EFFECTS OF MUSIC ON ENHANCING EXERCISE PERFORMANCE

CHADAPHAN SUWANNATE

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (SPORTS SCIENCE)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2011**

Thesis
entitled

EFFECTS OF MUSIC ON ENHANCING EXERCISE PERFORMANCE

……………………………………..
Miss Chadaphan Suwannate
Candidate

……………………………………..
Asst. Prof. Pranomporn Juangphanich,
Ph.D. (Exercise and Sport Science)
Major advisor

……………………………………..
Assoc. Prof. Narongchai Pidokrajt
M.Ed. (Cultural Music), M.A. (Education in Higher Education)
Co-advisor

……………………………………..
Prof. Banchong Mahaisavariya,
M.D., Dip. Thai Board of Orthopedics
Dean
Faculty of Graduate Studies
Mahidol University

……………………………………..
Prof. Arth Nana,
M.D. (Doctor of Medicine)
Program Director
Master of Science Program in Sports Science
College of Sports Science and Technology
Mahidol University

Thesis
entitled
EFFECTS OF MUSIC ON ENHANCING EXERCISE PERFORMANCE

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science (Sports Science)
on
March 24, 2011

……………………………………..
Miss Chadaphan Suwannate
Candidate

……………………………………..
Prof. Arth Nana,
M.D. (Doctor of Medicine)
Chair

……………………………………..
Assoc. Prof. Narongchai Pidokrajt
M.Ed. (Cultural Music), M.A. (Education in Higher Education)
Member

……………………………………..
Asst. Prof. Pranomporn Juangphanich,
Ph.D. (Exercise and Sport Science)
Member

……………………………………..
Asst. Prof. Naruepon Vongjaturapat,
Ph.D. (Exercise and Sport Science)
Member

……………………………………..
Prof. Banchong Mahaisavariya,
M.D., Dip. Thai Board of Orthopedics
Dean
Faculty of Graduate Studies
Mahidol University

……………………………………..
Prof. Arth Nana,
M.D. (Doctor of Medicine)
Dean
College of Sports Science and Technology
Mahidol University

ACKNOWLEDGEMENTS

I would like to thank Assistant Professor Dr. Pranomporn Juangphanich, my thesis advisor who willingly gave me the excellent advices in research methodology and procedure, even in every kind of problem in doing this project, especially to encourage me to finish the study. I would like to thank Associate Professor Nrongchai Pidokrajt, my co-advisor who helped and consulted me about music with generous mind, also Assistant Professor Sumalee Singhaniyom who was kindly adviced me about statistical analysis. Give my regard to Mr. Monchai Chotdao and Miss. Ampika Nanbancha who gave their times to share ideas and help me to finish my thesis.

Chadaphan Suwannate

EFFECTS OF MUSIC ON ENHANCING EXERCISE PERFORMANCE

CHADAPHAN SUWANNATE 5137309 SPSS/M

M.Sc. (SPORT SCIENCE)

THESIS ADVISORY COMITTEE: PRANOMPORN JUANGPHANICH, Ph.D. (EXERCISE AND SPORT SCIENCE), NARONGCHAI PIDOKRAJT, M.Ed. (EDUCATION IN HIGHER EDUCATION), M.A. (CULTURAL MUSIC)

ABSTRACT

This study compared the effects of exercising with and without music on enhancing performance. Aerobics music and preferred music were used in this study. Thirty volunteers from Mahidol University with an average age of 20.73 years who regularly do aerobic exercise participated in this study. Each participant walked/ ran in all conditions (aerobic music, preferred music, and no music) at the same time of day until he or she was exhausted over 3 consecutive weeks. Time, Rating of Perceived Exertion (RPE), and vigor were recorded when heart rate reached 70% MaxHRR. Time and RPE were recorded again when the participant was exhausted. Wilcoxson Signed-Rank test was used to compare the vigor score between pre-performance and 70% MaxHRR. Friedman Two-Way ANOVA was used to analyze time to exhaustion and ratings of perceived exertion. The results in this study showed that participants exercising with aerobic music took a longer time to achieve 70% MaxHRR than those exercising with preferred music and those exercising without music at $p < 0.05$. Moreover, time to exhaustion took longer in those listening to aerobic music and preferred music than without music at $p < .001$. The mean value of time to exhaustion was longer for those using aerobic music than those using preferred music. It can be concluded from the existing data that music effects enhancing exercise performance.

KEY WORDS: AEROBIC MUSIC / PREFERRED MUSIC /
EXERCISE PERFORMANCE

70 pages

ผลของดนตรีต่อการเพิ่มสมรรถภาพในการออกกำลังกาย
EFFECTS OF MUSIC ON ENHANCING EXERCISE PERFORMANCE

ชฎาพันธุ์ สุวรรณเนตร 5137309 SPSS/M

วท.ม. (วิทยาศาสตร์การกีฬา)

คณะกรรมการที่ปรึกษาวิทยานิพนธ์: ประณมพร จ๋วงพานิช, Ph.D. (วิทยาศาสตร์การออกกำลังกายและการกีฬา), ณรงค์ชัย ปิฏกรัชต์ M.Ed. (การศึกษามหาบัณฑิต สาขาวิชาการอุดมศึกษา), M.A. (ศิลปศาสตรมหาบัณฑิต วัฒนธรรมการดนตรี)

บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อเปรียบเทียบผลของการไม่ฟังดนตรีและการฟังดนตรี 2 ประเภทคือ ดนตรีแอโรบิกและดนตรีที่ชอบต่อสมรรถภาพในการออกกำลังกายซึ่งผู้เข้าร่วมการวิจัยเป็นอาสาสมัครจากมหาวิทยาลัยมหิดล ศาลายา จำนวน 30 คน โดยให้ผู้เข้าร่วมการวิจัยแต่ละคนเดิน/วิ่งทั้ง 3 วิธีจนกระทั่งหมดแรงที่วันและเวลาเดียวกัน ในสัปดาห์ติดต่อกัน บันทึกเวลาในการออกกำลังกาย, สภาวะอารมณ์ (vigor) และ ระดับความเหนื่อย (RPE) ที่อัตราการเต้นของหัวใจร้อยละ 70 ของชีพจรสูงสุดของแต่ละคน เวลาและระดับความเหนื่อยบันทึกอีกครั้งเมื่อผู้เข้ารับการทดลองหมดแรง สถิติที่ใช้ในการวิเคราะห์ข้อมูล คือ Wilcoxson Signed-Rank test สำหรับทดสอบสภาวะอารมณ์ (vigor) และ Friedman Two-Way ANOVA สำหรับทดสอบระยะเวลาในการออกกำลังกายและระดับความเหนื่อย (RPE) ผลการวิจัยพบว่าดนตรีแอโรบิกมีระยะเวลาในการออกกำลังกายกว่าจะถึงที่อัตราการเต้นของหัวใจที่ร้อยละ 70 ของชีพจรสูงสุดนานกว่าดนตรีที่ชอบและไม่มีดนตรีอย่างมีนัยสำคัญทางสถิติที่ 0.05 นอกจากนี้ดนตรีแอโรบิกและดนตรีที่ชอบช่วยเพิ่มระยะเวลาในการออกกำลังกายจนกระทั่งหมดแรงนานขึ้นอย่างมีนัยสำคัญทางสถิติที่ .001 โดยผู้ที่ฟังดนตรีแอโรบิกมีค่าเฉลี่ยของระยะเวลาในการออกกำลังกายนานกว่าดนตรีที่ชอบ ซึ่งจากผลการวิจัยจึงสรุปว่าดนตรีมีผลต่อการเพิ่มสมรรถภาพในการออกกำลังกาย

70 หน้า

CONTENTS

CONTENTS (cont.)

LIST OF TABLES

LIST OF FIGURES

CHAPTER I
INTRODUCTION

There can be no doubt that people from widely different cultural backgrounds, who speak quite different languages, can readily communicate with each other through music (Campbell, 1997 quoted in Hargreaves & North, 1999) such as love, sad, fun, courage and etc. We use music to reach the goal of activity. As music has become an essential accompaniment to many aspects of everyday life (Hagreaves & North, 1999) for instance during transportation, in restaurants or hotels. In addition, the current exercises with music are also popular in the exercise participants and athlete groups. Exercise with music is not just only aerobic dance or class exercise in the fitness but also in the exercise contexts such as walking, running, cycling, weight training. Most athletes or exercise participants do physical and mental workout with musical influence. Karageorghis & Terry, 1997 revealed four main ways of music that enhance sport and exercise performance (quoted in Karageorghis, 2010). First, during submaximal repetitive exercise in running, music can narrow a performer's attention and as a consequence, divert attention away from sensations of fatigue. Effective dissociation tends to promote a positive mood state through the avoidance of thoughts that relate to the fatigue component of mood. Second, music alters arousal levels and can be used as a stimulant prior to competition or as a sedative to calm over-anxious athletes (Karagorghis & Terry, 1996 quoted in Karageorghis, 2010). Third, music is beneficial as a result of the similarities between rhythm and human movement; hence, the synchronization of music with exercise consistently demonstrates increased levels of work output among exercise participants. Forth, in relation to the previous point, the rhythmical qualities of music also emulate patterns of physical skills; therefore, music can enhance the acquisition of motor skills and create a better learning environment.

Previous researches studied the effects of the rhythm that provided the physical and psychological differences between cardiovascular training or resistance training. Using fast music in progressive exercise would have a positive effect in terms of performance and psychological state of the athlete, regardless of the level of fitness (Mohammadzadeh, Tartibiyar, & Ahmadi, 2008). Listening to motivational music had a greater ergogenic effect than did oudeterous music during walk to exhaustion at 75% maxHRR (Karageorghis et al., 2009). The effect of music on performance, and interaction of emotions and properties of sedative music in reducing the decremental effect of frustration on performance (Caspy, Peleg, Schlam, & Goldberg, 1988). Music can be used for both sport training and competition. Therefore, how to select the style of music is very important to each person, the components of music as tempo, loudness, rhythm, or preferences have to be considered. We should choose rhythm and tempo of the music to match the goal of activity, for example, listening to Jazz, Classic, or relaxed music for relaxed activity, and fast music, such as Rock, Hip-Hop or dance music for stimulated activity because human responds to the rhythmical qualities of music by synchronizing movement patterns to tempo (Karageorghis et al., 1999 quoted in Bishop, 2007). Most of synchronous music can produce an ergogenic effect (Karageorghis et al., 2009; Simpson & Karageorghis, 2005).

Aerobic music is one kind of fast music which has strong rhythm and track continuation throughout in teaching class. The rhythm starts from slow to fast tempo and faster gradually which is different from regular music which has a pattern of slow-fast-stop then slow-fast-stop. Therefore, aerobic music has its own pattern specially for aerobics dance which corresponds to the rhythm of the body of the exerciser (Ana, 2001). Music beat varies from one piece of music to another which has sound of drums and other instruments and occur at regular intervals with a rhythmic pattern inside the music. Exercising with aerobic music makes the workout process enjoyable which leads exerciser to prolong exercising for health and fitness improvement. Previous researches revealed the benefits of exercise with fast music but it still has very few study regarding the effect of aerobic music on exercise. The purpose of this study is to examine the effect of aerobic music on enhancing exercise performance.

Purpose

To compare the effects of exercising without music and with music (aerobic music and preferred music) on enhancing exercise performance.

Hypothesis

Exercising with aerobic music enhances better performance than those with preferred music and without music.

Definitions in this study

Exercise performance = duration that participants can hold walking/ running though Bruce's protocol

Aerobic music = fast music which has a strong rhythm and continuation of the tracks which has 125-134 beat/ min and duration 30 minutes

Preferred music = the favorite songs chose by research participants depended on individual preference

Brunel mood scale = only vigor subscale

CHAPTER II
LITERATURE REVIEW

Music can be applied to everybody. Many researches revealed that different types and tempo of music effected physiological and psychological states in different ways. The review literature of this study comprised as the following;

2.1The elements of music

2.2Effects of music on physiological and psychological states

2.3Effects of music on sport and exercise performance

2.1 The elements of music

The elements of music are vital component of music and the forms of voice that influenced the listeners. The elements of music consist of:

2.1.1 Melody

Melody is often the element in music that makes the most direct appeal to the listener. It is usually what we remember and whistle and hum. Melody may rise and fall with bold movement, or change slowly, subtly, almost imperceptibly (Machilis & Forney, 2003). A melody begins, moves, and ends; it has direction, shape, and continuity (Kamien, 2006). Melodies were associated with feelings of mankind. The effect of causing similar effects as (Srisopark, 2511 quote in Sriwibool, 2003).

- Resulting in a relationship and reduce anxiety.
- Make you feel calm. Relax in the deep sense of soul.
- Make a creative initiative.

2.1.2 Harmony

Harmony describes the movement and relationship of intervals and chords (Machilis & Forney, 2003). Harmony will hold chorus music that has emotional power. Chorus of the musical elements within a sensitive help support the beauty of music (Charoensuk, 1989 quote in Sriwibool, 2003).

The chorus will allow the audience the emotion and feel the harmony in which the 2 types.

Polyphonic music refers to music of many sounds, that is, of more than one sound or more than one melody at the same time. Homophonic is a synonym for harmonic. Second, homophonic means music of "the same sound," and used to describe music in which a dominant melody is supported by chords (Boyden, 1971).

Consonance and dissonance

In a subjective sense consonance means simple that to any individual or to any era intervals (to harmonize with the nature of voiced out the same 2 audio) or chords (the chorus over 2 voices over) sound well. While dissonance means that they strike the ear harshly or disagreeably. Consonance is also related to feelings of stability and repose, while dissonance implies instability as well as motion toward a consonance as a point of repose. However, consonance and dissonance can be defined objectively. In acoustical terms: agree of consonance is relative to the simplicity of the ratios of the frequency vibrations of the tones that comprise the intervals of the chord. The concept of consonance and dissonance is applied to the melodic as well as to the harmonic aspect of music (Boyden, 1971).

2.1.3Time and time on musical elements include Tempo, Meter and rhythm.

2.1.3.1 Tempo –the speed of the beat- is the basic pace of the music. We associate fast tempos with energy, drive, and excitement, and slow tempos with solemnity, lyricism, or calmness (Kamien, 2006). However, tempo can be indicated with mathematical exactness. An indication is called a metronome marking - a metronome being an apparatus which marks exactly the time indicated (Boyden, 1971) is a term defined by the music as such.

Largo	(Very Slow, broad)	40-56
Grave	(Very Slow, solemn)	
Adagio	(Slow)	58-70
Andante	(Moderately Slow)	72-90
Moderato	(Moderately fast)	93-100
Allegretto	(Modeately)	102-120
Allegro	(Fast)	125-134
Vivace	(Lively)	136-172
Presto	(Very fast)	174-216
Prestissimo	(As fast as possible)	218-....

The metronome is told in 1 minute rhythm or rhythmic slap rap (beat) how many times that means rap beat or rhythm count on a regular basis. The normal rhythm of operation indefinitely similar to the rhythm of your heart (pulse) the speed of the rhythm is slow or fast depending on the rhythmic slap as fast tempo, slow tempo.

2.1.3.2 Rhythm: music is propelled forward by rhythms, the element that organizes movement in time (Machilis & Forney, 2003). Rhythm is basic to life. We see it in the cycle of day and night, the four seasons, the rise and fall of tides. More personally, we find it in our heartbeats, and we feel it when we breathe and walk. The essence of rhythm is a recurring pattern of tension and release, or expectation and fulfillment (Kamien, 2006).

2.1.3.3 Meter: in music, some beats feel stronger or more stressed -that is, more emphasized-than others, and we find repeated patterns of a strong beat plus one or more weaker beats. The organization of beats into regular groups is called meter (Kamien, 2006).

2.1.4 Texture

The nature of the relationship between melody (Polyphony) and chorus (Homophony) there are many forms.

2.1.4.1 Monophonic texture (one sound) music means music using melody only, such as a single unaccompanied tune (Boyden, 1971).

2.1.4.2 Homophonic texture, a single voice takes over the melodic interest, while the accompanying parts take a subordinate role. Normally, they came become blocks of harmony, the chords that support, color, and enhance the principle line (Machilis & Forney, 2003).

2.1.4.3 Polyphonic texture music refers to music of many sounds, that is, of more than one sound more than one melody at the same time. Contrapuntal means the same thing as polyphonic, since counterpoint means "point against point or, more generally, melody against melody" (Boyden, 1971).

2.1.5 Tone color or tembre

Tone color or tembre means the characteristic quality of sound of voices or instruments. There are characteristic differences between voices and instruments in general and also between different individual voices and instruments of the same register (Boyden, 1971).

The human voice

Of all the "instruments" the human voice is the most perfect, the most vivid in expressing human emotions, and the oldest-since music undoubtedly began with singing.

A "mixed" choir consists of men's and women's voices normally divided into four parts: soprano, alto, tenor, and bass (Boyden, 1971).

Instruments in general

People around the world use musical instruments that vary greatly in construction and tone color, and instruments have had many functions at different times and in different cultures. They may provide entertainment; they may accompany song, dance, ritual, and drama; they have sometimes been considered sacred or thought to have magical power; and they have even been status symbols (Kamien, 2006). Instruments are so extremely numerous and varied in tone color that it is impossible to describe their timbres in general terms (Boyden, 1971). An instrument may be defined as any mechanism—other than the voice—that produces musical sounds. Western instruments are usually classified in six broad categories: string (such as guitar and violin); woodwind (flute, clarinet); brass (trumpet, trombone); percussion (bass drum, cymbals); keyboard (organ, piano); and electronic (synthesizer) (Kamien, 2006).

2.1.6 Characteristics of Sound

2.1.6.1 Dynamics: degrees of loudness or softness in music are called dynamics. Loudness is related to the amplitude of the vibration that produces the sound. When instruments are played more loudly or more softly, or when there is a change in how many instruments are heard, a dynamic change results; such a change may be made either suddenly or gradually. A gradual increase in loudness often creates excitement, particularly when the pitch rises too. On the other hand, a gradual decrease in loudness can convey a sense of calm (Kamien, 2006).

2.1.6.2 Expressions: beside loudness, expressions is another characteristic of sound that make music a true music and visual art. The expressions of music that express the emotion, love, hate, sorrow, happy, sad, merry, happy, funny & etc. (Kosinanon, 2552 quote in Sriwibool, 2003).

2.1.6.3 Pitch refers to the highness and lowness of sound, measured in frequency (or vibration: the number of vibrations per second) - the faster the vibration, the higher the pitch (Marchilis & Forney, 2003).

2.2 Effects of music on physiological and psychological states

2.2.1 Effects of music on physiological state

Edworthy & Waring, (2006) examined the effects of loudness and tempo of background music on exercise performance. A total of 30 volunteers performed five 10-min exercise sessions on a treadmill. The music listened to whilst exercising was either fast/ loud, fast/ quiet, slow/ loud, slow/ quiet or absent. Measures of running speed, heart rate, perceived exertion and affect were taken. The results revealed a significant main effect of tempo. Participants' heart rate was higher in the fast music conditions (163.57 bpm) than the slow (158.76 bpm). The mean comparisons between the fives conditions [loud/ fast (80dB/ 200bpm); loud/ slow (80dB/ 70bpm); quiet/ fast (60dB/ 200bpm); and quiet/ slow (60dB/ 70bpm); in absence of music] and, in particular, tested the differences between the control and the music conditions. Post hoc analysis showed that heart rate levels were significantly higher when participants were listening to fast/ loud music when compared to slow/ loud music or slow/ quiet music. RPE revealed no overall significant difference between the fives conditions, although there is a pattern here whereby participants' RPE where highest in the fast music and no music conditions and lowest in the slow music conditions (Edworthy & Waring, 2006).

Bharani, et al (2004) studied the effect of music on treadmill exercise in healthy males. Twenty healthy males age 23-34 years exercised till exhaustion on a treadmill, twice within 24-72 h, using Bruce protocol under identical conditions, while listening to self selected music or without music randomly. The results revealed highly significant differences between the exercise performance with music compared to that without music accompaniment. Participants, while listening to self selected music exercised longer before exhaustion, achieved higher peak heart rates, higher peak pressure-rate products and showed lower rating of perceived exertion at equivalent sub-maximal exercise compared to exercise without music (Bharani, Sahu, & Mathew, 2006). Later on, Sokhadze, (2007) studies the effects of music on the recovery of autonomic and electrocortical activity after stress induced by aversive visual stimuli. Aversive visual stimulation evoked heart rate deceleration, increased high frequency component of heart period variability, increased skin conductance level and skin conductance response frequency, decreased facial blood flow and velocity, decreased temporal slow alpha and increased frontal fast beta power in all three sessions. Both subjectively pleasant and sad music led to the restoration of baseline levels on most parameters; while white noise did not enhance the recovery process. The effects of pleasant music on post-stress recovery, when compared to white noise, were significantly different on heart rate, respiration rate, and peripheral blood flow. Both positive and negative music exerted positive modulatory effects on cardiovascular and respiratory activity, namely increased heart rate, balanced heart period variability, increased vascular blood flow and respiration rate during the post-stress recovery (Sokhadze, 2007).

Additional, Listening to fast music increased respiratory frequency and the cortisol responses under high intensity exercise conditions. Respiratory frequency was lowest under the sedative music condition at low and moderate intensities (Brownley, McMurray, & Hackney, 1995). Haas et al., 1986 showed significant correlation between rhythm (slowest-quickest) and Tt (Tt = breath period (Haas, Distenfeld, & Axen, 1986). Total breath length and total expiration length was longest for the sad induction, intermediate during fear, and shortest during the happiness induction. A heart rate deceleration was found during the sadness inductions and acceleration during the fear inductions (Etzel, Johnsen, Dickerson, Tranel, & Adolphs, 2005).

Krumhansl, (1997) explored the musical emotions and psychophysiology. The physiological measures all showed a significant effect of music compared to the pre-music interval. The sad excerpts produced the largest changes in heart rate, blood pressure, skin conductance and temperature. The fear excerpts produced the largest changes in blood transit time and amplitude. The happy excerpts produced the largest changes in the measures of respiration. These emotion-specific physiological changes only partially replicated those found for nonmusical emotions. The physiological effects of music observed generally support the emotivist view of musical emotions (Krumhansl, 1997). Labbe,' et al (2007) studied the effectiveness of different types of music (classical music, self-selected relaxing music and heavy metal music). The study indicates that the group listening to self –selected music experienced a decrease in heart rate where as participants listening to classical, heavy metal music or silence did not. The group listening to classical and heavy metal music experienced lower respiration rates than participants listening to self-selected or silence (Labbe', Schmidt, & Jonathan, 2007).

Helper & Kapke, (1996) studied effect of relaxation music during treadmill walking. Ten college students of varying physical fitness levels performed two 10-minute walks at 70% of age-predicted maximal heart rate on a motorized treadmill. Throughout the walk subjects were connected to an automated metabolic cart to determine metabolic function. The result showed relaxation music did not significantly change the energy cost of walking, but it did produce a significantly lower cardiac stress and if the objective is to keep cardiac stress low while maintaining an exercise effect, as in a cardiac rehabilitation or stress management setting, relaxation music would be appropriate ergogenic aid. It is possible longer durations of exercise might manifest greater effects for the relaxation music condition (Hepler & Kapke, 1996). Perhaps the music allowed individuals to relax reducing muscle tension thereby increasing blood flow and lactate clearance while decreasing lactate production in working muscle. The combined results of this study suggest the introduction of music has a psychobiological impact on the exerciser demonstrated by changes in perceived effort, lactate and norepinephrine (Szmedra & Bacharach, 1998).

Khalfa, et al (2003) investigated the effects of listening to relaxation music on salivary cortisol level after psychological stress. Twenty- four francophone male university students were evaluated before and after the Trier Social Stress Test (TSST). It consists of a speaking task and mental calculations performed in front of an audience. The sampling of salivary cortisol was undertaken 20 and 30 minute after the subject's arrival and served as a baseline. The students were comfortable seated and were asked to relax in silence or with a musical tape being played. The psychological stressor provoked a strong emotion that was revealed by a sharp increase in cortisol levels within 15 minutes. The concentration of cortisol decreased more rapidly in the saliva of the subjects exposed to music than in the group recovering from stress in silence, suggesting that relaxing music after a stressor can act by decreasing the poststress response of the hypothalamic-pituitary-adrenal axis (Khalfa, Bella, Roy, Peretz, & Lupien, 2003). Listen to music produces a greater effect on the immune system than no listening to music supporting by SIgA levels of the active group showed a significantly greater increase than those of the passive group and the control group (Kuhn, 2002).

Yamamoto, et al (2003) examined the effect of listening to two different types of music (with slow and fast rhythm), prior to supramaximal cycle exercise, on performance, heart rate, the concentration of lactate and ammonia in blood, and the concentration of catecholamines in plasma. Six male students participated in this study. After listening to slow or fast rhythm music for 20 minutes, the subjects performed supramaximal exercise for 45 s. Listening to slow and fast rhythm music prior to supramaximal exercise did not effect on blood lactate and ammonia levels following exercise. The heart rate did not affect when resting, during exercise or during recovery. The plasma norepinephrine level decreases when listening to slow rhythm music and increases when listening to fast rhythm music (Yamamoto, et al 2003).

Schwartz, et al (1990) studies the effects of music (fast-tempo music and without music) on submaximal exercise performance (75% of max). The study revealed that neither gender nor music exhibited a significant effect on submaximal relative VO_2, HR, blood lactate, or exercise duration ($P > 0.05$). Men exhibited a higher submaximal absolute VO_2 and VE than females ($P < 0.001$), but music did not significantly influence these variables. These data show that music does not alter the submaximal exercise performance or physiological response for either men or women. In addition, the psychological perception of effort was not altered with the presence of music in submaximal exercise. Consequently, music does not appear to be an ergogenic agent for exercise training (Schwartz, Fernhall, & Plowman, 1990).

Schie, et al (2008) studied the effect of music on submaximal cycling. Volunteer men and women (N=30), performed an initial familiarization session. Part of this session involved the measurement of maximal oxygen consumption. With at least a 48-hour intervening period, this was then followed by a first 20-minute submaximal cycling session, at 80% of maximal oxygen consumption. At least 48 hours later a second submaximal cycling session was performed. Subjects were randomly divided into two groups. Group A cycled without music and group B cycled with music. The result showed that listening to music while performing submaximal cycling resulted in no physiological benefit (plasma lactate and heart rate). However, it may allow individuals to alter their overall perception of effort while cycling. By acting as a positive emotional distracter, music may motivate the cyclist to increase adherence to training, allowing the to train longer and more efficiently (Schie, Stewart, Becker, & Rogers, 2008).

Tenenbaum, et al (2004) examined the effect of music type on running time and on sensations, and thoughts experienced by the runners under high physical exertion, and the role that music play in the use of two distinct self-regulation techniques during high exertion, namely dissociative and motivational. In study 1 and 2, performed in the laboratory, 15 males ran at 90% of their maximal o_2 uptake. In study 3, performed in the field, 25 males ran a hilly course eight times. Result revealed that music failed to influence HR, RPE, and sensations of exertion in the three studies. Conclusions of this examination: People engaged in high intensity may benefit from listening to music, but may not increase their ability to sustain that effort longer than they could without music (Tenenbaum et al., 2004). Moreover, Brownley, et al (1995) studied effects of music on physiological and affective responses in trained and untrained runners. The study revealed that plasma cortisol levels did not differ at baseline across the music conditions ;however , following high intensity exercise, higher cortisol levels were associated with fast music as compared to no music and sedative music and at voluntary exhaustion revealed significantly more positive affect and higher skin temperature in untrained compared to trained subjects (Brownley, McMurray, & Hackney, 1995).

Afterwards, Rickard, 2004 indicated that the emotionally powerful music treatment (a music piece selected by participants) elicited significantly greater increases in skin conductance and number of chills than the other treatments. The finding are discussed in terms of the sensitivity of skin conductance and chills as measures of emotional intensity. In contrast, the emotionally powerful music treatment had no significant effect on the other physiological measures recorded (HR, Skin temperature, EMG, or salivary cortisol) (Rickard, 2004).

In addition, Barwood, et al (2009) studied motivational music and video intervention improves high-intensity exercise performance. Six, non-acclimate, male participants took part in the study. Each participant completed three 30-minute exercise bouts on a motorized treadmill under three counterbalanced conditions on separate days: control, motivational music plus video intervention, non-motivational intervention. The study showed that participants covered a greater distance in the M (motivational music plus video intervention) than both the NM (non-motivational intervention) and the CON (control). Blood lactate accumulated to a significantly greater extent in the M compared to the NM condition. Heart rate during treadmill running had a tendency to be higher throughout the maximal effort run in the M condition. RPE peak was similar during each of the experimental manipulations and averaged 18 in each condition (Barwood, Weston, Thelwell, & Page, 2009). Furthermore, the used full vision + preference music increased duration of dissociation when compared to squeezing the dynamometer under no vision + music, or without music conditions. This interaction suggests that, alone, alterations in visual information or auditory stimuli do not appear to play a significant role in altering associative strategies of attention. However, when visual information is paired with auditory stimuli, there appears to be a tendency for an additive effect on dissociative strategies of attention. Evident is the fact that the additive effect of vision paired with music is most prominent at earlier and later stages of grip performance, while less pronounced during mid performance (Razon, Basevitch, Land, Thompson, & Tenenbaum, 2009).

2.2.2 Effect of music on psychological state

Types of different music appears effective for the induction of differ emotions (Kreutz, Ott, Teichmann, Osawa, & Vaitl, 2008; Bishop, Karageorghis, & Kinrade, 2009; Bishop, 2007; Caspy et al., 1998).

Webster & Weir, (2005) explored the interactive effects of mode, texture, and tempo in emotion responses to music. Participants were tested in four different groups. Each group received a unique, random order of the 48 stimuli to control for serial dependency. The musical stimuli varied in duration from 5 to 15s and were presented with 12s inter-stimulus times. Each experimental session lasted between 15 and 20 min. Following each session, participants were debriefed on the purpose of the experiment. Musical phrases presented in major key, a simply melodic texture, or at a fast tempo were rated happier than those presented in minor keys, a thick harmonized texture, or at a slow tempo. Results indicated that the effects of mode, texture, and tempo were interactive in nature, producing a reliable three-way interaction. The nature of this interaction was such that the typically positive relationship between increase in tempo and happier responses was inverted among nonharmonized, minor music. The magnitudes of the effects of mode and tempo were stronger for women than men (Webster & Weir, 2005). Music is a major key produces feelings of happiness and contentment while music in a minor key produces feelings of sadness and depression (Hevner, 1936; Webster & Weir, 2005; Priest, 2003).

Bishop, (2007) examined the effect of music listening on EMG activity after cescation of the music; the latency of in-task EMG during CRT performance trials was significantly shorter than for silence and baseline conditions. There appeared to be an additive effect of intensity and tempo: Fast tempo music played at a loud intensity elicited significantly faster reaction times than did the same music played at a moderate intensity. This later activation may be related to the intensity of the stimulus: Loud intensity stimulus elicited significantly greater activation in the putamen, also. Fast tempo also yielded greater inferior temporal gyrus activation than did music played at a slow tempo, both during listening and during subsequent CRT performance. Listening to a music track with a fast tempo played at a loud intensity induced somewhat durable emotion responses manifested in increased subjective arousal, and corticospinal excitability- as indicated by reduced latency of EMG response when performing a CRT task (Bishop, 2007). Moreover, he showed that faster tempi were associated with higher arousal and pleasantness. Music successfully altered affective state and motor corticospinal excitability, music per se did not elicit significantly higher activation than did silence in emotion-processing areas. Affective data showed that fast loud music was perceived as significantly more arousing than music played at a slow tempo, at both loud and moderate intensities.

Later on, Bishop, et al (2009) achieved the same result and added that faster music tempi induced higher valence and arousal; loud music elicited heightened arousal and shorter RTs. The finding that loud intensity (75dBA) music yielded significantly greater arousal and accompanying superior CRT performance than did moderate intensity (55dBA) (Bishop, Karageorghis, & Kinrade, 2009). The implications for athletes' use of music as part of a prevent routine when preparing for reactive tasks are discussed. Firm rhythms are vigorous and dignified; flowing rhythms are happy, dreamy, and tender, Complex harmonies are exciting, vigorous, and sad; simple harmonies are happy, serene, lyrical (Hevner, 1936). He also found out that high pitch is most expressive of sprightliness and humor, while low pitch expresses sadness, majesty, and dignity. The effects of tempo are largest and most consistent. Harmony and rhythm are less effective, while assending-dessending quality of the melody is of practically no significance. Slow tempos are most expressive of dignity, calmness and sadness; fast tempos of happiness and restlessness (Hevner, 1937; Carol & Krumhansl, 2002).

Kreutz, et al (2008) studied effect of classical music induce emotions in adults, five excerpts representing one of five emotion categories: 'happiness', 'sadness', 'fear', 'anger', and 'peace'. The participants seated comfortably on a reclining chair. Participants were requested to fill in the mood questionnaire first and then rate each excerpt immediately after listening. The light was dimmed and participants were left alone for create a private atmosphere. In general, the participants reported to be in a 'peaceful' and 'relaxed' mood. Lowest levels of affect were found for 'anger' and 'fear' scales. With respect to affective state changes, significant reductions of tiredness and tension were noted, while sadness was the only emotion that showed a significant increase. Emotion induction was found to be strongest for pieces in the ‘happiness’ and ‘peace’ categories, and was found to be weaker in the ‘sadness’, ‘anger’, and ‘fear’ categories. Preference for classical music clearly enhanced both intensity and specificity of induced emotions. Thus, the results provide further evidence that absorption is associated with emotional experiences during music listening (Kreutz, Ott, Teichmann, Osawa, & Vaitl, 2008). Whilst the aldolescents showed that the aldolescents appears to employ music effectively and successfully in diverting themselves from stress, worries and disturbances. Music also provided the aldolescents with experiences of solace and consolation. The strategies of mental work and solace are very similar in the sense that both include experiences of dealing with worries and starting to feel better in the process. Music offer aldolescents strong emotional experiences and entertainment, and served as a resource for personal renewal and recovery (Saarikallio & Erkkila, 2007). Music decreased stress the most in aldolescents preparing for labor. Artificially induced stress in between aldolescence and adulthood affected by music than older (Priest, Karageorghis, & Sharp, 2004; Pelletier, 2004). It may be that subject preferred music is too distracting and therefore stimulates the subject rather than increasing relaxation (Pelletier, 2004).

Bella, et al (2001) studied affective value of tempo and mode in music. Experiment I: Participants were presented with the full set of 32 excerpts in any of the four conditions and were required to judge whether each excerpt sounded happy or sad. The excerpts were presented in random order in each condition and the order of presentation was different in the four conditions. The results demonstrated that tempo and mode are the sole determinants of the happy-sad distinction of the excerpts, since the tempo + mode manipulation cancelled all residual difference between the happy and sad excerpts. Experiment II: the same materials and conditions as those of experiment I were employed. The only difference regarding the procedure was that instead of rating the emotion on a scale, the children responded by pointing to one of two drawings of faces designed to express happiness and sadness. These children were presents with 16 excerpts per condition instead of 32 excerpts. Results showed that adults were highly sensitive to mode manipulation, whereas tempo manipulation affected their happy-sad. Similarly, 6-8-year-old children were affected both by tempo and mode manipulations and these manipulations were found to have a comparable effect. Finally, 5-year-old children are shown to be sensitive to tempo manipulation only. The sensitive to tempo emerges earlier than sensitivity to mode during development, as assessed via emotional judgements. Tempo and mode are the sole determinants of the happy-sad distinction of the excerpts (Bella, Peretz, Rousseau, & Gosselin, 2001). In conclusion, an individual's response to a given stimulus or piece depends on an interaction between the characteristics of the person (such as age, gender, musical training, personality); of the music (e.g. its complexity, familiarly, style, etc.); and of the situation in which it is encountered (Hargreaves & North, 1999).

McCullough, (1997) studied the effect of using music to change mood. The three focus unwelcome moods assessed were; sad, stress, and neutral. The study showed music was significantly more likely to be used to after sad or stressed moods than other things. The study showed that the participants used music when they were sad to help cheer up. Music was also used to cope with stress. Music was not used to change a neutral or apathetic mood. The participants did not use music more when sad than when stressed, and visa versa. People may use music to pick themselves up when things are not going as well as possible. Music could also be used to unwind and relax after a stressful day (McCullough, 1997). Moreover, listening to classical music or self-selected relaxing music after exposure to a stressor reductions in state anxiety and an increase in feeling of relaxation as compared to those who sit in silence or listening to heavy metal music. Interestingly, those participants who listened to heavy metal music not only experienced greater levels of state anxiety but were even more anxious after listening to the heavy metal music than when they were being stressed (Labbe', Schmidt, & Jonathan, 2007).

Some researcher has even found that subjects who were angry to begin with become happier, calmer and more relaxed after listening to heavy metal when it is their preferred musical genre. The emotion response to heavy metal music found that heavy metal music is used for cathartic release and to dissipate negative emotions. Particularly among those with low self-esteem (Copley, 2008; Nater, Abbruzzese, Krebs, & Ehlert, 2006).

Sorenson, et al (2008) investigated the participants experienced music in sport within their recent collegiate athletic career and listened to music at least once a day: before, during, or after a performance. The participants in this study were 7 NCAA Division I collegiate athletes ages 18-23 years old. The participants participated in following sports: 1) soccer, 2) football, 3) tennis. The analysis of the participant's interview exposed four major theme: 1.arousal, 2.focus, 3.mood, 4.team. Moreover, each of these themes contained subthemes. Results revealed that

1. Arousal: most of athletes described that they utilize this type of music to significantly increase their arousal level before a competition. The positive effect that upbeat music has on an athletes' arousal level while listening to slow tempo music the morning of a game and after a game or competition. From this review, the tempo effects the transition of feelings. From the study of Husain, Thompson, et al (2002) suggested that tempo changes are more closely associated with arousal rather than emotion. Rhythms evoke physical responses. (Husain, Thompson et al. 2002 quote in Griffin, 2006)

2. Focus: the athletes favored the use of music in order to achieve mental focus before going out and playing in a competition. Both fast and slow tempo music were utilized by the athletes. The music allows them to clear their minds and strictly focus in on their visualization routine and the goals they want to accomplish during a game or competition.

3. Mood: athletes explained that they used music not only to enhance their personal mood but also to enhance the mood of the entire team. Even more interesting was the fact that the participants use music in all three of these instances: before practice, before a game, and during training, to ensure that they and their teammates were in a good mood. This suggests the possibility of and enhanced performance due to and enhanced mood.

4. Team: the athletes used of a team music compilation to be very important for their pre-game warm-up and was utilizing music or a team song to create a sense of team unity (Sorenson, Czech, Gonzalez, Klein, & Lachowetz, 2008).

In addition, sedative music was highly correlated with calmness, tenderness, and contentedness, while stimulative music was related to tension, anger, boldness, and salience. Therefore, the effects of music on performance, and the interaction of emotions and properties of sedative music in reducing the decremental effects of frustration on performance (Caspy, Peleg, Schlam, & Goldberg, 1998).

Hume & Crossman, (1992) studied musical reinforcement of practice behaviors among 6 competitive swimmers. The swimmers were randomly assigned to either the contingent reinforcement group, who received music for productive behavior (e.g. specific practice -i.e. doing sit-ups, running laps of the pool etc.), or the noncontingent group, who received music regardless of their training productivity. The musical reinforcement conditions resulted in large improvements in the percentage of productive behaviors over the baseline conditions of the contingent reinforcement group. Likewise, the introduction of the musical reinforcement condition resulted in a dramatic drop in the amount of nonproductive behavior (e.g. unrelated activity – i.e. doing handstands during warm-up, eating etc.) (Hume & Crossman, 1992).

Hayakawa, et al (2000) evaluated the effect of Japanese traditional folk song, aerobic dance music, or nonmusic on the mood of women during bench stepping exercise (60 min. bench step exercise). The subjects reported significantly less fatigue with aerobic dance and Japanese traditional folk song than with nonmusic. Aerobic dance music was associated with significantly more vigor and less confusion than nonmusic (Hayakawa, Miki, Takada, & Tanaka, 2000). Moreover, music alone and music assisted relaxation techniques have a strong effect on increasing relaxation when under an arousal condition due to stress (Pelletier, 2004).

Pates, et al (2003) examine the effects of self-selected asynchronous music on flow and netball shooting performance in three netball players. The participants comprised three collegiate netball players who were asked to complete 11 performance trials. Each trial involved taking 12 shots from lines located at three shooting positions. After each performance trial, flow and the internal experience of each player were assessed using the Flow State Scale and Practical Assessment Questionnaire. Participants received the intervention of asynchronous music with the length of pre-intervention baseline increasing for each succeeding player. The results showed self-select music and imagery helped to control both the emotions and cognitions that impacted upon performance. The music not only improves performance and increases feeling associated with flow but may also be used to help athletes cope with competition anxiety and to improve their self-confidence. These results are clearly relevant for applied sport psychologists (Pates, Karageorghis, Fryer, & Maynard, 2003).

Indeed stimulative music and sedative music, purposed to differently affect the human body, are most clearly differentiated by tempo (Priest, 2003). Although music is not the only stimulus that has positive impacts on emotional state, it may be somewhat special in this regard because music does not have to se digested physically (unlike coffee or medication), no one is allergic to music, and music is easy (i.e., unobtrusive, noninvasive) to administer to oneself and others (Schellenberg & Hallam, 2005).

2.3 Effects of music on sport and exercise performance

Music can be applied to exercise participants and athlete (both training and competition). The effect of carefully selected music are both quantifiable and meaningful (Karageorghis & Priest, 2009).

The original conceptual framework for predicting psychophysical effect of music held that 4 factors (Karageorghis, Terry, & Lane, 1999 quote in Terry & Karageorghis, 2006).

1. Rhythm response: Rhythm response relates to natural responses to musical rhythm, especially tempo (measured in beats per min: bpm.)

2. Musicality: Musicality refers to pitch-related elements such as harmony and melody.

3. Cultural impact: Cultural impact is the pervasiveness of the music within society or a sub-cultural group.

4. Association: Association pertains to the extra-musical associations that music may evoke.

All four factors contribute to the motivational qualities of a piece of music.

Among the music factors, rhythm is the most salient and should be considered to be the main prerequisite when selecting a piece of music for exercise. However, various personal characteristics influence the response to music during exercise. Hence, personality, sociocultural affiliations and attitude towards exercise should all be considered when selecting a music programme to accompany exercise.

Several potential additions may be made to the existing conceptual framework (Priest & Karageorghis, 2008).

First, motivational music may influence individuals on a cognitive level, leading them to more favourably evaluate themselves and their own ability to meet the perceived demands of tasks.

Second, music may function as a conditioned stimulus within an education setting.

Third, music may demotivate exercise participants/ pupils and negatively affect their performance and eventually their adherence.

Fourth, the model does not account for the effects of personal variables such as personality and attitude towards exercise or contextual variables such as the time of day.

Fifth, music may lead exercise participants/ pupils to experience an altered state of attention comparable to flow state.

Sixth, the current findings indicate that exercise participants vary the intensity and duration of their physical activity as a result of music listening. This is a phenomenon that is difficult to demonstrate in tightly controlled experimental conditions and might be better examined in a class setting.

Seventh, the strength of musical rhythm may be linked to arousal.

Eighth, exercise participants/ pupils may exhibit a heightened response to individual segments of musical pieces; this response may be exacerbated by anticipation. and

Ninth, music may promote relatedness amongst exercise participants or pupils.

There are three additional considerations when selecting music.

- Variety in the music tends to maintain athletes' interest in the activity.
- The volume of the music should not be obscured by the noise of the exercise environment. and
- If synchronizing music with exercise, the tempo must concur with the preferred work rate.

Therefore we should select rhythm and tempo of music that corresponds with the activities (Terry & Karageorghis, 2006) and suitable with individual's target to achieve their ultimate performance. Choosing the correct song has the ergogenic effects while many researches report that listening to the song during exercise enhance the performance (e.g. Morris, Myers, Schaumburg, Schrage, & Veasey; Priest & Karageorghis, 2008; Szabo, Small, & Leigh, 1999), enhance work output (Atkinson, Wilson, & Eubang, 2004; Priest & Karageorghis, 2008), induce emotions (Kreutz, Ott, Teichmann, Osawa, & Vaitl, 2008; Daniel T. Bishop, Karageorghis, & Kinrade, 2009).

Karageorghis, et al (2009) examined the impact of motivational music and oudeterous music on endurance and range of psychophysical indices during a treadmill walking task. Experimental participants (N=30) selected a program of either pop or rock tracks from artists indentified in an earlier survey. They walked until exhaustion, start at 75%MaxHRR under conditions of motivational synchronous music and oudeterous synchronous music, and no music control. Dependent measures included time to exhaustion, rating of perceived exertion, and in-task affect. The present result indicated that motivational synchronous music can elicit an ergogenic effect and enhance in-task affect during an exhaustive endurance task (Karageorghis et al., 2009).

Mohammadzadeh, et al (2008) studied the effects of music on the perceived exertion rate and performance of trained and untrained listening to music during progressive exercise. The participants took part in the Bruce Test during the first session, where some of them were randomly chosen to listen to music, while others were not. During the second session, those who had been chosen to listen, took part in the Test without listening to music and vice versa. The music had greater effect on the RPE among untrained subjects than the trained ones. The result suggested that the using music (fast music) in progressive exercise would have a position effect in terms of performance and the psychological state of the athlete, regardless of the level of fitness (Mohammadzadeh, Tartibiyar, & Ahmadi, 2008).

Crust, (2004) assessed the effects of familiar and unfamiliar asynchronous music on treadmill walking endurance. The assessment indicated that the participants walked for significantly longer when accompanied by Familiar and Unfamiliar Music in comparison to White Noise ($p<.01$). Although participants rated Familiar Music as significantly more motivating than Unfamiliar music ($p<.05$), no significant differences were found between the two music conditions for treadmill endurance. Heart rates did not appear to be influenced by music during treadmill walking or on completion of the task (Crust, 2004b). Meeks, et al (2002) showed that participants traveled significantly farther (11%) while listening to music than while listening to noise or no music (Meeks & Herdegen, 2002).

Schelert investigated the effects of preferred music on perceived duration, exertion, and enjoyment during aerobic exercise. The task performed was a treadmill walk/run at 60% of their max VO_2 for 23 minutes. Subjects in the preferred music condition reported significantly shorter time for perceived task duration than subjects in the no music condition. Subjects in the preferred music condition reported significantly lower scores for RPE than subjects in the no music condition. Subjects in the preferred music condition reported significantly higher scores for perceived task enjoyment than subjects in the no music condition. The result of listening to prefer music showed effects on decreasing both perceived duration and perceived exertion, while increasing perceived enjoyment during aerobic exercise. (Schelert, 1996; Dyrlund & Winingre, 2008).

Bharani, et al (2004) conducted a randomized, blinded, controlled study to determine if distractive auditory stimuli in the form of self selected music would improve maximal exercise capacity and reduce the rate of perceived exertion during treadmill exercise in young untrained volunteers. Twenty healthy males aged 23-34 years exercised till exhaustion on a treadmill, while listening to self-select music or without music randomly. Participants, while listening to self-select music exercised longer before exhaustion, achieved higher peak heart rates, higher peak pressure-rate products, and showed lower rate of perceived exertion at equivqlent sub-maximal exercise (Bharani, Sahu, & Mathew, 2004).

Yamashita, et al (2006) investigated the relationship between the influence of music on RPE during sub-maximal exercise and on the autonomic nervous system before and after sub-maximal exercise. The exercise protocol consisted of a 30 min seated rest (control) period followed by a 30-min submaximal cycling exercise and a 35-min recovery period. Autonomic-nervous activity was measured before and after exercise, during exercise, RPE was recorded every 3 min and HR was recorded for every minute. These finding suggested that music evokes a “distracting effect” during low intensities exercise, but might not influence the autonomic nervous system. Therefore, when jogging or walking at comparatively low exercise intensity, listening to a favorite piece of music might decrease the influence of stress caused by fatigue, thus increasing the "comfort" level of performing the exercise (Yamashita, Iwai, Akimoto, Sugawara, & Kono, 2006). Another explanation may be that the participants that listened to music they liked dissociated more by paying more attention to the music and less to their physical discomfort caused by the exercise. On the other hand, participants that were required to listen to music they did not like may have tried to block out the music by focusing their attention on other aspects such as physical sensations caused by the exercise (Dyrlund & Winingre, 2008).

Johnson, (2004) evaluated the effect of 3 music genres (Rock, Country, and Polka) during 3 exercise bouts using a standard music tempo progression protocol. Nine apparently healthy adults (18-53 yr.) who exercised regularly participated in 4 exercise bouts (Rock, Country, Polka, and No Music) on a cycle - ergometer equipped with a wind resistance unit attached to the rear of the bicycle and a computer mounted in the crank arm (SRM Training System) to record power output (W), heart rate (HR), cadence (RPM), and rating of perceived exertion (RPE) during the exercise bouts. Subjects were instructed to ride as they would normally with full control over the gearing of the bicycle. After each bout, subjects completed the Physical Activity Enjoyment Scale (PACES) to determine the enjoyment level of the exercise. No significant differences ($p < .05$) were found amongst music genres with the exception of more subjects preferring the Rock music to Polka music. Not even the preferred music genre elicited any significance during the exercise bout. Tempo appeared to be the driving force behind W, HR, RPM, and RPE ($p < .05$). Musical preference had no effect on the exercise bouts. When considering what type of music to use during exercise, it appears that any music is better than no music regardless of musical preference (Johnson, 2004). Therefore, music preference may have a greater influence on exercise enjoyment for some but someone do not listen nor pay attention to the music during exercise (Dyrlund & Winingre, 2008).

Simpson & Karageorghis, (2005) investigated the effects of motivating and oudeterous synchronous music on 400-metre sprint performance while controlling for the potential confound of pre-performance mood. A volunteer Caucasian males completed three 400-metre time trials under conditions of motivational music, oudeterous music and a no-music control. Pre-performance mood was assessed using the Brunel University Mood Scale (BRUMS). A RM ANOVA revealed no differences in the BRUMS subscales. A RM ANOVA on the 400-metre times showed a significant effect. Times in the motivational and oudeterous synchronous music condition were shorter than no music control condition. The present results indicate that synchronization of a rhythmical anaerobic motor task to music can have a strong impact on performance, regardless of the motivational quality of the music played (Simpson & Karageorghis, 2005).

Eliakim, et al (2007) studied the effect of arousing music (140 bpm) during warm-up on consecutive anaerobic performance in elite aldolescent volleyball players. Twenty-four players performed the Wingate Anaerobic Test following a 10-minute warm-up with and without music. The result showed that mean heart rate during the ten-minute warm-up was significantly higher when music was used. Rate of perceived exertion at the end of ten-minute warm-up was significantly greater the warm-up with music. Peak anaerobic power was significantly greater following the warm-up with music in all subjects. Music had no significant effect on anaerobic power and on the fatigue index both genders. In summary, in elite, arousing music during warm-up had a significant effect on peak anaerobic power. Whether this effect leads to better competitive performance is yet to be determined (Eliakim, Meckel, Nemet, & Eliakim, 2007).

Karageorghis, et al (1996) investigated the effects of stimulative (energizing) and sedative (relaxing) music on grip strength. The investigation revealed that the participants evidenced higher grip strength after listening to stimulative music than after sedative music or a white noise control condition. Sedative music yield lower scores than white noise (Karageorghis, Drew, & Terry, 1996).

Crust, (2004) tested the effects of exposure to self-selected motivational music both prior to and during performance of a muscular endurance task. The results demonstrated the participants held the weight suspended significantly longer when listening to music than with white noise and participants' performance increased more exposure to music during the entire session, than for exposure to music prior to the session. Theses results suggest that exposure to music during muscular endurance trials can yield significantly longer endurance times, but that exposure to music prior to task commencement may not carry over to influence performance (Crust, 2004a). Later on, Crust & Clough, (2006) examined participants, responses to motivational asynchronous music by isolating rhythmical properties and exploring personality correlates. Participants performed an isometric weight-holding task on three occasions while being randomly exposed to no music, rhythm and motivational music. The examination found the participants held the weight suspended for significantly longer when listening to motivational music in comparison to rhythm or no music. When listening to rhythm, participants endured the task for significantly longer than when listening to no music. The response to music was found to be significantly related to liveliness, while sensitivity correlated with responses to music factors (harmony, melody, lyrics, etc.) not present in the rhythm condition. These results suggest that responses to motivational music are subtle in nature and are determined by both musical factors and individual characteristics, and potentially an interaction between the two (Crust & Clough, 2006). Within the context of exercise, stimulative music has been shown to enhance performance in explosive, anaerobic tasks (Priest, 2003).

Moreover, besides music tempo, the loudness level also has effects on the performance of exercise. Fast, loud music (200bpm./80dB) might be played to enhance optimal exercising (Edworthy & Waring, 2006). The loudness of 80-90 dB perceived the music as most distracting, with the majority of these same subjects reporting that the musical element of loudness seemed to be the contributing factor (Wolfe, 1983).

Copeland & Franks (1991) studied effects of different types of music on heart rate, rate of perceived exertion, and time to exhaustion during treadmill work were determined on 24 volunteer college students. The participated in three randomly assigned multistage treadmill walk/run to exhaustion while wearing a head-set. The three treatments were: loud, fast, exciting, popular music (type A); soft, slow, easy-listening, popular music (Type B); and no music (control). HR was lower with Type B music in minutes one and six. The peak HR and the HR in the minute preceding max were higher with Type B music. Time to exhaustion was longer during the Type B music treatment than during the control treatment. RPE was lower for Type B music than control during moderate work. This study provided some support for the hypothesis that soft, slow music reduce physiological and psychological arousal during submaximal exercise and increases endurance performance (Copeland & Franks, 1991).

McMordie investigated the effect of music loudness on anaerobic power and bench and leg press strength performance in regularly active females. At each testing session, participants were randomly assigned to 1 of 4 music loudness level: zero decibels (Db), 20 Db lower than preferred volume, 20 Db higher than preferred volume, and preferred volume. Leg press repetitions to fatigue, bench press repetitions to fatigue, and average power (W/ kg) on a 30 second Wingate bike sprint were measured for each participant at every music loudness levels. A loud music was not found to elicit a significantly higher average anaerobic power when compare to participants' preferred loudness level. All level of music loudness elicited a significant increase in average anaerobic power when compared to the no music condition. Participants' preferred loudness level showed a significant increase in repetitions to exhaustion on the bench press and only when compared to the no music condition. This suggests that music, at all volume levels, elicits significantly greater average power output over the duration of the anaerobic sprint than no music even though participants were exercising at the same intensity each trial (McMordie, 2008).

The volume is an important feature of the musical stimulus and a tentative conclusion would be that a louder volume is likely to enhance motivation to exercise. Therefore, adjusting the appropriate loudness of the ages is very important. The juvenile exhibited a marker preference for louder music but elder exhibited a marked preference for quieter music (Priest, Karageorghis, & Sharp, 2004). In addition, fast tempo and loud intensity collectively elicited significant activations in inferior temporal gyrus, subcallosal gyrus, inferior parietal lobule, and putamen, albeit at the fixed effects level of analysis. These activations were witnessed at the regions-of-interest (ROI) analysis level for stimuli perceived as highly arousing, when contrasted with low-arousing stimuli (Bishop, 2007).

External stimuli may serve as mediating agents in diverting attention away from internal and painful stimuli. This distraction may likely contribute to the pleasantness of the exercise experience, ultimately leading to increased exercise participation and reduced dropout rates (Razon, Basevitch, Land, Thompson, & Tenenbaum, 2009).

This reviews found that music appears effective for the induction of moods. Finding from the present study of Lane et al., 2008 lend support to the notion that mood states are associated with successful performance (Lane, Soos, Leibinger, Karsai, & Harma, 2008). Lane and Terry, (2000) defined mood as “a set of feelings, ephemeral in nature, varying in intensity and duration, and usually involving more than one emotion” (Lane and Terry, 2000 quote in Lane, Terry, Beedie, Curry, & Clark, 2001). The instrument measuring changes in mood in sport and exercise is the Profile of Mood State (POMS); which includes the subscales of anxiety, depression, fatigue, anger, vigor, and confusion (Weinberg & Gould, 2003). Sport psychology researches have relied almost exclusively upon the Profile of Mood State as the measure of mood when examining links with athletic performance. Morgan developed a mental health model that he reported to be effective in predicting athletic success (Morgan, 1979b, 1980; Morgan, Brown, Raglin, O’Connor, & Elickson, 1987 quote in Weinberg & Gould, 2003). Basically, the model suggests that positive mental health as assessed by a certain pattern of POMS scores is directly related to athletic success and high levels of performance. Positive mood states were associated with more facilitative cognitive states and performance, with negative mood states hampering performance (Weinberg & Gould, 2003).

CHAPTER III
MATERIALS & METHODS

3.1 Research participants

Thirty volunteers from Mahidol University who regularly do aerobic exercise at 3-5 times per weeks, age 20 to 29 years participated in this study. The Physical Activity Readinees Questionnaire (PAR-Q) and questionnaires before the exercise were used before the experiment to measure VO_2max for selecting and grouping the participants. The participants were blind to the purpose of the study. They were fully informed about the experimental design and signed the consent form

3.1.1 Inclusion Criteria

1. Participants were healthy and no any problem that might affect when they exercise.
2. Participants had regular aerobic exercise (3-5 times per weeks) and VO_{2max} range from 42.5-46.4 ml/ kg/ min for male and 33.0-36.9 ml/ kg/ min for female by Bruce's protocol test.

3.1.2 Exclusion Criteria

1. Participants had some problems that might affect when they exercise.
2. Participants had history of hearing problems.
3. Participants wanted to resign from this investigation.

3.2 Instrumentation

1. Demographic questionnaire: age, height, weight, history of sports and exercises (i.e. types of activity, frequency, and duration) was asked before the experiment.

2. The Physical Activity Readiness Questionnaire (PAR-Q) is a Yes/No question with seven items. It assessed an individual's general medication condition (e.g. heart condition, chest pain, bone or joint problem etc.)

3. Rating of perceived exertion scale (RPE) to monitor individual's exercise tolerance (ACSM, 2009) by being defined the subjective rating of the intensity of physical work and the increasing of attention in exercise (Borg G. 1962 cited in O'Sullivan, 1984). The participants graded scale with numbers ranging from 6 to 20. These numbers followed the normal heart rate (HR) range closely (60-200 bpm) (O'Sullivan, 1984). Borg originally proposed that during a short bout of work, perceptions originated from the working muscles, whereas during a prolonged bout of work, central signals from the organs of circulation predominated (Borg G. 1962; Borg G. 1974 cited in O'Sullivan, 1984). RPE was recorded when the participants walked / ran up to 70% MaxHRR and until voluntary exhaustion in all conditions.

4. Brunel Mood Scale Thai Version (Choosakul, 2008) developed from Terry & Lane's (2003), contained 24 items to assess six dimensions of mood ; anger ,confusion, depression, fatigue, tension and vigor, with 5-point scale ranging from "not at all (0)" to "extremely (4)". Only "vigor dimension" was assessed in this study. The vigor consisted of 4 items (i.e. lively, energetic, active, and alert).

3.3 Music Selection

3.3.1 Selecting music or aerobic music

For selecting "aerobic music" as an intervention in this study, forty volunteers (age: 20-40 years) had listened to 40 songs twice, then they were asked to rank all of those songs from 1-20 (1 - highest rank, 20 - the lowest rank). The researcher recorded all songs in 1 CD in order from the highest to the lowest, then brought it to the three experienced and expertise musicians (Assoc.Prof. Nrongchai Pidokrajt, Asst.Prof. Anak Charanyananda and Mr.Surat Kemaleelakul) to select 10 songs that met the objectives of this study, which their characteristics stimulated and aroused the enjoyment of exercise. The songs the experts picked was selected for "aerobic music" (125-134 bpm) (Allegro: Fast). Then researcher brought that aerobic music to pilot study and interview the participants' feeling during their exercise. This research found out that the selected songs (aerobic music) aroused the interest of the participants to exercise. Their concentration to the songs lessened their boring to exercise, but desired to take longer exercise instead. and only a few feeling that the fast music makes them tired faster.

3.3.2 Preferred music

Preferred music is the favorite songs which were selected by every single participant. Each participant selected their own 5 favorite songs for exercise.

3.4 Apparatus

1. Treadmill (Sensor Medics: 2000 Treadmill).
2. HR Monitor (Polar S810i): on the chest of the participants by the sensor held at handle and continuously monitor.
3. Hand-held stopwatch (CASIO STOPWATCH HS-30W).
4. iPod (iPod classic)
5. Earphone (iPod: Apple)
6. Stethoscope
7. Sphygmomanometers

3.5 Procedure

This study was considered by the ethics committee on human experiment of Mahidol University and conducted at laboratory room in College of Sports Science and Technology.

To select the participants to the pretest stage was the consideration of their regular exercise (3-5 times/ weeks) with The Physical Activity Readiness Questionnaire or PAR-Q, by answering “YES” to all questions. Researcher described the process of testing, guidelines for answering mood state and RPE, explaining the preparations before the experiment (see experimental below) and finally informed every participants to answer only the truth.

To classifying those participants with the same physical fitness level using Bruce's protocol. The Bruce Protocol is a maximal exercise test where the athlete works to complete exhaustion as the treadmill speed and incline is increased every three minutes. Total time complete use estimate VO_2max (Quinn, 2008). The participant (s) who could achieved walk/run up to 70%MaxHRR until exhaustion and VO_2max range from 42.5-46.4 ml/ kg/ min for male and 33.0-36.9 ml/ kg/ min for female were selected for this research.

Each participant performed in 3 conditions of exercise with aerobic music, preferred music, and without music at the same time of the day over consecutive weeks in the laboratory room under the same temperature. The order of the 3 conditions was randomized for each participant.

Researcher explained participants for answering vigor from Brunel Mood Scale, RPE, the process of testing, and the preparations before the experiment: 6-8 hrs sleeping in the night, not eat at least 3 hours with no alcohol and caffeine before exercise, not exercise hard before the test, always dress with comfortable sporting attire and shoes. Participants arrived at the laboratory room, enter HR monitor, sat idle for 15 minutes, then answered Brunel Mood Scale. Researcher measured BP and RHR (RHR was measured three times for calculation the average RHR). Prior to every test, RHR was measured to calculate the target HR (70% MaxHRR). Researcher then calculated target HR. The exercise HR of 70% MaxHRR was calculated by Kavonen formula (ACSM, 2009). Participants performed warm-up and stretching for 5 minutes before walk/ run trial by Bruce's protocol until voluntary exhaustion with aerobic music, preferred music, and without music with earphones,. Researcher considered the participants' HRs at 85-90% MaxHRR for sure that each participant exercised until exhaustion. Timer was started with a handheld stopwatch and stop at exhaustion. The music was started when pressing track start. The volume of music was adjusted according to preferences of individual. HR was continuously monitored with a polar. Time, RPE and mood were recorded at 70% MaxHRR, RPE and time were recorded again when he or she exhaustion. Later on, cool down 2 min.

3.6 Statistical Analysis

	Normal distribution data	Non-parametric data
RPE and Time all three conditions	ANOVA	Friedman Two-Way ANOVA
Pre performance – 70% MaxHRR of vigor all three conditions	Pair-t-test	Wilcoxson Signed-Rank test

CHAPTER IV
RESULTS

4.1 Ethic Approval

This study was not normal distribution, therefore, Friedman Two Way ANOVA was used to analyze time to exhaustion data and ratings of perceived exertion data while Wilcoxson Signed-Rank test was used to compare the vigor score between pre performance and 70%MaxHRR in all conditions. The significance level was set at 0.05.

4.2 Data analyses

4.2.1. The general characteristic of the participants

Thirty volunteers from Mahidol University who regularly do aerobic exercise at 3-5 times per weeks, age 20 to 29 (M = 20.73 yr., SD = 1.1 yr.) participated in this study (as showed in table 4.1). They had the same of cardiovascular fitness.

Table 4.1 The demographic characteristics of participants (mean ± SD)

	Height (m.)	Weight (kg.)	Age (yr.)
Male	171.55 ± 6.2	68.7 2 ± 7.1	20.78 ± 1.3
Female	173.41 ± 3.8	55.21 ± 4.6	20.57 ± 0.5
Total	165.42 ± 8.8	65.57 ± 8.7	20.73 ± 1.1

4.2.2. Time

Table 4.2 The comparison of time at 70% MaxHRR and exhaustion for walk/ run with aerobic music, preferred music and without music (Mean ± SEM).

		Without music	Aerobic Music	Preferred Music	P value
Time (min)	70% MaxHRR	8.3 ± 0.2	8.9 ± 0.3	8.64 ± 0.3	0.034*
	Exhaustion	11.44 ± 0.2	12.71 ± 0.3	11.93 ± 0.3	< 0.001*

*P < 0.05

According to table 4.2, the comparison of exercise time (70% MaxHRR and exhaustion) with music (aerobic music and preferred music) and without music revealed that time to exhaustion took longer in the aerobic music and the preferred music than without music condition (p<0.001), but non significant difference between aerobic music and preferred music. However, when considered participants' average time to exhaustion the aerobic music was longer than the preferred music. Time at 70% MaxHRR was significant difference (p<0.05) and multiple comparisons revealed that it was only significant difference for aerobic music when compared with preferred music and without music.

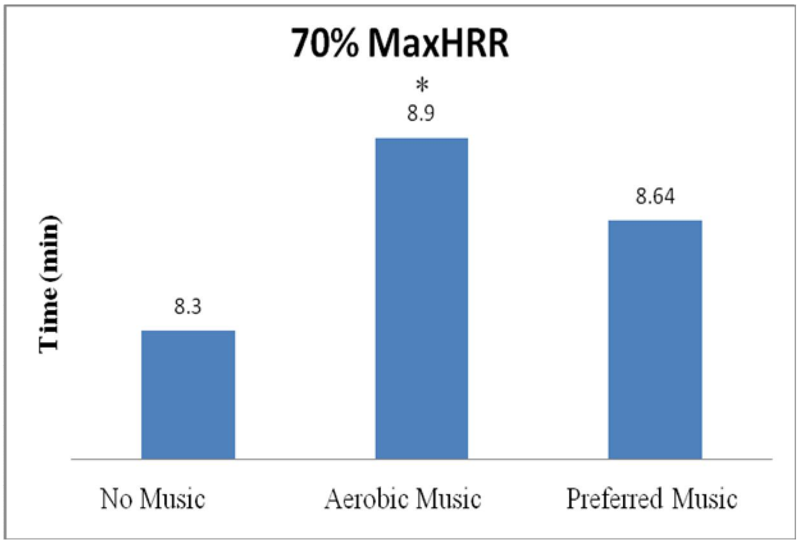

Figure 4.1 The comparison of time at 70% MaxHRR for walk/ run with aerobic music, preferred music and without music.

* significant difference between aerobic music and without music, p < 0.05

Figure 4.1 demonstrated that time to 70% MaxHRR spend longer in aerobic music than preferred music and without music.

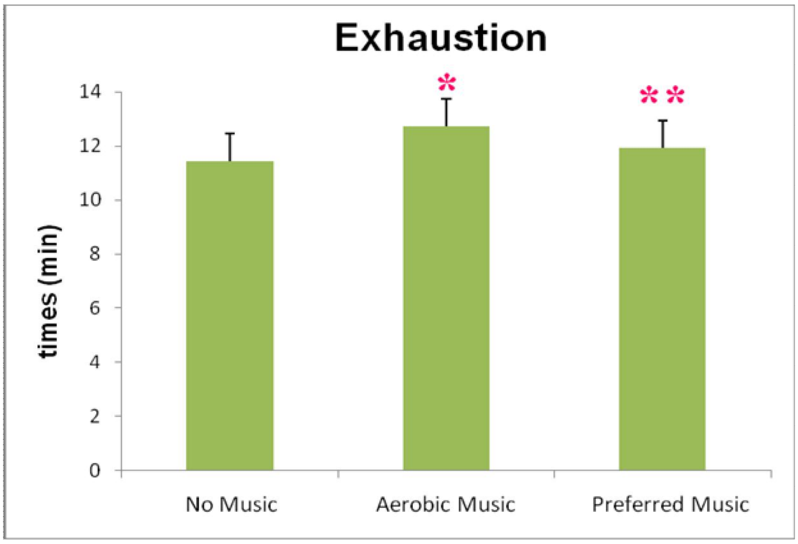

Figure 4.2 The comparison of time at exhaustion for walk/ run with aerobic music, preferred music and without music.

*significant difference between aerobic music and without music, $p < 0.001$

**significant difference between preferred music and without music, $p < 0.001$

4.2.3. Ratings of Perceived Exertion (RPE)

Table 4.3 The comparison of RPE at 70% MaxHRR and exhaustion for walk/ run with aerobic music, preferred music, and without music (Mean ± SEM).

		Without music	Aerobic Music	Preferred Music	P value
RPE	70%MaxHRR	12.81 ± 0.4	12.93 ± 0.4	12.4 ± 0.4	0.279
	Exhaustion	17.03 ± 0.3	16.17 ± 0.3	15.9 ± 0.3	< 0.001*

* $p < 0.05$

According to table 4.3, RPE at exhaustion was significant difference ($p<0.05$) and multiple comparisons revealed that it decreased in both music conditions when compare with without music, but non significant difference between aerobic music and preferred music. At 70% MaxHRR, RPE was not significant difference (p>0.05). The mean value of RPE at exhaustion was lower in preferred music than aerobic music (see table 4.3).

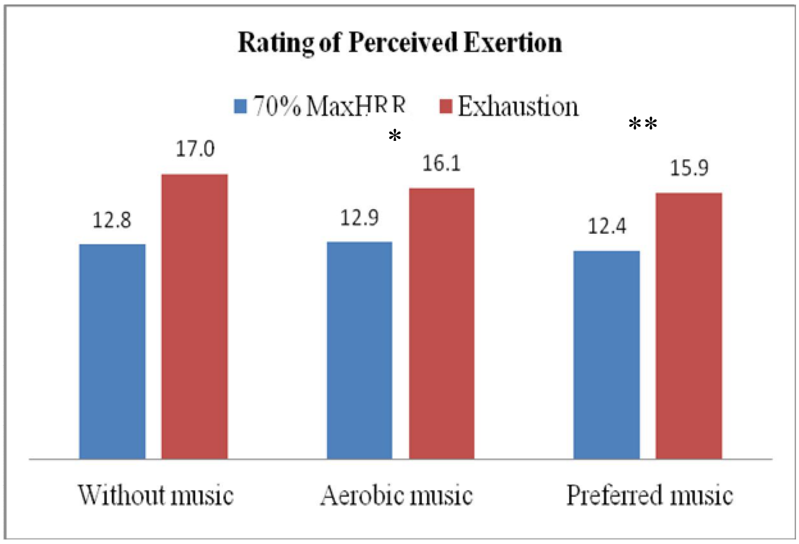

Figure 4.3 The comparison of RPE at 70% MaxHRR and exhaustion for walk/ run with aerobic music, preferred music, and without music.

* significant difference between aerobic music and without music, $p < 0.05$

**significant difference between preferred music and without music, $p < 0.05$

From the figure 4.3 showed rating of perceived exertion under exercise with aerobic music, preferred music, and without music. In with music, RPE was lower effort than without music, however, preferred music was decreased RPE more than aerobic music.

4.2.4. Vigor

Table 4.4 The comparison of vigor for walk/ run with aerobic music, preferred music, and without music (Mean ± SEM.).

Conditions	Vigor		P-value
	pre	post	
	Mean ± SEM	Mean ± SEM	
Without Music	8.27 ± 0.571	6.63 ± 0.582	0.006*
Aerobic Music	6.6 ± 0.615	7.7 ± 0.666	0.099
Preferred Music	7.03 ± 0.74	6.7 ± 0.715	0.37

*$p < 0.05$

From the table 4.4, the comparison of the vigor between aerobic music, preferred music, and without music showed a negative significant difference in without music ($p<0.05$) but non significant in aerobic music and preferred music ($p > 0.05$). The mean value of vigor increased in aerobic music but decreased in preferred music (see table 4).

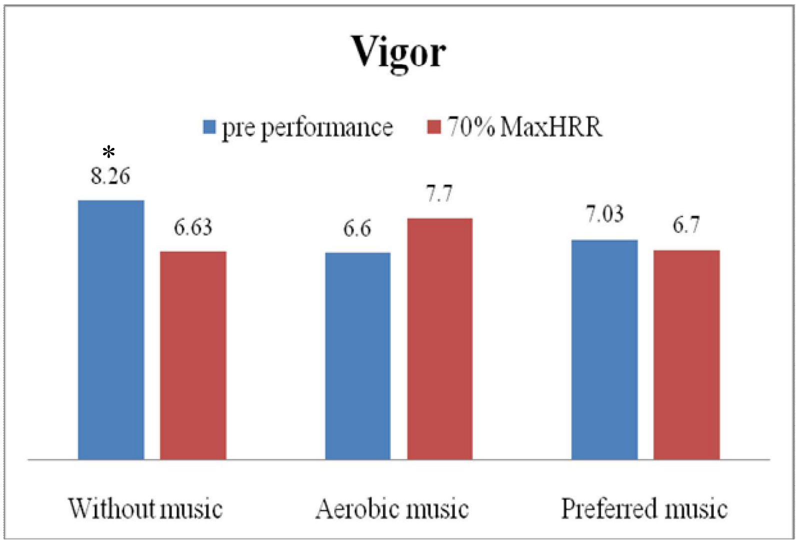

Figure 4.4 The vigor score for walk/ run with aerobic music, preferred music, and without music.

*$p < 0.05$

From the illustrated in Figure 4.4 the vigor scores between pre performance and at 70% MaxHRR under aerobic music, preferred music, and without music. Vigor scores decreased in exercise without music and preferred music but increased in exercise with aerobic music.

CHAPTER V
DISCUSSION

This study was approved by the ethics committee on human experiment of Mahidol University.

The purpose of this study was to compare the effects of exercise without and with music (aerobic music and preferred music) on enhancing exercise performance. It was hypothesized that aerobic music enhanced better performance than preferred music and without music. These finding was partial support the hypothesis that the aerobic music enhanced better performance than no music condition, but not differ in the preferred music condition. However, aerobic music tended to enhance exercise performance. Results in the present study were consistent with a conceptual model of Karageorghis & Terry, 1995 (Karageorghis & Terry, 1995 quote in priest, 2003). The model specifies that the intrinsic properties of the musical position, such as tempo, were primary important and these constitute the logical starting point for the model (see figure 5.1). The characteristic of aerobic music was one kind of fast music which had strong rhythm. Fast tempo were associated with higher arousal and pleasantness (Bishop, 2007). A strong rhythm will dictate a good pace for muscular strength and endurance training. Moreover, music for cardio-vascular training needs to be vigorous with a strong rhythm. The music must motivate participants sufficiently to keep working and create a fun atmosphere (Lawrence, 2009). In addition, the continuation of the track may make the contexts of exercise happiness. It showed that aerobic music has characterized for using accompany to exercise. Although, a significant difference not found between aerobic music and preferred music.

Effect of music on exercise time

This research studied the effects of music as a possible ergogenic effect on sport and exercise performance. There were two music conditions (aerobic music and preferred music) in this research.

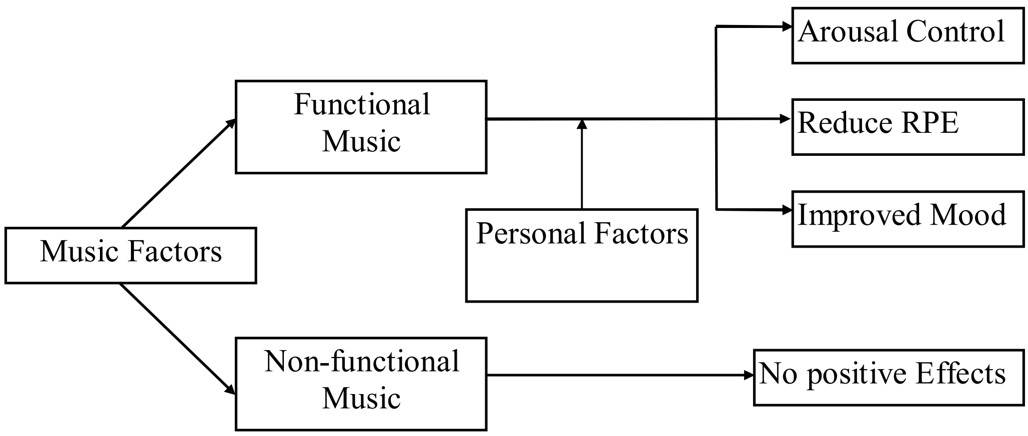

Figure 5.1 A conceptual model to predict the psychophysical responses to asynchronous music during submaximal exercise (Karageorghis & Terry, 1995 cited in priest, 2003)

This study demonstrated that time to exhaustion took longer in both music conditions whereas aerobic music tend to take longer time to exhaustion than preferred music, although, it had non significant difference. Moreover, time to 70% MaxHRR also longer in aerobic music more than preferred music and without music. The results of this study indicated that aerobic music improved performance by all extended time to 70% MaxHRR and exhaustion, which were consistent with previous researches that exercising with music improved performance more than without music (Bharani et al., 2004; Meeks & Herdegen, 2002; Elliott, Carr, & Savage, 2004). Beside, exercise with motivational music could elicit performance than oudeterous music and without music (e.g. Karageorghis et al., 2009; Bishop, 2007). Karageorghis, et al (1996) revealed that the participants evidenced higher grip strength after listening to stimulating music than sedative music or a white noise control condition. Sedative music yield lower scores than white noise (Karageorghis, Drew, & Terry, 1996). Contrary to Copeland & Franks, (1991) showed that soft, slow music reduced physiological and psychological arousal during sub maximal exercise and increased endurance performance (Copeland & Franks, 1991). In addition, relaxation music produced lower cardiac stress and if the objective was to keep cardiac stress low while maintaining an exercise effect, relaxation music would be appropriate ergogenic aid (Helper & Kapke, 1996). Music was a stimulus that led exercise participants to exert themselves at a higher intensity and for a longer duration (Priest, Karageorghis, & Sharp, 2004).

In addition, within the contexts of exercise, stimulating music also enhanced performance in explosive, anaerobic task (Priest, 2003). Previous research showed that fast music was synchronized with the movement- rhythm could enhance the quality of training in female volleyball teams because the fast tempo music could have dictated a pace that better matched the pace of the training (Szabo & Hoban, 2004). Beside, the music-tempo absolutely had an effect on the attainment of an equal pace. It was obvious that the stages with the fastest music give the most successful results. Not only did more joggers successfully synchronize their pace to the music, they did so with a significant smaller deviation from the music tempo (Schuurmans, 2006). By acting as a positive emotional distracter, music might motivate the participants to increase adherence to training, allowing to train longer and more efficiently (Schie, Stewart, Becker, & Rogers, 2008). Moreover, arousing music during warm-up had a significant effect on peak anaerobic power. This effect led to better competitive performance was yet to be determined (Eliakim, Meckel, Nemet, & Eliakim, 2007). Later on, in 2008 Rendi, Szabo and Szabo' showed that fast music enhanced 500-m rowing sprint performances, time to completion was shortest and stroke per minute was higher during rowing to fast music (Rendi, Szabo, & Szabo', 2008). The result confirmed previous researches, which showed that fast /upbeat improved performance (Brownley et al., 1995; Atkinson et al., 2004).

Effect of music on rating of perceived exertion

In this study revealed that RPE decreased in both music conditions, but non significant difference between aerobic music and preferred music. The mean value of RPE was lower in preferred music than aerobic music. According with Edworthy & Waring (2006), who demonstrated that in the absence of external stimulation, participants might focus more strongly on their own efforts and perceive them to be higher. Thus, in the no music condition they did not work harder, but perceived themselves to be working harder (Edworthy & Waring, 2006). Beside, previous researches showed that subjects in preferred music and fast music reported significantly lower scores for RPE than subjects in the no music condition (Schelert, 1996; Bharani et al., 2004; Seath & Thow, 1995; Meeks & Herdegen, 2002). Therefore, in this condition arousal levels might underpin performance (Edworthy & Waring, 2006). Contrary to Tenenbaum et al., 2004, who showed that music failed to influence RPE (Tenenbaum et al., 2004; Schie, Stewart, Becker, & Rogers, 2008). Although participants' RPE were lower in the preferred music than aerobic music. The finding showed that exercising with aerobic music the participants exercised greater exhaustion therefore, they provided more effort. These results might be assumed that the participants were more strenuous exercise in the aerobic music condition. According with, Hayakawa and colleague (2000) show that the subjects listening to aerobic music moved actively and felt the exercise somewhat hard (Hayakawa, Miki, Takada, & Tanaka, 2000). Edworthy & Waring (2006) reported that in the loud/ fast music condition the participants were running at faster speeds and produced higher heart rate. They thus correctly perceived themselves to be at higher levels of perceived exertion. Therefore, the music chosen should be characterized by a strong rhythmical component (Priest & Karageorghis, 2008; Priest, Karageorghis, & Sharp, 2004).

Effect of music on vigor

In the present study, vigor in the Brunel mood scale was negatively significant in without music condition and vigor tended to increase in the aerobic music condition. These results indicated that the aerobic music stimulated participants' mood state such as energetic. The current finding were coincides with Hayakawa and colleague (2000) which reported that listening to aerobic music and Japanese traditional folk song during bench stepping exercise had confusion less than non-music. Aerobic dance music was associated with significantly more vigor and less confusion than non-music (Hayakawa, Miki, Takada, & Tanaka, 2000). In agreement with preceding research which demonstrated that the motivational music promotes positive affective states, improved mood, and increases the likelihood of flow experience during physical activity (Preist, 2003). These results might be assumed that aerobic music increased vigor. The increase of vigor might promote exercise performance because vigor was associated with good performance (Lane, Terry, Beedie, & Stevens, 2004). Furthermore, the continuation of tracks might promote the emotion to continue exercising. This might also increase an exercise performance. Effective dissociation could promote a positive mood state, turning the attention away from thoughts of physiological sensations of fatigue (Karageorghis & Priest, 2009) because mood states were associated with successful performance (Lane et al., 2008). Familarity, Winberg & Gould (2003) showed that positive mood states were associated with more facilitative cognitive states and performance, with negative mood states hampering performance (Winberg & Gould, 2003). Seath & Thow (1995) reported a significant influence of music in the enhancement of the subject's personal feelings and reduced the perception of effort (Seath & Thow, 1995). This agreed with Mohammadzadeh and coolaborate (2008), who suggested that using music in progressive exercise would have a positive effect in terms of performance and the psychological state of the athletes (Mohammadzadeh, Tartibiyar, & Ahmadi, 2008). Moreover, the effects of music on mood and emotions opened up the possibility that it could be used to improve compliance to exercise and therefore help people achieve their long-term health and fitness goals (Karageorghis, 2008). Further, the music chosen should be characterized by a strong rhythmical component (Priest, 2003) because the strength of musical rhythm might be linked to arousal (Priest & Karageorghis, 2008). It might say that music was one the most effective triggers of strong emotional experience (Gabrielsson, Juslin, & Sloboda, 2001) and moreover, fast music acted as an external psyching up stimulus (Rendi, et al., 2008). Supported by many researches which revealed that fast music tempi elicited more pleasant and aroused emotional states (e.g. Bishop & Karageorghis, 2009; Hevner, 1937; Krumhansl, 2002). Therefore, the importance of music was intrinsically related to enjoyment and positive experiences (Saarikallio, & Erkkila, 2007).

Moreover, researcher interviewed participants' feeling about exercising with music. They informed that the rhythm was stimulus and enjoyable to exercise due to the continuation of the tracks because normal song had some blank of tracks.

Aerobic music prevented ones from thinking otherwise and if without music, ones would think only tiredness and exhaustion. The preferred music differed upon the songs, tempo of each individual. Participants mentioned that sad songs, slow to fast, fast to slow tempo caused exhaustion but some said aerobic music caused tiredness contrast to preferred music that they could sing along which corresponds to the conclusion of Hargreaves & North (1999), who concluded that and individuals response to a given stimulus or piece depend on an interaction between the characteristic of the person (such as age, gender, personality); of the music (e.g. its complexity, style, etc.) and of the situation in which it was encounter (Hargreaves & North, 1999). However, some participants did not like aerobic music but found out that they could exercise for longer time than preferred music. This agreed with Szabo et al., 1999 who indicated that listening to slow to fast music during progressive exercise was higher workload than the other sessions (Szabo, Small, & Leigh, 1999). It would be plausible that aerobic music could aid exercise participants to achieve the goal of physical activity. It might make a positive exercise experience and also influence exercisers to repeat the physical activity.

In summary, the importance and power of music in mood regulation might be founded on it versatility in satisfying multiple goals. Music was an effective means of discharging negative emotions (Saarikallio, & Erkkila, 2007). Most athletes and exercise participants preferred exercise with music. There approaches might likely contribute to the perceived pleasantness of the exercise experience, ultimately leading to increased exercise participation, and thus potentially offering at least partial remediation to the problem of high dropout rates (Razon, et al., 2009). However, we should select rhythm and tempo of music that suitable with individual’s target to achieve their ultimate performance because each type of music (such as sedative or stimulating music) had opposite effects. The existing moods and emotional states might be intensified by music (Caspy, Peleg, Schlam, & Goldberg, 1998).

CHAPTER VI
CONCLUSION

In general, the results of this study indicated that exercising with music conditions providing greater performance than without music. Although both music conditions could prolong time to exhaustion but time to exhaustion was longer in the aerobic music than preferred music. Furthermore, aerobic music revealed greater performance by extended time to 70% MaxHRR and improved vigor. In addition, RPE also showed their effort to exercise that coincided with the increase in vigor and exercise performance. These results supported by Szabo et al., 1999, who explained the reasons for the effects of music on exercise performance. Music helped exercisers to dissociate from the annoying perception of fatigue which was gradually amplified during progressive and/ or prolonged exercise. At higher levels of exercise (i.e., above 70% MaxHRR) the distracting effects of music depend upon its arousing qualities. Dissociation at this level could be maintained only if the arousing strength of the distracting stimulus (such as fast music), is stronger than the impact of physiological process begging for internal focus or associative thoughts (Szabo, Small, & Leigh, 1999). Notwithstanding, this research did not study in the athletes but aerobic music could also be applied to athletes for another activities exceptional training skills and strategies of their sports such as, exercise for cardiovascular system (running and jogging) or weight training. It could be concluded from the existing data that music effected on enhancing exercise performance. Therefore, this research suggested that we should exercise with aerobic music in sport and exercise contexts for the best performance.

REFERENCES

ACSM. (2009). *Guidelines for Exercise Testing and Prescriptin* (Eighth Edition ed.): Lippincott Williams & Wikins

Ana, S. (2001). Aerobic music. from http://www.suite101.com

Atkinson, G., Wilson, D., & Eubang, M. (2004). Effects of Music on Work-Rate Distribution During a Cycling Time Trial. *International Journal Sports Medicine, 25*, 611-615.

Barwood, M. J., Weston, N. J. V., Thelwell, R., & Page, J. (2009). A motivational music and video intervention improves high intensity exercise performance. *Journal of Sport Science and Medicine, 8*, 435-442.

Bella, S. D., Peretz, I., Rousseau, L., & Gosselin, N. (2001). A developmental study of the affective value of tempo and mode in music *Cognition, 80*, 1-10.

Bharani, A., Sahu, A., & Mathew, V. (2006). Effect of passive distraction on treadmill exercise test performance in healthy males using music. *International Journal of Cardiology, 97*, 305-306.

Bishop, D. T. (2007). *A Multicomponential Examination of Tennis Players' Emotional Responses to Music.* Brunel University, UK.

Bishop, D. T., Karageorghis, C. I., & Kinrade, N. P. (2009). Effects of Musically-Induced Emotions on Choice Reaction Time Performance. *The Sport Psychologist, 23*, 1-19.

Boyden, D. (Ed.). (1971). *An Introduction to MUSIC* (Second edition ed.). London: Faber andf Faber Limited.

Brownley, K. A., McMurray, R. G., & Hackney, A. C. (1995). Effects of music on physiological and affective responses to graded treadmill exercise in trained and untrained runners. *International Journal of Psychophysiology, 19*, 193-201.

Caspy, T., Peleg, E., Schlam, D., & Goldberg, J. (1988). Sedative and Stimulative Music Effects: Differential Effects on Performance Impairment Follwing Frustration. *Motivation and Emotional, 12*, 123-138.

Caspy, T., Peleg, E., Schlam, D., & Goldberg, J. (1998). Sedative and Stimulative Music Effects: Differential Effects on Performance Impairment Follwing Frustration. *Motivation and Emotional, 12*, 123-138.

Choosakul, C. et al. (2008). *The Brunel Mood Scale. Translated to Thai by the permission of Peter C. Terry & Andrew M. Lane.*

Copeland, B., & Franks, B. (1991). Effects of types and intensities of background music on treadmill endurance. *Journal of Sports Medicine and Physical Fitness, 31(1)*, 100-103.

Copley, J. (2008). Psychological of Heavy Metal Music: Effects on Mood, Aggression, Suisude, Drug Use and Intelligence. Retrieved 8, from http://www.suite101.com/content/psychology-of-heavy-metal-music-a53261

Crust, L. (2004a). Carry-over effects of music in an isometric muscular endurance task. *Percept Mot Skills, 98(3Pt1)*, 985-991.

Crust, L. (2004b). Effects of familiar and unfarmiliar asynchronous music on treadmill walking endurance. *Percept Mot Skills, 99(1)*, 316-318.

Crust, L., & Clough, P. (2006). The influence of rhythm and personality in the endurance response to motivational asynchronous music. *Journal of Sports Scencesi, 24(2)*, 187-195.

Dyrlund, A. K., & Winingre, S. R. (2008). The Effects of Music Preference and Exercise Intensity on Psychological Variables. *Journal of Music Therapy, XL.V (2)*, 114-134.

Edworthy, J., & Waring, H. (2006). The effect of music tempo and loudness level on treadmill exercise. *Ergonomics, 49*, 1597-1610.

Eliakim, M., Meckel, Y., Nemet, D., & Eliakim, A. (2007). The effect of music during warm-up on consecutive anaerobic performance in elite adolescent volleyball players. *International Journal Sports Medicine, 28*, 321-325.

Elliott, D., Carr, S., & Savage, D. (2004). Effects of Motivational Music on Wofk Output and Affective Responses During Sub-maximal Cycling of a Standardized Perceived Intensity. *Journal of Sport Behavior, 27*, 134-147.

Etzel, J. A., Johnsen, E. L., Dickerson, J., Tranel, D., & Adolphs, R. (2005). Cardiovascular and respiratory responses during musical mood induction. *International Journal of Psychophysiology, 61*, 57-69.

Gabrielsson, A., Juslin, P. N., & Sloboda, J. A. (2001). Emotions in strong experiences with music. Music and emotion: Theory and research. *Oxford University, VIII*, 431-449.

Griffin, M. (2006). Background music and the learning environment: borrowing from other disciplines. University of Adelaide.

Haas, F., Distenfeld, S., & Axen, K. (1986). *Effects of perceived musical rhythm on respiratory pattern.* New York University School of Medicine, New York.

Hargreaves, D. J., & North, A. C. (1999). The Functions of Music in Everyday Life: Redefining the Social in Music Psychology. *Psychological of Music, 27*(71).

Hayakawa, Y., Miki, H., Takada, K., & Tanaka, K. (2000). Effects of music on mood during bench stepping exercise. *Percept Mot Skills, 90(1)*, 307-314.

Hepler, C., & Kapke, R. (1996). Effect of music on cardiovascular performance during treadmill walking. *IAHPERD Journal, 29(2)*, 240-252.

Hevner, K. (1936). Experimental studies of the elements of expression in music. *American Journal of Psychology, 48*, 246-268.

Hevner, K. (1937). The affective value of pitch and tempo in music *American Journal of Psychology, 49*, 621-630.

Hume, K. M., & Crossman, J. (1992). Musical reinforcement of practice behaviors among competitive swimmers. *Journal of Applied Behavior Analysis, 25*, 665-670.

Johnson, V. W. (2004). The Effects of Music Genre on Spontaneous Exercise and Enjoyment. University of Wisconsin-la Crosse.

Kamien, R. (Ed.). (2006). *Music: An Appreciation* (Fifth Brief Edition ed.): The McGraw-Hill Companies.

Karageorghis, C., Drew, K., & Terry, P. (1996). Effects of pretest stimulative and sedative music on grip strength. *Perceptual and Motor Skills, 83(3, Pt2)*, 1347-1352.

Karageorghis, C. I. (2008, Oct. 2). Jog To The Beat: Music Increases Exercise Endurance By 15% from http://www.sciencedaily.com.

Karageorghis, C. I. (2010). Music in Sport and Exercise: Theory and Practice <http://www.thesportjournal.org/>

Karageorghis, C. I., Mouzourides, D. A., Priest, D. L., Sasso, T. A., Morrish, D. J., & Walley, C. L. (2009). Psychophysical and Ergogenic Effects of Synchronous Music During Treadmill Walking. *Journal of Sport & Exercise Psychology*, *31*, 18-36.

Karageorghis, C. I., & Priest, D.-L. (2009). Music in Sport and Exercise: An Update on Research and Application. <http://www.thesportjournal.org/>.

Khalfa, S. p., Bella, S. D., Roy, M., Peretz, I., & Lupien, S. J. (2003). Effects of Relaxing Music on Sarivary Cortisol Level after Psychological Stress. *New York Academy of Sciences, 999*, 374-376.

Kreutz, G., Ott, U., Teichmann, D., Osawa, P., & Vaitl, D. (2008). Using music to induce emotions: Influences of musical preference and absorption. *Psychological of Music, 36(1)*, 101-126.

Krumhansl, C. L. (1997). An exploratory study of musical emotions and psychophysiology. *Canadian Journal of Experimental Psychology, 51(4)*, 336-353.

Krumhansl, C. L. (2002). Music: ALink Between Cognitin and Emotion. *Current Directions in psychological science, 11*, 45-50.

Kuhn, D. (2002). The effects of active and passive participation in musical activity on the immune system as measured by salivary immunoglobulin A (SIgA). *Journal of Music Therapy, 39(1)*, 30-39.

Labbe', E., Schmidt, N., & Jonathan, B. (2007). Coping with Stress: Rhe Effectiveness of Different Types of Music. *Applied Psychophysiol Biofeedback, 32*, 163-168.

Lane, A. M., Soos, I., Leibinger, E., Karsai, I., & Harma, P. (2008). *Emotional intelligence, , mood states and performance in Hungarian athletes.* University of Wolverhampton, UK, University of Sunderland, UK, Semmeilweis University, Budapest, and University of Pecs, Hungary.

Lane, A. M., Terry, P., Beedie, C. J., & Stevens, M. (2004). Mood and Concentration Grid Performance: Effects of Depressed Mood. *Inernational Journal of Sport and Exercise 2*, 133-145.

Lane, A. M., Terry, P. C., Beedie, C. J., Curry, D. A., & Clark, N. (2001). Mood and Performance: Test of a Conceptual Model With a Focus on Depressed Mood. *Psychology of Sport and Exercise, 2(3)*, 157-172.

Lawrence, D. (Ed.). (2009). *The Complete Guide To Exercise To Music* (3rd Revised edition ed.): A & C Black Publishers.

Machilis, J., & Forney, K. (Eds.). (2003). *The Enjoyment of Music An Introduction to Perceptive Listening.* (Ninth Edition ed.): W.W.NORTON & COMPANY, Inc.

McArdle, W. D., Katch, F. I., & Katch, V. L. (2007). *Exercise Physiology Energy, Nutrition, and Human Performance* (sixth edition ed.): Lippincott Williams & Wikins

McCullough, A. K. (1997). *When music used to change mood.* Missouri Western State College.

McMordie, J. (2008). *The effect of music loudness on anaerobic and strength performance.* St. Francis Xavier University.

Meeks, J. D., & Herdegen, R. T. (2002). *Music enhances exercise performance but not Physiological recovery following exercise.* Hampden-Sydney College.

Mohammadzadeh, H., Tartibiyar, B., & Ahmadi, A. (2008). The effects of music on the perceived exertion rate and performance of trained and untrained individuals during progressive exercise. *Physical Education and Sport, 6*, 67-74.

Morris, A., Myers, S., Schaumburg, L., Schrage, K., & Veasey, M. The perceived effects of music on exercise performance. *Department of Psychology Milligan college*.

Nater, U. M., Abbruzzese, E., Krebs, M., & Ehlert, U. (2006). Sex difference in emotion and psychophysiological responses to musical stimuli. *International Journal of Psychophysiology, 62*, 300-308.

O'Sullivan, S. B. (1984). Perceived exertion. *Department of Physical Therapy, Sargent College of Allied Health Professions, Boston University, 64*, 343-345.

Pates, J., Karageorghis, C. I., Fryer, R., & Maynard, I. (2003). Effects of asynchronous music on flow states and shooting performance among netball players. *Psychology of Sport and Exercise, 4*, 415-427.

Pelletier, C. L. (2004). The Effect of Music on Decreasing Arousal Due to Stress: A Meta-Analysis. *Journal of Music Therapy, 41*(3), 192-214.

Priest, D.-L. (2003). *Characteristics and Effects of Motivational Music in Exercise.* Brunel University.

Priest, D.-L., & Karageorghis, C. I. (2008). A qualitative investigation into the characteristics and effects of music accompanying exercise. *European Physical Education Review, 14(3)*, 347-366.

Priest, D. L., Karageorghis, C. I., & Sharp, N. C. C. (2004). The characteristics and effects of motivational music in exercise settings: the possible influence of gender, age, frequency of attendance, and time of attendance. *Journal of Sports Medicine and Physical Fitness, 44*, 77-86.

Quinn, E. (2008, June 09). The Bruce Treadmill Test Protocol. from http://sportmedicine.about.com/od/fitnessvalandassessment/a/Bruce_Protocol.htm

Razon, S., Basevitch, I., Land, W., Thompson, B., & Tenenbaum, G. (2009). Perception of exercise and attention allocation as a function of visual and auditory conditions. *Psychological of Sport and Exercise, 10*, 636-643.

Rendi, M. R., Szabo, A., & Szabo', T. s. (2008). Performance Enhancement With Music in Rowing Sprint. *The Sport Psychologist, 22*, 175-182.

Rickard, N. S. (2004). Intense emotional responses to music: a test of the physiological arousal hypothesis. *Psychological of Music, 32*, 371-388.

Saarikallio, S., & Erkkila, J. (2007). The role of music in adolescents' mood regulation. *Psychological of Music, 35*, 88-106.

Schelert, R. (1996). *The effects of prefered music on perceived duration, perceived exertion, and perceived enjoyment during aerobic exercise.* Texas Tech University.

Schellenberg, E. G., & Hallam, S. (2005). Music Listening and Cognitive Abilities in 10- and 11-Year-Olds: The Blur Effect. 202-209.

Schie, N. A., Stewart, A., Becker, P., & Rogers, G. G. (2008). Effect of music on submaximal cycking. *SAJSM, 20*, 28-31.

Schuurmans, T. W. G. (2006). *Motivating joggers through adaptive music feedback.* Eindhoven University of Technology.

Schwartz, S. E., Fernhall, B., & Plowman, S. (1990). Effects of music on exercise performance. *Journal of Cardiopulmonary Rehabilitation and Prevention, 10*, 312-316.

Seath, L., & Thow, M. (1995). The Effect of Music on the Perception of Effort and Mood During Aerobic Type Exercise. *Physiotherapy, 81*, 592-596.

Simpson, S. D., & Karageorghis, C. I. (2005). *Effects of Synchronous Music on 400-Metre Sprint Performance.* Brunel University, UK.

Sokhadze, E. M. (2007). Effects of Music on the Recovery of Autonomic and Electrocortical Activity After Stress Induced by Aversive Visual Stimuli. *Applied Psychophysiol Biofeedback, 32*, 31-50.

Sorenson, L., Czech, P. R., Gonzalez, S., Klein, J., & Lachowetz, T. (2008). Listen Up! The Experience of Music in Sport - A Phenomenological Investigation. . *Journal of Sport Psychology*.

Sriwibool, U. (2003). *Effects of music on progressive cycling to voluntary exhaustion.* Burapra University, Chonburi.

Szabo, A., & Hoban, L. J. (2004). Psychological Effects of Fast- and Slow-Tempo Music Played during Volleyball Training in a Nation League Team. *International Journal of Applied Sports Sciences, 16*, 39-48.

Szabo, A., Small, A., & Leigh, M. (1999). The effects of slow- and fast- rhythm classicalmusic on progressive cycling to voluntary physical exhaustion. *Journal of Sports Medicine and Physical Fitness, 39*, 220-225.

Szmedra, L., & Bacharach, D. (1998). Effect of music on perceived exertion, plasma lactate, norepinephrine and cardiovascular hemodynamics during treadmill running *International Journal Sports Medicine, 19(1)*, 32-37.

Tenenbaum, G., Lidor, R., Lavyan, N., Morrow, K., Tonnel, S., Gershgoren, A., et al. (2004). The effect of music type on running perseverance and coping with effort sensations. *Psychological of Sport and Exercise, 5*, 89-109.

Terry, P. C., & Karageorghis, C. I. (2006). *Psychophysical Effects of Music in Sport and Exercise: An Update on Theory, Research and Application.* University of Southern Queensland and Brunel University.

Terry, P. C., & Lane, A. M. (2003). User Guide for the Brunel Mood Scale (BRUMS). *University of Southern Queensland, Australia & University of Wolverhampton, UK.*

Webster, G. D., & Weir, C. G. (2005). Emotional Responses to Music: Interactive Effects of Mode, Texture, and Tempo. *Motivation and Emotional, 29*, 19-39.

Weinberg, R. S., & Gould, D. (2003). Foundations of Sport & Exercise Psychology.

Wolfe, D. E. (1983). Effects of Music Londness on Task Performance and Self-Report of College-Aged Students. *Journal of Research in Music Education, 31*, 191-201.

Yamamoto, T., Ohkuwa, T., Itoh, H., Kitoh, M., Terasawa, J., Tsuda, T., et al. (2003). Effects of Pre-exercise Listening to Slow and Fast Rhythm Music on Supramaximal Cycle Performance and Selected Metabolism Variables. *Archives of Physiology and Biochemistry, 111*, 211-214.

Yamashita, S., Iwai, K., Akimoto, T., Sugawara, J., & Kono, I. (2006). Effects of music during exercise on RPE, heart rate and the autonomic nervous system. *J Sports Med Phys Fitness, 46(3)*, 425-430.

APPENDICES

APPENDIX A

COA. No. MU-IRB 2010/287.1810

Documentary Proof of Mahidol University Institutional Review Board

Title of Project:	Effects of Music on Exercise
Title of Subproject:	Effects of Music on Enhancing Exercise Performance (Thesis for Master Degree)
Principal Investigator:	Miss Chadaphan Suwannate
Title of Subproject:	Effects of Relaxation Music on Recovery Period (Thesis for Master Degree)
Principal Investigator:	Miss Prompatsorn Pattanapornchai
Name of Institution:	College of Sports Science and Technology

Approval includes:
1) MU-IRB Submission form version received date 11 October 2010
2) Participant Information Sheet version date 14 October 2010
3) Informed Consent form version date 11 October 2010
4) Questionnaire for screening version date 11 October 2010
5) Data Record form for Effects of music on enhancing exercise performance version date 11 October 2010
6) Data Record form for Effects of relaxation music on recovery period version date 11 October 2010

Mahidol University Institutional Review Board is in full compliance with International Guidelines for Human Research Protection such as Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Approval: 18 October 2010

Date of Expiration: 17 October 2011

Signature of Chairman:..

(Professor Rutja Phuphaibul)
Vice Chair for Chair

Signature of Head of the Institute: ....

(Professor Sansanee Chaiyaroj)
Vice President for Research and Academic Affairs

Office of the President, Mahidol University, 999 Phuttamonthon 4 Rd., Salaya, Phuttamonthon District, Nakhon Pathom 73170. Tel. (662) 8496223-5 Fax. (662) 8496223

APPENDIX B

The Brunel Mood Scale

(Peter C Terry and Andrew M Lane, 2003)

Below is a list of words that describe feelings. Please read each one carefully.
Then cross the box that best describes HOW YOU FEEL RIGHT NOW.
Make sure you answer every question.

		Not at all	A little	Moderately	Quite a bit	Extremely
1.	Lively	❑	❑	❑	❑	❑
2.	Energetic	❑	❑	❑	❑	❑
3.	Active	❑	❑	❑	❑	❑
4.	Alert	❑	❑	❑	❑	❑

APPENDIX C

แบบวัดอารมณ์ บรูเนล (The Brunel Mood Scale)

(อ.ดร.ชัยรัตน์ ชูสกุล และคณะ, 2008)

ข้างล่างนี้ คือ คำที่อธิบายถึงความรู้สึก ขอความกรุณาอ่านแต่ละคำอย่างรอบคอบ จากนั้นให้ทำเครื่องหมายถูกในช่องสี่เหลี่ยมที่อธิบายได้ดีที่สุดถึงความรู้สึกที่เป็นจริงของท่านว่าเป็นอย่างไร

	ไม่มีเลย	นิดหน่อย	ปานกลาง	มาก	มากสุด ๆ
1. มีชีวิตชีวา	......☐	☐	☐	☐	☐
2. กระตือรือร้น	......☐	☐	☐	☐	☐
3. กระฉับกระเฉง	......☐	☐	☐	☐	☐
4. ตื่นตัว	......☐	☐	☐	☐	☐

APPENDIX D

Personal Details

Part I
Personal information

1. Gender □ male □ female
2. Age ____
3. Weight ________ Height ________
4. Are you an athlete? □ Yes, that kind is _____________
   □ No
5. At present, are you smoking? If yes, what kind of tobacco?
   □Yes, ______ □ No
6. Are you drinking alcohol? If yes, how often do you drink?
   □ Yes, ______ □ No
7. Do you like listening to music?
   □ Yes (□ Thai song □ International song)
   □ No
8. Please list your 5 favorite songs (bands/singers)
   1.____
   2.____
   3.____
   4.____
   5.____

Thank for your kindness
Chadaphan Suwannate

Part II
Questionnaires before the exercise

9. Gender _______ Age _____

10. Activity profile
Within the last three months describe the activities that you regularly participated in:

Activity	Sessions per week	Average duration			
Walking		30 min or less	45 min	1 hr.	1 hr.+
Running/Jogging		30 min or less	45 min	1 hr.	1 hr.+
Golf		30 min or less	45 min	1 hr.	1 hr.+
Racquet sports		30 min or less	45 min	1 hr.	1 hr.+
Swimming		30 min or less	45 min	1 hr.	1 hr.+
Football		30 min or less	45 min	1 hr.	1 hr.+
Rugby		30 min or less	45 min	1 hr.	1 hr.+
Martial arts		30 min or less	45 min	1 hr.	1 hr.+
Cycling		30 min or less	45 min	1 hr.	1 hr.+
Aerobic dance		30 min or less	45 min	1 hr.	1 hr.+
Weight lifting		30 min or less	45 min	1 hr.	1 hr.+
Other activity (specify_____)		30 min or less	45 min	1 hr.	1 hr.+
Do not regular exercise.					

Part III
PAR-Q TO ASSESS READINESS FOR PHYSICAL ACTIVITY
ORIGINAL PAR-Q

Common sense is your best guide in answering these questions. Please read each question carefully and check *yes* or *no* if it to you. The Physical Activity Readiness Questionnaire (PAR-Q) has been recommended as minimal screening for entry into moderate –intensity exercise program. PAR-Q was designed to identify the small number of adults for whom physical activity might be inappropriate or those who should receive medical advice concerning the most suitable type of activity

YES □ NO □ 1. Has your doctor ever said that your have a heart trouble?

YES □ NO □ 2. Do you frequently have pains in your heart and chest?

YES □ NO □ 3. Do your often feel faint or have spells of severe dizziness?

YES □ NO □ 4. Has a doctor ever said your blood pressure was too high?

YES □ NO □ 5. Has your doctor told you that you have a bone or joint problem that has been aggravated by exercise or might be made worse with exercise?

YES □ NO □ 6. Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?

YES □ NO □ 7. Are you over age 65 and not an customed to vigorous exercise?

APPENDIX E

<u>แบบสอบถามข้อมูลทั่วไปของผู้เข้ารับการวิจัย</u>

<u>ส่วนที่ 1</u>

รายละเอียดเกี่ยวกับข้อมูลส่วนตัว

1.เพศ ☐ ชาย ☐ หญิง

2.อายุ ______ ปี

3.น้ำหนัก ________ ส่วนสูง ________

4.เป็นนักกีฬาหรือไม่ ☐ เป็น ชนิดกีฬา____________

☐ ไม่เป็น

5.ปัจจุบันสูบบุหรี่หรือไม่ (ถ้ามีคุณสูบอะไร ? และบ่อยแค่ไหน ? เช่น บุหรี่ ซิการ์ ไปป์ อื่นๆ)

☐ สูบ_______ ☐ ไม่สูบ

6.ปัจจุบันดื่มแอลกอฮอล์หรือไม่ (ถ้าดื่มบ่อยแค่ไหน)

☐ ดื่ม_______ ☐ ไม่ดื่ม

7.ปกติชอบฟังเพลงหรือไม่

☐ ชอบ (☐เพลงไทย/☐เพลงสากล) ☐ ไม่ชอบ

8.กรุณากรอกรายชื่อเพลงที่ท่านชอบ 5 เพลงพร้อมทั้งชื่อวงและชื่อนักร้อง

1.____

2.____

3.____

4.____

5.____

ขอขอบคุณที่ให้ความร่วมมืออย่างดียิ่ง

ชฎาพันธุ์ สุวรรณเนตร

ส่วนที่ 2

แบบสอบถามก่อนการออกกำลังกาย

9. เพศ _______ อายุ _____ ปี

10. กิจกรรมทางกายที่เกี่ยวข้อง

ภายใน 3 เดือนที่ผ่านมาคุณเคยทำกิจกรรม / การออกกำลังกายชนิดใดบ้าง

กิจกรรมต่างๆ	จำนวนครั้ง/สัปดาห์	ระยะเวลาการออกกำลังกาย
การเดิน		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
การวิ่ง/จ๊อกกิ้ง		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
กอล์ฟ		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
กีฬาที่ใช้ไม้แร็คเก็ต		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
ว่ายน้ำ		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
ฟุตบอล		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
รักบี้		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
กีฬาต่อสู้ป้องกันตัว		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
ขี่จักรยาน		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
การเต้นแอโรบิก		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
Weight		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
อื่นๆ โปรดระบุ		30 นาที หรือน้อยกว่า 45 นาที 1 ชม. 1 ชม.+
ออกกำลังกายไม่สม่ำเสมอ		

<u>ส่วนที่ 3</u>

แบบสอบถามความพร้อมทางร่างกาย (สำหรับผู้ที่มีอายุตั้งแต่ 15 ปี-69 ปี)

การออกกำลังกายอย่างสม่ำเสมอช่วยให้เกิดความเพลิดเพลินและสุขภาพที่ดี อย่างไรก็ดีการออกกำลังกายยังเป็นสิ่งที่ปลอดภัยมากสำหรับคนส่วนใหญ่ แบบสอบถามด้านล่างนี้ถูกออกแบบมาเพื่อช่วยให้ทุกคนที่มีอายุตั้งแต่ 15 ปี-69 ปี สามารถใช้ในการตรวจสอบว่าคุณควรจะพบแพทย์ก่อนการออกกำลังกายหรือไม่

ใช่	ไม่ใช่	
☐	☐	1.หมอเคยบอกว่าคุณมีสภาวะทางโรคหัวใจและคุณควรจะทำกิจกรรมทางกายภาพตามแนะนำของหมอ?
☐	☐	2.คุณรู้สึกเจ็บหน้าอกเวลาทำกิจกรรมทางกายภาพ?
☐	☐	3.ในเดือนที่ผ่านมา คุณเคยเจ็บหน้าอกเวลาทำกิจกรรมทางกายภาพ?
☐	☐	4.คุณสูญเสียความสมดุลเพราะหน้ามืดวิงเวียนศีรษะ หรือเคยหมดสติ?
☐	☐	5.คุณมีปัญหากระดูกหรือข้อต่อที่จะทำให้เปลี่ยนแปลงไปในทางเลวร้ายลงเมื่อทำกิจกรรมทางกาย?
☐	☐	6.หมอของคุณสั่งยาให้คุณเป็นประจำสำหรับความดันเลือดหรือสภาวะทางหัวใจของคุณ?
☐	☐	7.คุณรู้ด้วย**<u>เหตุผลอื่น</u>**ว่าทำไมคุณไม่ควรทำกิจกรรมทางกายภาพ?

APPENDIX F

Rating of perceived exertion scale (RPE)

rating	*description*
6	
7	Very, Very Light
8	
9	Very Light
10	
11	Fairly Light
12	
13	Somewhat Hard
14	
15	Hard
16	
17	Very Hard
18	
19	Very, Very Hard
20	Maximal Exertion

APPENDIX G

แบบสอบถามความเหนื่อย

6	สบายๆ
7	เบาสุดๆ
8	
9	เบามาก
10	
11	
12	
13	ค่อนข้างหนัก
14	
15	หนัก
16	
17	หนักมาก
18	
19	หนักสุด
20	หนักสุดๆ

APPENDIX H

No ……..

Data Record

Resting Heart rate 1…………bpm 2 …………bpm 3.…………bpm

Blood Pressure 1 …………mm.Hg 2 …………mm.Hg 3 …………mm.Hg

70%MaxHRR 1…………. 2…………... 3………….

	Condition	without music	Aerobic music	Prefer Music
RPE	70%MaxHRR			
	exhaustion			
Time	70%MaxHRR			
	exhaustion			
Mood State	Pre Performance			
	exhaustion			

APPENDIX I

Selected Music

1. 3 by Britney Spears
2. Tik Tok by Kesha
3. Sexy Bitch by David Guetta
4. Poker Face by Lady Gaga
5. Fire Burning on The DanceFloor by Sean Kingston

APPENDIX J

Table 2 Time at 70% MaxHRR and exhaustion under without music, aerobic music, and preferred music

Subjects	Without music		Aerobic music		Preferred music	
	70% MaxHRR	Exhaustion	70% MaxHRR	Exhaustion	70% MaxHRR	Exhaustion
1	10.01	12.15	10.38	13.59	7.12	12.32
2	9.1	12.1	9.38	13.42	6.38	11.18
3	8.23	12.12	10.14	14.26	6.47	12.02
4	8.33	12.1	9.58	14.09	9.42	15.03
5	7.41	12	8.45	15	7.18	10.25
6	10.33	12.05	7.07	10.28	6.53	10.3
7	10.52	12.38	13.4	14.56	12.43	13.15
8	12.27	12.31	10.54	14.54	11.09	12.42
9	7.2	12.23	9.22	14.59	8.09	13.09
10	9.44	12.21	13.13	14.52	12.24	13.09
11	8.26	12.2	10.43	14.2	8.35	12.35
12	7.49	12.14	7.49	10.35	9.59	13.39
13	7.53	12.04	6.03	12.51	7.1	10.32
14	7.31	12.33	8.11	14.26	7.42	12.45
15	7.24	12.03	7.47	12.13	9.49	12.3
16	8.4	12.27	8.47	12.44	8.25	12.53
17	11.11	12.35	11.22	13	12.27	15.31
18	9.37	12.3	9.34	12.06	9.28	12.52
19	9.49	12.02	11.09	15.47	12.18	14.09
20	6.18	12.08	6.18	11.5	7.18	12.16
21	10.23	12.12	10.5	14.06	9.38	12.31
22	8.34	12.2	7.28	10.38	9.16	13.31
23	6.43	12.04	10.05	15.18	9.17	13.11
24	8.12	9.3	8.32	9.37	9.21	11.11
25	6.32	9.28	8.1	9.46	8.27	11.33
26	7.27	9.04	8.4	11.36	8.37	9.25
27	7.21	8.56	9.19	11.37	8.42	9.5
28	7.39	9.17	6.55	12.23	8.3	10.03
29	6.27	9.3	5.26	11.21	5.55	9.46
30	6.26	9.03	6.46	10.15	5.54	8.47

BIOGRAPHY

NAME	Miss Chadaphan Suwannate
DATE OF BIRTH	28 OCTOBER 1983
PLACE OF BIRTH	Bangkok, Thailand
INSTITUTIONS ATTENDED	Mahidol University, 2002-2005 Bachelor of Science (Sports Science) Mahidol University, 2008-2011 Master of Science (Sports Science)
RESEARCH GRANTS	This thesis is partially supported by Graduate Studies of Mahidol University Alumni Association
HOME ADDRESS	66 MOO 7 Bang Khun Thian, Chom Thong Bangkok, 10150 Tel. 089-8213969 E-mail: s-chadaphan@hotmail.com
PUBLICATION / PRESENTATION	Journal of Sports Science and Technology, 10(2), 338-343 Oral Presentation: (Pre-ASEAN University Games Conference 2010) December 10-14, 2010, Chiang Mai, Thailand