rhythm and enhance performance (Karageorghis & Priest, 2012).

There are four factors of motivational music that includes internal factors (rhythm response, musicality) and external factors (cultural impact and association) were contributed to the music's motivational qualities (Karageorghis & Priest, 2012). Rhythm response refers to the musical tempo which is the speed of music that is measured in beats per minutes (bpm). Musicality can be referred as the background music that consists of combination of different notes and tune. Cultural impact is related to the socio-cultural background influence on the types of music listen by people in a group or society. Finally, association refers as the extra musical association that a musical piece has, for example a song that brings childhood memories to a person (Karageorghis & Priest, 2012). Selecting music by considering these four factors create a motivational music that can provide ergogenic effects to

exercise performers, such as reduced RPE, improved mood and optimal arousal to enhance exercise adherence and pre-event routine (Karageorghis & Priest, 2012). I

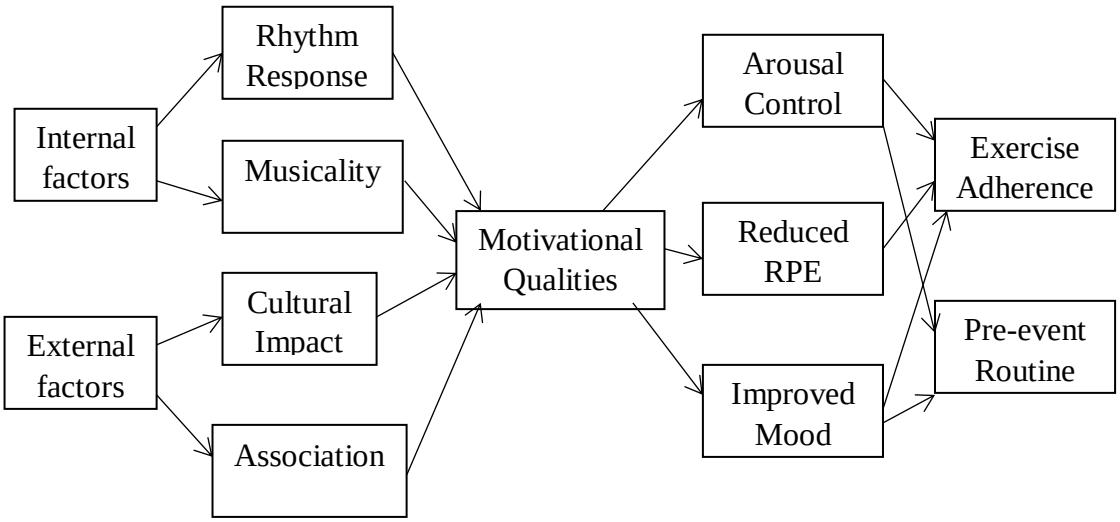


*Figure 2.1.* Conceptual framework of motivation music in exercise

Maddigan, Sullivan, Halperin, Basset and Behm (2019) investigated the effects of repeated high intensity cycling bouts on RPE and exercise duration between high tempo music and no-music conditions. The finding showed that participants in music group had lower RPE and performed longer duration than participants in non-music group. Similarly, Mehta, Hande and Kale (2018) reported that participants in music group showed lower RPE and more enjoyment than non-music group during HIIT. Moreover, Nakamura, Pereira, Papini, Nakamura and Kokubun (2010) claimed that listening to preferred music can improve the exercise distance and lower the RPE during continuous cycling exercise during a high intensity exercise. It is The presence of music can improve exercise performance because it alter the perception of fatigue towards a positive evaluation of the situation (Mehta, Hande & Kale, 2018).

Apart from the acute effects of music that occur during exercise, in long term, music can also increase exercise motivation for people to participate and adhere in

exercise. For example, Chizewski (2016) showed that music was a source of motivation that boost participants' motivation, leading to continuous exercise engagement and greater enjoyment with exercise. Also, Alter et. al., (2015) supported the benefits of using music during PA on the participants' exercise adherence, as being shown by improved attendance to exercise activity as compared to non-music group. It is acknowledged that listening to music increase positive mood of individuals, thus enhance exercise motivation and adherence to exercise (Campbell, 2014).

In addition, music can help people in regulating their mood state. According to Ahmad and Rana (2015), music was used to examine the mood and behavior responses of music listeners. The result claimed that listening to different types of music will have different impact on human behavior and mood. For example, listening to calm music can put them into calm state and develop a positive mood and mind whereas listening to happy music will lead individuals to feel happy and enjoyment (Ahmad & Rana, 2015). Moreover, a research showed that use background music can regulate physiological arousal such as, music make me cheerful, help me relax and make me more alert, and get into positive mood (Schafer, Sedlmeier, Stadtler & Huron, 2013). The reason that music can regulate mood may due to the popularity of songs that participants often listen from radio or social event such as, music concert, which may make participants to recall back with thoughts and feeling during the social event (Ganser & Huda, 2010).

To summarize, previous research supports the effectiveness of music to enhance performance when doing exercise by positively influencing physiological and psychological of individuals. The effects that are produced after participating in an exercise programme is somehow meaningful to promote individuals' wellness.

Nevertheless, it is also important to understand how involvement in HIIT will benefit participants' perception on the QoL and exercise motive, taking into account that these two components are vital for individual wellness related to PA participation.

# CHAPTER 3

# METHOD

## 3.1 Introduction

Chapter 3 discusses the research design, study setting, sample population, sampling method, sample size determination, exclusion and inclusion criteria, measures, data collection procedure, and data analysing procedure that has been used in the present study. The main objective of the present study was to determine the effects of motivational music during HIIT on QoL and exercise motive in physically inactive young adults.

## 3.2 Research design

The present study is an experimental, pre and post study that involves six weeks exercise intervention to measure the changes in exercise motive and QoL. Participants were randomly assigned into two groups by using a computer-generated randomization procedure. The groups were music and HIIT group (HIIT-M) and no music and HIIT group (HIIT-NM). Participants in both groups underwent similar HIIT programme and provided their responses on the exercise motive and QoL in pre-test and post-test sessions.

## 3.3 Study settings and period of study

The location for testing and intervention was conducted in participants' place due to the movement restriction order (MCO) that occurred during the period of study. That means, there was no face to face meeting between the researcher and participants. The period of study lasted for six weeks, comprised of 12 sessions of HIIT intervention programme (with music or with no music) and two testing sessions (pre-test and post-test).

### 3.4 Sample population

Participants in the present study were recruited by means of online platforms (e.g., WhatsApp, Facebook). Participants were within the age range of 18 to 35. To eliminate participants' vulnerability, only those who were interested in participating in this study were recruited. In addition, to avoid data errors prediction, potential participants who met the inclusion criteria were selected. The inclusion criteria include, (1) age between 18 to 35 years old, which was categorised as young adult (Petry, 2002), (2) being physically inactive (based on scores on International Physical Activity Questionnaire-short form (IPAQ), (3) non-obese (based on BMI value established by Lambert Adolph Jacque Quetelet) and (4) non-smoking. The exclusion criteria include, (1) having disability such as hearing problem and physical impairment and (2) having chronic health problems such as heart disease and diabetes.

### 3.5 Sampling method

Purposive sampling method was used to recruit participants by displaying an advertisement poster on social media such as Facebook, WhatsApp and Instagram. Information including brief study procedures and participation (inclusion and exclusion) criteria were stated on the poster. Individuals who were interested to become participants contacted researcher through phone or email.

### 3.6 Sample size determination

Sample size calculation was conducted by using G-power version 3.1.9.2. Considering the alpha = .05, power = .80, number of groups = 2, number of measurements = 2, effect size (exercise motivation sets) = 1.52 (Ballmann, Maynard, Lafoon, Marshall, Williams & Rogers, 2019) and effect size (quality of life) = .40

(Dauwan, Begemann, Slot, Lee, Scheltens & Sommer, 2019). A total of 16 participants were recruited in the present study. Considering 20% dropout rate, four participants were added, therefore the total number of participants was 20 (10 participants in each group).

## 3.7 Research Instruments

**3.7.1 International Physical Activity Questionnaire- Short Form (IPAQ).** IPAQ is a questionnaire that aims to measure the physical activity and inactivity level (Craig et al., 2003). The validity of IPAQ was .30 and the reliability was .80. IPAQ consists of seven items and participants need to provide the responses on how much the time or day that participants spent being active physically in the last 7 days. To determine that participants are physically inactive, the following categories as stated in the form were used.

- High level PA: Participants who engage in vigorous intensity activities three day or above with at least 1500 metabolic equivalent (MET) minutes a week or seven days or above of any combination of walking, vigorous intensity or moderate intensity activities with at least 3000 MET minutes.
- Moderate level PA: Participants who engage three days or above with at least 30 minutes per day on walking and vigorous intensity activity or 5 days or above with at least 30 minutes on walking or moderate intensity activities or 5 days or above with at least 600 MET minutes.
- Physically inactive: Participants who are not meeting any criteria of either moderate or high level of physical activity.

**3.7.2 Motive for Physical Activities Measure (MPAM-R).** MPAM-R is a questionnaire that is developed by using the theoretical background of self-

determination theory (STD) (Albuquerque, Lopes, Paula, Faaria, Pereira & Costa, 2017). The questionnaire is used to examine participants' motivation in joining PA (Vancampfort et. al., 2017). MPAM-R consists of 30 items and the items are assessed using a 7-point Likert Scale ranged from 1 (not true at all) to 7 (very true for me). There are five different subscales including fitness, appearance, competence, social, and interest or enjoyment (Vancampfort et. al., 2017). Among these five subscales, interest or enjoyment and competence are categorized as intrinsic motivation, whereby social, fitness and appearance are categorized as extrinsic motivation (Vancampfort et. al., 2017). The reliability of each subscale ranged between .78 to .92, in which all of these subscales are reliable in measuring motivation for participating in PA (Albuquerque et. al., 2017).

**3.7.3 Quality of Life Scale (QoLS).** QoLS is a questionnaire that is used to measure wellness of multiple aspects of life including material and physical well-being, relationships with other people, social, community and civic activities, personal development and fulfilment and recreation (Burckhardt & Anderson, 2003). QoLS consists of 16 questions in a 7-point Likert scale ranged from 1 (Terrible) to 7 (Delighted) (Burckhardt & Anderson, 2003). The validity of QoLS is .92 whereas reliability of QoLS is .84 (Burckhardt & Anderson, 2003). The range of scores for QoLS is from 16 to 112. Higher score that is obtained from the test indicates higher quality of life (Burckhardt & Anderson, 2003).

**3.7.4 Brunel Music Rating Inventory-3 (BMRI-3).** BMRI-3 is a questionnaire that is used to assess motivation characteristic music for exercise. BMRI-3 consists of 6 items in a 7-point Likert Scale ranged from 1 (strongly disagree) to 7 (strongly agree) (Clark, Baker, Peiris, Shoebridge & Taylor, 2016).

The reliability of BMRI-3 is .70, whereas the validity is .70 (Clark, Baker, Peiris, Shoebridge & Taylor, 2016).

**3.7.5 Exercise Readiness Questionnaire (ERQ).** ERQ is a questionnaire that is used to assess participants' current health status before they are allowed to participate in the exercise study. This questionnaire consists of 10 questions asking about the health conditions of participants, for example, 'do you have an injury or orthopaedic condition that may worsen due to a change in your physical activity?' and 'do you have insulin dependent diabetes?'. Participants need to answer Yes or No for each question. Researcher did not recruit individuals who give answer 'Yes' to any questions listed in the questionnaire.

**3.7.6 Rating of Perceived Exertion (RPE).** The Borg Rating of Perceived Exertion (RPE) scale is a tool that is used to measure individual's exertion, effort, fatigue and breathlessness during physical work out (Williams, 2017). In the present study, the RPE scale was used as an indicator to determine at which intensity level participants perform the exercise. Participants need to rate their exertion by selecting a number from 6 (No exertion at all) to 20 (Maximal exertion) immediately after every exercise session completes (Williams, 2017). The validity of RPE is .90 (Chen, Fan & Moe, 2002), whereas the reliability is .92 (Leung, Chung & Leung, 2004).

## 3.8 Procedure

### 3.8.1 Music selection process

For the music selection process, researcher prepared a music playlist consists of 20 English songs, which were selected among popular and current songs (i.e., produced in 2016 – 2020) and top streamed on Spotify. The tempo of each song was

between 130 to 135 beats per minute (determined from the website https://tunebat.com/). All songs were downloaded and installed in a music folder of a smartphone. Then, researcher shared the music folder with all participants in the HIIT-M group. Participants in the HIIT-M group listened to each song until finish and they immediately provided their responses on the Brunel Music Rating Inventory- 3 (BMRI-3) to indicate the motivational qualities of the songs. Researcher summed up the scores of each song given by participants and picked only 10 songs with the highest score to be used during the exercise intervention programme (Table 3.1).

*Table 3.1.* Music playlists

| | Track Title | Artist(s) | Tempo (bpm) | Year |
|---|---|---|---|---|
| 1 | So Am I | Ava Max | 130 | 2019 |
| 2 | Bad Guy | Billie Eilish | 135 | 2019 |
| 3 | Sweet But Psycho | Ava Max | 133 | 2018 |
| 4 | Hostage | Billie Eilish | 130 | 2017 |
| 5 | In the name of love | Martin Garrix & Bebe Rexha | 134 | 2016 |
| 6 | Without You | Avicii | 135 | 2017 |
| 7 | Kings & Queens | Ava Max | 130 | 2020 |
| 8 | Tears | Clean Bandit | 130 | 2016 |
| 9 | Whatever it takes | Imagine dragon | 135 | 2017 |
| 10 | Head above water | Aril Lavigne | 130 | 2018 |

### 3.8.2. Study procedure

After obtaining the ethical approval from the Jawatankuasa Etika Penyelidikan Manusia (JEPEM), USM, researcher published an advertisement poster using online platforms to recruit potential participants for the study. Potential participants who were interested to participate in the study contacted researcher to inform that they want to be considered as one of the participants. By using email, the screening test forms including demographic profile, IPAQ and Exercise Readiness Questionnaire (ERQ) was sent to assess participants' PA level and general health, respectively. Also, participants were asked to measure their height and body weight, and calculate the BMI themselves. For participants who met the inclusion criteria, information and consent form were sent to their emails. Participants were briefed about the information related to the study using telephone calls, then, potential participants signed the consent form after they understood and agreed to participate in the study. In the next stage, participants were randomly assigned into HIIT-M and HIIT-NM groups by using a computer-generated sampling method. Participants were gender matched to ensure balance distribution of participants in both groups.

All participants started with a pre-test, in which participants were contacted to identify the day and time when they available to do the pre-test. On the day of the pre-test, researcher emailed the MPAM-R and QoLS to the participants. After receiving the questionnaires, participants immediately answered the questionnaire and returned the questionnaire using an email. All participants in the HIIT-M and HIIT-NM started the exercise intervention programme one week after the pre-test.

On the day of exercise intervention programme, participants received HIIT programme on their WhatsApp. The HIIT programme consists of two sets of exercise;

Set A and Set B. In each set, participants performed different exercise routine (Table 3.2). For example, in week one session one of set A, the exercises were high knee, jumping jack, plank, and push up, whereas in set B, the exercises were mountain climbing, squat, burpees and plank hold. All exercises were demonstrated by using photos and video recording. In HIIT-M group, participants performed the exercise while listening to music using their phone, whereby participants in the HIIT-NM performed the exercise with no music. During the exercise, RPE was employed in both groups (HIIT-M and HIIT-NM) in order to monitor the intensity of exercise. Participants performed the HIIT programme two sessions per week for six weeks (Keech et al., 2020) at their own place. After participants completed the six weeks period of exercise intervention programme, researcher carried out a post-test that similar to procedure and tests conducted during the pre-test.

*Table 3.2.* High intensity interval training (HIIT) programme

| Week 1 (Session 1) | |
|---|---|
| Set A<br>High knee<br>  <br>Jumping jack<br>  <br>Plank<br>  <br>Push up<br>  <br>Set B<br>Mountain climbing<br>  <br>Squat<br>  | **High knee (30 seconds) → Rest (30 sec) → Plank (30 sec) → Rest (30 sec) → Jumping jack (30 sec) → Rest (30 sec) → Push up (30 sec) → Rest (60 sec)**<br><br>*Continue*<br><br>**High knee (20 seconds) → Rest (20 sec) → Plank (20 sec) → Rest (20 sec) → Jumping jack (20 sec) → Rest (20 sec) → Push up (20 sec) → Rest (60 sec)**<br><br>*Continue*<br><br>**High knee (10 seconds) → Rest (10 sec) → Plank (10 sec) → Rest (10 sec) → Jumping jack (10 sec) → Rest (10 sec) → Push up (10 sec) → Rest (60 sec)**<br><br>*Continue*<br><br>**Mountain climbing (30 seconds) → Rest (30 sec) → High plank (30 sec) → Rest (30 sec) →** |