

Abstract

Smith, Karen L. The Effects of Contemporary Rock and Roll Music on Heart Rate, Blood Pressure, VO_2 , Perceived Exertion and Duration in Females aged 18 - 31 years. M. S. in Adult Fitness/Cardiac Rehabilitation, 1987. 59 pp. (Dr. Philip Buckenmeyer)

Three submaximal exercise tests were performed on a sample of 27 graduate and undergraduate level students to determine the effects of fast and slow rock and roll music on certain physiological parameters. Oxygen consumption (VO_2) and duration (D) were measured with the assistance of a Beckmann Metabolic Measurement Cart (BMMC). A modified CM5 lead system was used and heart rate (HR) was recorded on a Burdick electrocardiogram. Rated Perceived Exertion (RPE) was indicated by a Borg perceived exertion scale and blood pressure (BP) was determined using a mercury sphygmomanometer. The three experimental conditions were no music (NM), slow rock and roll music (SRM), and fast rock and roll music (FRM). One condition was randomly assigned for each test. The subjects ran on a treadmill until they reached 80% of their age-predicted maximum HR. The variables were analyzed by a one way ANOVA with repeated measures at the $p < .05$ level of significance. A Scheffe' test was used when significant F-ratios were obtained to determine which pairs of treatment groups differed. HR was significantly higher during the second and fifth stages of the exercise protocol in the FRM condition compared to the SRM condition. VO_2 was significantly lower during the fourth stage in the SRM condition compared to the NM condition. Finally, D was highly significant with the Ss running longer during the SRM condition than either the FRM or NM conditions. Future studies need to be done in this area to determine how different types of music and different test termination points influence these physiological parameters.

THE EFFECTS OF CONTEMPORARY ROCK AND ROLL
MUSIC ON DURATION, VO_2 , BLOOD PRESSURE, HEART
RATE AND PERCEIVED EXERTION IN FEMALES AGED 18 -31 YEARS

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by
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DEDICATION

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"A man's happiness and success in life will depend not so much upon what he has, or upon what position he occupies, as upon what he is, and the heart he carries into his position."

S. J. Wilson

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CHAPTER I

INTRODUCTION

The great popularity of the portable stereo/cassette player has raised the question of how music affects physical performance. What is it that makes exercise more enjoyable when listening to music? Miller (1984), as reported by Van (1984), concluded that music made training more enjoyable and gave subjects the feeling that their performance improved. A study by Coutts (1965) indicated that music was being used in pre-game situations even though there was no experimental evidence that music would improve performance.

Does music improve performance? What other effects does it have on the human body? Many studies have looked at the musical effects on psychological factors such as reading comprehension (Hilliard & Tolin, 1979), type A and type B personalities (Strube, Turner, Patrick, & Perrillo, 1983), anxiety levels (Peretti & Swenson, 1979), and exam scores (Blanchard, 1979). Other studies have investigated how music could be used as a therapeutic tool with the mentally retarded (Jones, 1976) and the elderly (Tanner & O'Briant, 1980). Four studies that reviewed how music affected different physiological parameters had statistically significant results. These effects included a greater endurance time (Anshel & Marisi, 1978), better recovery of the heart rate back to normal following a written examination (Blanchard, 1979), higher respiration rate (Ellis & Brighouse, 1952) and a heart rate that was directly related to the tempo of the music (Landreth & Landreth, 1974). A weakness of these

studies done on the effects of music, was that they did not use contemporary music. The type of music that was used most often was classical music and marches. To evaluate how music affects people, psychologically or physiologically, more studies need to be performed on the music utilized by people during activity.

This study was designed to investigate the effects of fast and slow rock and roll music on selected physiological parameters and the physical performance of females.

Purpose of the Study

The purpose of this study was to determine if contemporary rock and roll music could change physiological parameters and increase the physical performance of females.

Statement of the Problem

The problem of this study was to establish the effects of fast (between 144 b.p.m. and 192 b.p.m.) and slow (between 60 b.p.m. and 66 b.p.m.) contemporary rock and roll music on duration, heart rate, blood pressure, VO_2 , and perceived exertion of females aged 18 to 31 years during a submaximal exercise.

Null Hypothesis

Contemporary rock and roll music will not affect exercise duration, heart rate, blood pressure, oxygen consumption, or rated perceived exertion of females aged 18 to 31 years during a submaximal exercise test.

Need for the Study

Most of the studies conducted on the effects of music on physiological parameters have resulted in nonsignificant differences ($p < .05$). No studies have been done specifically on how music affects females, although Peretti and Swenson (1974) found that females were more influenced by the calming, soothing music than were males. Sears (1960) found that music was more successful in changing muscle tension in females than in males. These studies indicated that statistically significant results might be attained if females exercised while listening to contemporary rock and roll music. This study will emphasize two areas that are lacking in the literature, one being a study on females and the second using contemporary rock and roll music as a factor.

Assumptions

1. The subjects answered the activity questionnaire honestly.
2. The subjects regularly exercised, as defined by this study.
3. The subjects were representative of the female student population at the University of Wisconsin - La Crosse.
4. The subjects performed to the best of their ability.
5. The subjects had no hearing or sensory impairments.

Delimitations

1. The subjects were volunteers, rather than randomly selected.
2. The order in which the tests were given was randomized.
3. All of the subjects were females between the ages of 18 and 31 who exercised regularly.
4. Due to a time factor, the subjects were not able to perform each test at the same time of day.

Limitations

1. The emotional state of the subject was not determined before each test.
2. The subject's previous music background was not established.
3. The subject's disappointment when no music was presented was not measured.

Definitions of Terms

BECKMAN METABOLIC MEASUREMENT CART: Programmable computer that analyzes respiratory and metabolic measurements on exercising subjects while they are breathing room air.

CONTEMPORARY ROCK AND ROLL MUSIC: Fast or slow rock and roll music that is frequently played on radio stations.

DECIBEL (dB): Numerical expression of the relative loudness of a sound.

ELECTROCARDIOGRAM (EKG): Measures the electrical activity of the heart and produces a graphic display of the heart beat over a specified period of time. Electrodes are placed in a modified CM5 position.

METRONOME: A clockwork device with an inverted pendulum that is used to determine the tempo of music. It determines the number of beats per minute.

RATED PERCEIVED EXERTION (RPE): Determines how the subject mentally rates the effort of work at each stage on the treadmill. Subject's perception of how hard they are working.

REGULAR EXERCISE: Exercise four or more times a week, for 30 minutes, at 75 percent or more of maximum heart rate.

SUBMAXIMAL EXERCISE: Exercise at a predetermined protocol until subject reached 80 percent of maximum heart rate (80 percent of maximum heart rate was determined by the formula $[(220 - \text{age}) \times .80]$).

VO₂ : Volume of oxygen per minute utilized by the working muscles for energy. It is expressed in milliliters per kilogram of body weight per minute (ml·kg⁻¹·min⁻¹).

CHAPTER II

REVIEW OF LITERATURE

Introduction

Many studies have been done to examine the effects of music on the human body both psychologically and physiologically. The studies reviewed in this chapter have been divided into three categories: music therapy, music in psychology, and music in physiology.

Music Therapy

Music therapy was developed to treat people's ailments with music, rather than drugs. It has found some success in the hospital setting. Pickrell (1950), cited by Taylor (1981), stated that music was helpful in three phases of a hospital visit. During the admission phase, music helped to soothe and comfort the patient; during the surgical phase, the music helped to distract the patient from the noise of the surgical tools and the conversation of the operation; and during the post operative stage, the music helped to distract the patient from any pain or discomfort. Morgan (1975) noted that when a musical stimulus was presented the patient concentrated on the music rather than personal problems. Music was used to keep the patient occupied during the day and as a sleep aid at night (Taylor, 1981).

Music has been found to change physiological processes such as body metabolism, pulse and blood pressure (Morgan, 1975); along with cardiac

output, respiration rate and volume, and bodily secretions (Light, Love , Benson, & Morch, 1954), as cited by Taylor (1981).

Another branch of the medical environment that uses music is anesthesiology. Lewis, Burris-Meyer, & Cardinell (1947) as cited by Taylor (1981), found that when semiclassical music was used to assist the administration of anesthesia it was possible to reduce the amount of medication needed. This helped the patient to recover more rapidly with less confusion (Light et al. 1954; Pickrell, 1950;, both cited by Taylor, 1981). The researchers emphasized the importance of selecting music that was calming to the patient.

Soothing music is commonly used in the dentist's office. Best (1935), as cited by Taylor (1981), stated that the central nervous system could only focus on one stimulus at a time when many stimuli were presented. Other studies, Guer (1960) and Gardner (1960), as cited by Nelson (1963), found that soothing music was used by dentists to ease anxiety and relax the patient by diverting attention. The music buffered the sounds of the dental equipment and diverted the patient's mind from the anticipation of pain. This type of anesthesia, pain killing by sound, was referred to as , "audio-analgesia" (Nelson & Finch, 1962, p. 588).

Tanner and O'Briant (1980) found that music was beneficial to the elderly patient mentally, physically, and socially. Music was used successfully to soothe patients, stimulate them to greater activity, and increase their memory span and concentration. By participating in making music, the patients got the greatest benefits. Singing motivated the patient to sit up straight and breathe deeply. Rhythmical music inspired

the clapping of hands and tapping of toes, which exercised the muscles and moved the stiff joints. Conducting the group music session developed leadership qualities, self-confidence and coordination while releasing tension, and exercising the large muscle groups of the arms and shoulders.

Music therapy has also been used when working with the mentally retarded. According to Alvin (1978), music therapy possesses a therapeutic value. "Music is a basic need, compulsion, people who cannot react to any other stimulus often react to music" (Jones, 1976, p. 14). This could be due to the fact that music was found to be perceived on the right side of the brain. A person does not need a high level of intelligence to listen to music (Alvin, 1978).

Music in Psychology

In thirteen studies, (Anshel & Marisi, 1978; Blanchard, 1979; Carver, Coleman, & Glass, 1976; Diserens, 1923; Etaugh & Ptasnik, 1982; Hilliard & Tolin, 1979; Konecni & Sargent-Pollock, 1976; Matthews & Burnson, 1979; Nelson, 1963; Nelson, 1962; Parente, 1976; Strube, Turner, Patrick, & Perrillo, 1983; and Van, 1984), various types of music (jazz, classical, instrumental, rock and roll, etc.) were played as a background stimulus to see how subjects performed on different tasks. The general focus was to determine if music was helpful or distracting to the subject.

Etaugh and Ptasnik (1982) found that subjects who studied with music performed better with music present, and subjects who studied without music performed better without the presence of music. Hilliard and Tolin (1979) stated that the familiarity of the music was an important variable. It was noted that the subjects performed better on reading comprehension

tests when familiar background music was played. The unfamiliar background music had a detrimental effect on the subjects' performances.

In a study by Parente (1976), music was found to be no more distracting than quiet while taking a test. Contemporary music selections were used from which each subject chose a least and most preferred piece. The control group took the test with no music and the two experimental groups took the test listening to either the most preferred selection or the least preferred selection. The two experimental groups were found to score higher than the control group at the .002 level of significance.

Blanchard (1979) used no music, rock and roll music and classical music as a background stimulus while university students took an examination. With both music conditions there was a very slight change in the pulse rate and with no music there was a significant increase in pulse rate. The same response was true for blood pressure. This indicated that the music reduced the stress of the students during the exams.

Anshel and Marisi (1978) used no music and popular rock music with a rhythm between 125 and 135 beats per minute. The subjects rode a bicycle ergometer synchronously and asynchronously with the music. The results indicated that the subjects performed significantly longer when they performed in synchronization with the music rather than asynchronously or in the absence of music.

Nelson (1962) and Nelson (1963) observed how three types of music stimulus (fast march, orchestra music, and white sound - resembles Niagra Falls) affected performance. It was found that strength and endurance

were not significantly affected by music (Nelson, 1962) nor was performance (Nelson, 1963).

Strube et al. (1983), Carver, Coleman, & Glass (1976), and Matthews & Burnson (1979), studied type A and type B personalities. According to Carver, Coleman, and Glass (1976), a person with a type A personality worked harder on a treadmill test and reported fewer symptoms of fatigue than a type B personality. For a type A personality, admittance of fatigue appeared to interfere with the completion of the task. This explained why type A's, who put more attention on the task than type B's, outperformed type B's. Type B's usually gave more attention to other stimulants, such as the music, that may have been irrelevant to the task at hand (Matthews & Brunson, 1979).

Strube et al. (1983) stated that prior research found pleasant stimuli as having a soothing effect on negative moods and increased the performance of a task. The results of this study indicated that simplex (simple and predictable) music was only able to alleviate the negative mood of type B's ($p < .05$). Therefore, only type B personalities benefited from stimuli that increased performance.

Tarchanoff (1895), as cited by Diserens (1923), made the following conclusion about the effect of music on performance:

When a subject is completely fatigued by working on the ergograph and can no longer raise the weight, gay music of rapid movement causes the fatigue to vanish for a variable time, and the subjects are able to raise the weight once more; i.e., do additional work. Sad, slow music in the minor key produces the opposite effect (p. 180).

Music in Physiology

Although very little experimental evidence can justify such a procedure, attempts have been made to use music in a pregame situation to increase physical performance (Coutts, 1965).

Three studies that were done to determine the physiological effects associated with music revealed insignificant results. Nelson (1963) found that music did not have a favorable or unfavorable effect on endurance performance. Anshel and Marisi (1978) found that music may have an effect on prolonging fatigue but differences in the physical work capacity were insignificant. Lastly, Coutts (1965) and Nelson (1963) found no significant difference in music on heart rate, or on the speed of a bicycle ergometer ride. Therefore, Nelson (1963) concluded that music may increase muscular endurance at a submaximal level, rather than a maximal level.

Faster music tended to make people feel better and find training more enjoyable (Nelson, 1963; Miller, 1984, as cited by Van. 1984). Exercise done to music that the subject enjoyed was less stressful. It reduced the anxiety levels of the subjects (Peretti & Swenson, 1974). In the studies by Peretti and Swenson (1974) and Sears (1960), females were found to be influenced by music in reducing anxiety levels more than men. Kibler and Rider (1983) noted that other studies (i.e., Sears, 1960) had found slow, sedative music to be effective in stress reduction, as measured by physiological changes.

Blanchard (1979) conducted a study on the effects of background music on exam anxiety of university students. The results suggested that music tended to minimize nervousness, and the subjects with the background music

(the experimental groups) got higher grades on the experimental exam. In the results the mean blood pressure and mean heart rate of the control group (group with no music) went up sharply. The mean blood pressure and heart rate of the two experimental groups stayed the same. This indicated that the control group had a slower recovery of the heart back to the normal rate and both of the experimental groups showed excellent heart rate recovery.

It has been frequently suggested that music could prolong physical performance. Many studies have tried to examine this. A study by Anshel and Marisi (1978) stated that music inhibits psychological feedback associated with physical exertion and fatigue. Miller (1984), as reported by Van (1984), stated that listening to music prevents a runner from hearing the heavy breathing or the feet hitting the ground. Most of the subjects in the physiological studies did feel that the perceived exertion was lower when faster music was played (Nelson & Finch, 1962; Miller, 1984, as cited by Van, 1984).

Nine studies attempted to explain the effects of different types of musical stimuli on physiological parameters. A common conclusion was that the type of music played was very important (Ellis & Brighthouse, 1952). Anshel and Marisi (1978) used music from the popular rock category on the premise that it would elicit a maximum effort and prolong the performance time of university aged subjects. Landreth and Landreth (1974) noted that physiological responses of the listener could be affected by the subject's knowledge and understanding of the musical score. Konecni and Sargent-Pollock (1976) stated that the type of music a person chose to listen to might depend on the type of activity. An experiment by Weld (1912) found

that there was no correlation between tempo and change in heart rate. Hyde and Scalapino (1918) indicated that the heart rate increased or decreased depending on the type of music played. Podolsky (1954) discovered that soft, soothing music in the minor key decreased blood pressure. Sears (1954), as cited by Coutts (1965), reported that pulse rates increased with stimulating, lively music and decreased with slow, sedative music. Landreth and Landreth (1974) found, at the .001 level of significance, that heart rate increased when driving and forceful music was played, and decreased when music with softer changes in rhythm, texture and dynamics was played. In contrast, Nelson and Finch (1962) revealed no significant difference on physiological parameters between a fast march, slow music, or white sound (noise resembling moving water).

Most women exercise at a submaximal level. This present study used a submaximal test to produce a realistic situation. Advantages of a submaximal test in this study include reduced chance of subject dropout and lesser risk to the subject (Wilmore, 1975). A study by Washburn and Montoye (1985) indicated that the reliability of heart rate response to submaximal leg cycling is high ($r=.91$) and remained relatively constant over various workloads. Since this was not a diagnostic test nor a test to determine maximal values, a maximal test was not necessary.

Summary

Music is a therapeutic tool. It is felt by people who otherwise cannot communicate, it is helpful in blocking pain for patients in the hospital, and it is relaxing and motivating. Physiologically, the literature indicated that music altered heart rate, blood pressure and

perceived exertion. The type of music chosen, favorable or aversive, was important to the results of the study. It was the purpose of this present study to examine how two types of contemporary rock and roll music, fast (between 144 b.p.m. and 192 b.p.m.) and slow (between 60 b.p.m. and 66 b.p.m.) would affect selected physiological parameters of a female subject during a submaximal exercise test.

CHAPTER III

METHODOLOGY

Introduction

This study examined the effects of fast and slow contemporary rock and roll music on selected physiological parameters of females aged 18 - 31 years during a submaximal exercise test. This chapter describes the instrumentation, subject selection, music selection, and the statistical treatment of the data.

Instrumentation

The following test instruments were used to collect the data for this study. Each instrument was calibrated and checked prior to each test to make sure it was in proper working order.

Treadmill (Quinton - model 24-72)

Burdick Electrocardiograph (M - 200)

Beckman Metabolic Measurement Cart

Beckman Instruments: Headpiece - for Randolph valves, model #2726

Rudolph two-way valve #2700

Rudolph rubber valves

#2708 Large Rubber Mouthpiece

52.5 cm Corregated Tubing

Blood Pressure Cuff

Mercury Sphygmomanometer

Stethoscope

Electrodes - Offset D_x, Silver/Silver Chloride

Electrode Belt

Sanyo Stereo/Cassette Player

Two Memorex dB - 60 minute Cassette Tapes

Rated Perceived Exertion Scale (Borg) (see APPENDIX A)

Stopwatch

Ban - Quet Tourniquets (to support the corrugated tubing,
electrocardiogram cable and portable stereo/cassette player)

Subject Selection

Twenty-seven female volunteers, who were regular exercisers, were obtained from the student body at the University of Wisconsin - La Crosse. An activity questionnaire (see APPENDIX B) was completed by every volunteer, and was used as a screening device. Subjects were excluded from the study if they had an audiological impairment; were not regular exercisers, (exercise four or more times a week for at least 30 minutes at 75% or more of maximum heart rate), or had a physical handicap of the lower extremities. The researcher randomly assigned (by a random drawing) the order in which the musical stimuli (fast, slow, or no music) would be presented. All three experimental conditions were presented to each subject.

Music Selection

The following three experimental conditions were given to each subject: a) no music; b) fast music (with a tempo between 144 b.p.m. and 192 b.p.m.); c) slow music (with a tempo between 60 b.p.m. and 66 b.p.m.); in a randomized order. The tempo of the music in beats per minute

(b.p.m.) were determined by a metronome. The fast contemporary rock and roll category consisted of, in order, "Jump", "Neutron Dance", and "I'm so Excited" from the Pointer Sisters album "Breaking Away". The slow contemporary rock and roll category consisted of, in order, "Love at Second Sight", "Extravagant Gestures", and "That's What Friends are For" from Dionne Warwick's album "Friends". The music was administered through a portable stereo/cassette player (PCP) with headphones. The PCP was attached to a pole beside the treadmill and was hung at head level. This prevented the PCP from being in the way of the EKG velcro belt, and from distracting the subject. The headphones were attached directly to the headpiece and were adjusted to fit each individual's head. The three musical selections were repeated in sequence on the cassette so that prolonged periods without music did not occur.

The sound level of the two tapes was determined in the audiology department of Gundersen Clinic, Ltd., LaCrosse, Wisconsin. The measurements were made by coupling the output of a Sanyo M-G41 portable stereo/cassette player fitted with lightweight earphones (the PCP) to a Quest No. 215 sound level meter. The earphones were coupled to a 2CC coupler which in turn was fitted over the microphone of the 215 sound level meter. One headphone was weighted on the 2CC coupler with approximately 1,000 grams. Only the left headphone was checked for output. All measurements were made using the slow meter speed of the sound level meter which was adjusted to the dBA setting.

The output of the sound level meter was read every 15 seconds. On the "slow music" tape the first song averaged 88 dBA, the second song 81 dBA and the third song 85 dBA. On the "fast music" tape the first song

averaged 92 dBA, the second song averaged 91 dBA and the third song averaged 85 dBA. The average sound level for the "slow music" tape was 84.66 dBA measured with a single phone and extrapolated to 87.66 dBA in the two phones (as it would be worn). The average level for the "fast music" tape was 89.3 dBA as measured on a single phone and extrapolated to 92.3 dBA using two phones. The difference between the "slow music" tape and the "fast music" tape was determined to be 4.7 dBA with the faster music being louder.

Experimental Treatment

Prior to the test each subject filled out an informed consent form (see APPENDIX C) and attended a practice session. At the practice session, the researcher showed the subjects: 1) where the electrodes were placed; 2) gave a verbal explanation of the Borg perceived exertion scale; 3) how to get on and off the treadmill; and 4) where to hold the head and hands during the test. Each subject got on the treadmill and was hooked up to the Beckman headgear.

On the day of the test, the subject was asked to refrain from eating for at least two hours prior to the test, and to report to the Human Performance Lab in a t-shirt, shorts or sweat pants, and jogging shoes. Before every test the Beckman was calibrated. Weight measurements were taken when the subject arrived.

The subject was prepared with a three lead arrangement (modified CM5) for electrocardiograph monitoring. The manubrium electrode was placed to the right side at the manubrium level, midclavicular. Preparing the subject consisted of cleaning the skin with gauze pads and alcohol, two

quick swipes with a skin prep scour pad, and one more rub with the alcohol. The lead electrodes were put into place as described above. Lead wires were attached to the electrodes and were connected to the Burdick electrocardiograph machine. After two minutes (supine position), the resting heart rate and blood pressure were taken. After this was done, the subject walked over to the treadmill. The lead wires were secured to the subject's waist by a velcro belt, the Beckman headpiece was fitted onto their head, a nose clip was applied, and the earphones were adjusted to the subjects ears. The Beckman Metabolic Measurement Cart was programmed using the subject's weight. A blood pressure was taken. The subject straddled the treadmill, the treadmill was started and a two minute warm up period (walking) began which allowed the subject to become re-acquainted with the treadmill. This study used a modified Balke treadmill protocol (see APPENDIX D). The music was begun at the beginning of the two minute warm up. A rating of their perceived exertion was taken at the end of every stage. Fifteen second electrocardiograph recordings were taken during the last 15 seconds of each minute throughout the test. The test was terminated when the subject reached 80 percent of their age predicted maximal heart rate. This was calculated by using the formula $(80\% \times [(220 - \text{age})])$ (Getchell, 1983). A blood pressure was taken immediately after the subject stopped running. The treadmill was returned to the warm up stage. The subject recovered (walked) on the treadmill for four minutes, an EKG strip was taken during the last 15 seconds of each minute. A blood pressure was taken at the end of the four minute recovery while the subject was standing. After the test, the subject was asked if they liked or disliked the music and how it made them feel. This was

recorded on the data sheet. Once the heart rate was below 120 b.p.m. and the four minute cool down was over, the treadmill was stopped and the subject was disconnected from the electrocardiograph machine. The tests were given in no less than 24 hours or no more than one week apart. The subjects were not told the test duration or any of the scores, nor were they encouraged or discouraged during the test. This helped to control motivational factors (Nelson & Finch, 1962).

A data collection sheet (see APPENDIX D) was used to record heart rate, blood pressure, oxygen uptake, duration, rated perceived exertion, and the subjects reaction to the music. A new data sheet was used for each test. The three data sheets for each subject were stapled together and put into a personal file.

Statistical Treatment of the Data

A one way analysis of variance (ANOVA) with repeated measures was used to analyze the data at the $p < .05$ level of significance. A post hoc Scheffe test was used when significant F-ratios were obtained to determine which pairs of treatment groups differed.

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

This study examined how contemporary rock and roll music affected the performance of females. It evaluated heart rate, VO_2 , blood pressure, rated perceived exertion, and duration responses during a submaximal exercise test.

This chapter includes the results and discussion of the data attained in this study as compared to the related literature.

Statistical Treatment of the Data

A one way analysis of variance (ANOVA) with repeated measures was performed on all of the parameters under all three experimental conditions. A post-hoc Scheffe' test was applied to all significant results at the $p < .05$ level. This chapter presents the ANOVA tables, Scheffe' tests, and tables of means and standard errors for all of the variables.

Descriptive Analysis of Subjects

As shown in Table 1 the mean age of the 27 subjects was 23.8 years with a standard error of 0.124. The mean weight of the subjects was 133.9 pounds with a standard error of 0.60.

Table 1

Mean and Standard Errors for Age and Weight

Sample	n	Mean	Standard Error
Age (years)	27	23.8	0.12
Weight (lbs)	27	133.9	0.60

Table 2 presents the heart rate and blood pressure responses while the subject was in the supine and standing position. A music stimulus was not played during either position. The mean supine and standing heart rate was the highest prior to the fast music condition (supine = 65.222, standing = 77.115). The mean systolic blood pressures in the supine and standing positions remained fairly consistent throughout all three tests with a variability of about 1mmHg. Likewise, the mean diastolic blood pressures, supine and standing, were found to be fairly consistent with a variability of about four beats.

Table 2

Means and Standard Errors for Demographic variables
while Supine and Standing

		No Music		Slow Music		Fast Music	
	n	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
HEART RATE							
Sp	27	61.444	1.339	63.667	1.754	65.222	1.897
St	26	74.115	2.244	75.500	2.050	77.115	2.582
SYSTOLIC BLOOD PRESSURE							
Sp	22	100.500	1.468	101.273	1.427	102.728	2.193
St	22	106.182	1.960	106.364	2.360	105.364	2.345
DIASTOLIC BLOOD PRESSURE							
Sp	22	60.273	1.682	64.818*	1.682	64.273	1.425
St	22	71.455	1.781	74.000	1.706	72.909	1.510

* - Significantly different compared to the no music condition
at the $p < .05$ level

Sp - Supine

St - Standing

Table 3 indicated that there were no significant differences in heart rate or systolic blood pressure in either the supine or standing position, but there was a significant difference in the supine diastolic blood pressure.

Table 3

One Way Analysis of Variance with Repeated Measures
for Values Obtained Prior to Music Stimulus

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F Value	F Critical	Probability
Supine HR	194.667	2	97.333	2.11	3.18	0.131
Error	2396.667	52	46.090			
Standing HR	117.231	2	58.615	0.81	3.18	0.451
Error	3617.436	50	72.349			
Supine SBP	56.273	2	28.136	0.87	3.22	0.428
Error	1364.394	42	32.486			
Standing SBP	12.485	2	6.242	0.13	3.22	0.879
Error	2027.515	42	48.274			
Supine DBP	271.030	2	135.515	4.43*	3.22	0.018
Error	1283.636	42	30.563			
Standing DBP	71.758	2	35.879	0.95	3.22	0.395
Error	1586.909	42	37.784			

* - Significant Difference at $p < .05$ level

HR - Heart Rate

SBP - Systolic Blood Pressure

DBP - Diastolic Blood Pressure

A Scheffe' test was applied (Table 4) and significance was found between the no music and slow music condition. Prior to the slow music condition the subjects mean blood pressure was approximately 4mmHg higher than the no music condition. This finding is questionable in light of the high standard error. This cannot be attributed to a music stimulus since none was employed at the time.

Table 4

Scheffe' Test

Variable	Population Comparison	Observed Mean Difference	Scheffe' Critical Value
DBP	$\bar{X}_A - \bar{X}_B$	-4.545*	4.232
	$\bar{X}_A - \bar{X}_C$	-4.000	4.232
	$\bar{X}_B - \bar{X}_C$	+0.545	4.232

* = Significant Difference at $p < .05$ level

DBP = Diastolic Blood Pressure

A = No Music Condition

B = Slow Music Condition

C = Fast Music Condition

Table 5 indicated that the highest mean systolic and diastolic blood pressures during exercise were found during the fast music condition (systolic = 143.815mmHg, diastolic = 75.636mmHg). In the recovery period, the mean systolic blood pressure was also the highest during the fast music condition (118.273mmHg) but the diastolic was highest during the slow music condition (75.635mmHg). Although there were some variations in the obtained values, no significant differences were found.

Table 5

Means and Standard Errors of Systolic and Diastolic Blood Pressures during Exercise and Recovery

Blood Pressures during Exercise and Recovery							
		No Music		Slow Music		Fast Music	
	n	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
SYSTOLIC BP							
Ex	22	142.818	0.527	140.455	3.386	143.818	3.089
Rec	22	112.364	2.012	114.545	2.890	118.273	3.008
DIASTOLIC BP							
Ex	22	73.818	1.726	73.545	1.907	75.636	2.338
Rec	22	72.364	1.798	75.636	1.566	73.909	1.390

No Significant Differences were observed at $p < .05$ level

Ex = Exercise

Rec = Recovery

No significant differences were found for blood pressure during exercise or recovery (Table 6).

Table 6

One Way Analysis of Variance with Repeated Measures
for Blood Pressure

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
SYSTOLIC						
Exercise	131.273	2	65.636	0.58	3.22	0.563
Error	4730.061	42	112.620			
Recovery	392.848	2	196.424	2.57	3.22	0.088
Error	3207.152	42	76.361			
DIASTOLIC						
Exercise	56.848	2	28.424	0.47	3.22	0.626
Error	2519.151	42	59.980			
Recovery	117.939	2	58.970	1.05	3.22	0.361
Error	2370.061	42	56.430			

No Significant Differences were observed at $p < .05$ level

According to Table 7, the mean heart rate increased with each stage of the protocol by approximately 10 beats or more. It was noted that as the stages increased the subject number decreased. The highest heart rates were obtained during the fast music condition at each stage. The heart rates between the slow music condition and the no music condition were within three beats at each stage.

Table 7

Means and Standard Errors for Heart Rate
at Each Stage

Stage	n	No Music		Slow Music		Fast Music	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
1	27	99.519	1.813	100.556	1.594	103.296	2.111
2	27	136.444	2.549	136.185	2.532	140.593*	2.720
3	20	143.750	2.735	142.950	2.695	145.900	2.886
4	13	148.923	2.064	148.538	2.427	151.462	2.177
5	6	155.667	0.803	152.667	2.232	159.167*	1.905

* - Significantly different compared to the slow music condition
at the $p < .05$ level

Table 8 indicates that although there was variability in the mean heart rates, only the heart rates in the second and fifth stages were significant. The Scheffe' test (Table 9) found the significant difference to be between the fast music (second stage = 140.592b.p.m., fifth stage = 159.167b.p.m.) and slow music (second stage = 136.185b.p.m., fifth stage = 152.667b.p.m.) conditions for both stages.

Table 8
One Way Analysis of Variance with Repeated Measures
for Heart rate

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
HR 1	205.728	2	102.864	2.30	3.18	0.112
Error	2327.604	52	44.761			
HR 2	515.346	2	257.673	3.95*	3.18	0.025
Error	3395.654	52	65.301			
HR 3	454.144	2	227.072	2.71	3.25	0.080
Error	3185.411	38	83.827			
HR 4	55.590	2	32.795	1.03	3.40	0.371
Error	761.077	24	31.712			
HR 5	127.000	2	63.500	6.88*	4.10	0.013
Error	92.333	10	9.233			

* = Significant Difference at $p < .05$ level
HR 1 = Heart Rate at stage 1

Table 9
Scheffe' Test

Variable	Population Comparison	Observed Mean Difference	Scheffe' Critical Value
HR 2	$\bar{X}_A - \bar{X}_B$	+ 0.259	4.274
	$\bar{X}_A - \bar{X}_C$	- 4.149	4.274
	$\bar{X}_B - \bar{X}_C$	- 4.408*	4.274
HR 5	$\bar{X}_A - \bar{X}_B$	+3.005	5.021
	$\bar{X}_A - \bar{X}_C$	-3.500	5.021
	$\bar{X}_B - \bar{X}_C$	-6.505*	5.021

* = Significant Difference at $p < .05$ level

A = No Music Condition

B = Slow Music Condition

C = Fast Music Condition

HR 2 = Heart Rate at the second stage

In Table 10, the mean oxygen consumption (VO_2) increased slightly with each stage. The highest values were obtained during the fast music condition for the first two stages (stage 1 = 0.802L/min., stage 2 = 1.560L/min.), and during the no music condition (stage 3 = 1.828L/min., stage 4 = 2.083L/min., stage 5 = 2.329L/min.) for the last three stages. In the fifth stage the VO_2 value was the lowest during the fast music condition (2.132L/min.) as compared to the slow music condition (2.218L/min.) and the no music condition (2.329L/min.).

Table 10
Means and Standard Errors for VO_2
at Each Stage

Stage	n	No Music		Slow Music		Fast Music	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
1	27	0.781	0.028	0.776	0.029	0.802	0.031
2	27	1.521	0.051	1.506	0.057	1.560	0.058
3	20	1.828	0.064	1.788	0.074	1.826	0.072
4	13	2.083	0.103	1.926*	0.116	2.039	0.107
5	6	2.329	0.066	2.218	0.154	2.132	0.154

* = Significantly different compared to the no music condition at the $p < .05$ level

According to Table 11, the only significant difference in VO_2 was during the fourth stage. A Scheffe' test (Table 12) indicated that the difference was between the no music condition (mean = 2.083 L/min) and the slow music condition (mean = 1.926 L/min).

Table 11

One Way Analysis of Variance with Repeated Measures
for VO_2

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
VO_2 1	0.010	2	0.005	0.76	3.18	0.473
Error	0.349	52	0.006			
VO_2 2	0.042	2	0.021	1.19	3.18	0.312
Error	0.910	52	0.018			
VO_2 3	0.055	2	0.027	1.39	3.25	0.261
Error	0.749	38	0.020			
VO_2 4	0.170	2	0.085	3.70*	3.40	0.040
Error	0.550	24	0.023			
VO_2 5	0.116	2	0.058	2.02	4.10	0.183
Error	0.288	10	0.029			

* = Significant Difference at $p < .05$ level

VO_2 1 = Oxygen Consumption at stage 1

Table 12

Scheffe' Test

Variable	Population Comparison	Observed Mean Difference	Scheffe' Critical Value
VO_2 4	$\bar{X}_A - \bar{X}_B$	+0.157*	0.155
	$\bar{X}_A - \bar{X}_C$	+0.044	0.155
	$\bar{X}_B - \bar{X}_C$	-0.113	0.155

* = Significant Difference at $p < .05$ level

A = No Music Condition

B = Slow Music Condition

C = Fast Music Condition

VO_2 4 = Oxygen Consumption at the fourth stage

Table 13 indicated that as the stages progressed and the exercise became more difficult, the mean perceived exertion increased by approximately one number per stage. The highest mean perceived exertion

that was reached was 13.250 during the no music condition. The means for each of the treatments were fairly consistent throughout each stage. Table 14 shows that no significance was found for rated perceived exertion at any stage.

Table 13

Means and Standard Errors for Rated Perceived Exertion
at Each Stage

Stage	n	No Music		Slow Music		Fast Music	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
1	27	7.037	0.181	7.148	0.254	0.074	0.223
2	27	9.037	0.335	9.296	0.380	9.321	0.321
3	18	11.111	0.378	10.556	0.381	10.852	0.370
4	10	12.300	0.496	11.800	0.490	11.800	0.490
5	4	13.250	0.479	12.250	0.479	12.500	0.289

No Significant Differences were observed at $p < .05$ level

Table 14

One Way Analysis of Variance with Repeated Measures
for Rated Perceived Exertion

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
RPE 1	0.222	2	0.111	0.13	3.18	0.880
Error	45.111	52	0.868			
RPE 2	4.765	2	2.383	2.14	3.18	0.128
Error	57.901	52	1.113			
RPE 3	1.633	2	0.817	0.65	3.25	0.527
Error	47.700	38	1.255			
RPE 4	0.389	2	0.194	0.22	3.44	0.806
Error	19.611	22	0.891			
RPE 5	2.333	2	1.167	2.69	4.10	0.116
Error	4.333	10	0.433			

No Significant Differences were observed at $p < .05$ level

RPE 1 = Rated Perceived Exertion at stage 1

Table 15 indicated that the mean recovery heart rate was highest during the fast music condition (110.407b.p.m.) as compared to the slow (109.222b.p.m.) and no music condition (108.148b.p.m.). However, as Table 16 indicated, these were not found to be significant. The mean recovery VO_2 for the fast music (0.913L/min) was slightly higher than the no music condition (0.911L/min) and both the fast and no music conditions were higher than the slow music condition (0.887L/min). Again, no significant differences were found.

Table 14

One Way Analysis of Variance with Repeated Measures
for Rated Perceived Exertion

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
RPE 1	0.222	2	0.111	0.13	3.18	0.880
Error	45.111	52	0.868			
RPE 2	4.765	2	2.383	2.14	3.18	0.128
Error	57.901	52	1.113			
RPE 3	1.633	2	0.817	0.65	3.25	0.527
Error	47.700	38	1.255			
RPE 4	0.389	2	0.194	0.22	3.44	0.806
Error	19.611	22	0.891			
RPE 5	2.333	2	1.167	2.69	4.10	0.116
Error	4.333	10	0.433			

No Significant Differences were observed at $p < .05$ level
RPE 1 = Rated Perceived Exertion at stage 1

Table 15 indicated that the mean recovery heart rate was highest during the fast music condition (110.407b.p.m.) as compared to the slow (109.222b.p.m.) and no music condition (108.148b.p.m.). However, as Table 16 indicated, these were not found to be significant. The mean recovery VO_2 for the fast music (0.913L/min) was slightly higher than the no music condition (0.911L/min) and both the fast and no music conditions were higher than the slow music condition (0.887L/min). Again, no significant differences were found.

Table 15

Means and Standard Errors for Duration and Recovery							
	n	No Music		Slow Music		Fast Music	
		Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
Duration	27	8.111*	0.444	8.407*	0.444	7.556	0.393
Rec HR	27	108.148	1.683	109.222	1.760	110.407	1.697
Rec VO ₂	27	0.911	0.030	0.887	0.032	0.913	0.032

* - Significantly different compared to the fast music condition at the $p < .05$ level

Rec HR - Recovery Heart Rate

Rec VO₂ - Recovery Oxygen Consumption

Table 16

One Way Analysis of Variance with Repeated Measures
for Recovery Heart Rate and VO₂

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
Rec HR	68.963	2	34.481	1.60	3.18	0.213
Error	1123.704	52	21.610			
Rec VC ₂	0.011	2	0.006	0.88	3.18	0.423
Error	0.335	52	0.006			

No Significant Differences were observed at $p < .05$ level

Rec HR - Recovery Heart Rate

Rec VO₂ - Recovery Oxygen Consumption

Duration was found to be significantly affected by the experimental conditions used (Table 17). The Scheffe' test (Table 18) demonstrated that the subjects ran longer when the slow music (mean = 8.407min.) was presented than when either the fast music (mean = 7.556min) or no music (mean = 8.111 min) conditions were present.

Table 17

One Way Analysis of Variance with Repeated Measures
for Duration

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F value	F Critical	Probability
Duration	10.099	2	5.049	9.41*	3.18	0.0003
Error	27.901	52	0.537			

* - Significant Difference at $p < .05$ level

Table 18
Scheffe' Test

Variable	Population Comparison	Observed Mean Difference	Scheffe' Critical Value
Duration	$\bar{X}_A - \bar{X}_B$	-0.296	0.503
	$\bar{X}_A - \bar{X}_C$	+0.555*	0.503
	$\bar{X}_B - \bar{X}_C$	+0.851*	0.503

* - Significant Difference at $p < .05$ level

A - No Music Condition
B - Slow Music Condition
C - Fast Music Condition

Table 19 indicated that the mean heart rates of the three experimental conditions at 80% of age-predicted maximum heart rate were within one beat of each other with the highest value occurring during the slow music condition (161.778b.p.m.). The VO_2 was highest during the no music condition (2.118L/min.) and lowest during the fast music condition (2.030L/min.). The rated perceived exertion was the highest during the slow music condition (12.074) and lowest during the fast music condition (11.296). Table 20 indicated that no significant differences were found.

Discussion

Examination of the data during the no music, slow music and fast music conditions indicated that the null hypothesis be rejected at the .05 level of significance. Heart rate, oxygen consumption (VO_2), and duration were found to be significantly affected by the musical stimulus. The following is a discussion of these significant responses and the other variables that were measured.

Heart Rate

Heart rate appears to be influenced by a musical stimulus. In this study it was significantly higher during the fast musical condition compared to the slow musical condition. For the same stage, the heart rates during the slow music condition were lower than they were during the fast music condition. These results disagreed with Coutts (1965) and Nelson (1963) who found no significant difference in music on heart rate, and agreed with the findings of Landreth and Landreth (1974) and Hyde and Scalapino (1978) who found that heart rate increased with lively music or decreased when calming, soothing music was played.

Blood Pressure

Blood pressure did not seem to be affected by a musical stimulus. The significance that was found in the supine diastolic blood pressure could have been due to the subject's anticipation of which musical condition would be presented. Because many of the subjects were classmates of the investigator and each other, the three experimental treatments were difficult to keep secret. As shown in Table 2, the mean systolic blood pressures remained fairly consistent throughout all three tests. Because of this consistency none were found to be significant. Likewise, the mean

diastolic blood pressures were found to be fairly consistent with a variability of about four beats. These results conflicted with Blanchard (1979) who found that blood pressures were significantly lower than the control (no music) when both rock and roll and classical music were played in the background. The difference between this present study and Blanchard (1979) was that the subjects in this study exercised to the music and the subjects in Blanchard's study were taking an examination.

Oxygen Consumption

The oxygen consumption (VO_2) appeared to be influenced by the presence of slow music. When slow music was played the VO_2 was significantly lower during the fourth stage of exercise than it was when the subjects exercised without any music. This indicated that slow music was more influential on oxygen consumption in the later stages of exercise.

Rated Perceived Exertion

Rated perceived exertion was not affected by music in this study. If the test had been a little longer a significant difference may have occurred. Many of the subjects did not run for more than five minutes and therefore did not work at a higher exercise intensity. Although the results of their study were not significant, Nelson and Finch (1962) suggested that the subjects felt that the perceived exertion was lower when they listened to a fast march at a maximal effort. If this present study had included a maximal exercise test a significant difference in rated perceived exertion might have been observed.

Duration

Duration was found to be significantly affected by the experimental conditions of this study. When the slower music was played the subjects

ran longer than when fast music or no music was played. As indicated by this present study, heart rate was lower when slow music was played. Since the termination point of this test was 80% of the age-predicted maximum heart rate, it appeared that the subjects ran longer with the slower music because it took longer for them to reach the termination heart rate. Nelson (1963) and Anshel and Marisi (1978) found that music did not significantly affect endurance of the subjects. Nelson (1963) had used a maximal effort and concluded that music may increase muscular endurance at a submaximal level, rather than a maximal level. This study found that music increased endurance at a submaximal exercise level.

Recovery

There were no significant differences in heart rate or VO_2 during recovery. When reviewing the data of heart rate and VO_2 some variations did exist; again, these were insignificant. Mean heart rate was found to be the highest during the fast music condition while mean VO_2 was the lowest during the slow music condition.

80% of Age Predicted Maximum Heart Rate

There were no significant differences at 80% of age predicted maximal heart rate (termination point). The heart rate during all three conditions was very similar because the subject age range was very small. The VO_2 was highest during the no music condition and the lowest during the fast music condition; again, these were insignificant. This suggests that the subjects were using oxygen more efficiently while the fast music was played. The perceived exertion was also insignificant but there was some variation. The lowest rated perceived exertion was during the fast music condition which agreed with the study by Nelson (1962) who suggested

that perceived exertion was lower while the subjects listened to a fast march at a maximal effort. If the test had been terminated by a different method, a significant difference in perceived exertion may have been found.

Summary

In this study, significance was found for heart rate, VO_2 , and duration. Heart rate was significant in the second and fifth stage of exercise with the lowest heart rate occurring during the slow music condition and the highest heart rate value occurring during the fast music condition. Since the termination point of the test was 80% of age-predicted maximum heart rate, the subjects ran for a longer duration when the slow music was played. This led to a significantly longer duration when the slow music was played. Significance was also found for VO_2 in stage four with the lowest value occurring in the slow music condition and the highest during the no music condition. Rated perceived exertion and blood pressure, were not significantly affected by music during any part of the test.

The results of this study indicated that jogging to slow tempo rock and roll music compared to fast tempo rock and roll music will enhance duration of performance. In addition, heart rate and oxygen consumption (VO_2) may be affected by musical stimuli, dependent upon the musical tempo utilized.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

With the popularity of jogging with a portable stereo/cassette player, studies need to be done to determine which type of music is the most beneficial to a person's performance. This study tested females who ran on a treadmill while listening to three musical stimuli. This study simulated, as closely as possible, the intensity of exercise women would do on a regular basis.

A statistical analysis of the data revealed that heart rate, VO_2 and duration were affected by the musical stimuli. During the slower musical condition the values for heart rate and VO_2 were the lowest and the duration was the longest compared to fast music condition. The data from this study suggested that jogging to slower music would increase the length of performance.

The heart rate during the slow music was consistently lower than the fast or no music conditions. The VO_2 was lower during the slow music condition until the subjects approached the later stages of exercise (as the intensity became more difficult). This suggested that slower music is better to use during submaximal exercise (less than 80% of maximal heart rate). To exercise at a greater intensity (80% or greater of maximal heart rate), this study indicated that one would be able to use oxygen more efficiently while listening to a faster musical selection.

Conclusions

Based upon the limitations of this study, the following conclusions were made:

1. There was no significant difference in rated perceived exertion or blood pressure during a submaximal exercise test while listening to fast or slow contemporary rock and roll music.
2. Heart rate was significantly lower during the second and fifth stages of exercise while slow rock and roll music was played as compared to fast rock and roll music.
3. Oxygen consumption during the fourth stage of exercise was significantly lower during the slow rock and roll music condition than it was when no music was played.
4. Duration was significantly longer while the slow music and no music conditions were played than when the fast music condition was present.
5. None of the physiological or psychological factors measured in this study were significantly affected by the musical stimuli during recovery.

Recommendations

The results of this study warrant the following recommendations for future studies:

1. A similiar study with a larger sample size may produce different results.
2. A study using a different termination point, such as rated perceived exertion, may elicit different results.
3. A study comparing different types of music such as jazz, classical, country, etc. may produce different results compared to the present investigation.
4. Using a maximal rather than a submaximal exercise test while listening to music may offer more significant data.
5. Calibration of the volume of the music so that it is consistant throughout all of the musical selections will decrease the likelihood of volume being an extraneous factor in the study.
6. A similiar study with a male population might help differentiate responses between the male and female gender.

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APPENDIX A

RATED PERCEIVED EXERTION CHART

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

Borg (1970)

APPENDIX B

ACTIVITY QUESTIONNAIRE

NAME: _____

AGE: _____

DATE: _____

PHONE: _____

1. Do you have any diagnosed hearing problems? Please list and describe.

Any undiagnosed hearing problems? Please list and describe.

2. Do you have a physical handicap that may prevent you from running on a treadmill?

3. Do you regularly exercise (4 or more times a week, for 30 or more minutes at a moderate intensity)?

4. List some of the physical exercise you do and for how long at one time?

5. Have you ever had a submaximal exercise test done before? _____

If your answer was yes, was it on the treadmill or bicycle ergometer?

APPENDIX C

INFORMED CONSENT FORM

I, _____, hereby authorize Karen Leanne Smith, a graduate student at the University of Wisconsin - La Crosse, to include me in her thesis study of the effects of music on physiological parameters. It has been explained to me that I will be required to complete an activity questionnaire and perform a submaximal test on the treadmill until I reach 80% of my predicted maximal heart rate, at which time the test will be terminated. I agree to have my blood pressure, heart rate, and VO (the amount of oxygen that is used by the muscles for energy per minute), evaluated by a cuff and stethoscope, electrocardiograph, and Beckman Metabolic Measurement Cart, respectfully, while I listen to music through headphones.

I understand that the test may cause dizziness, sweating and irregular heart rates due to the exercise. However, every effort will be made to minimize these occurrences and if any abnormal observations are noted the test will be terminated immediately. I also understand that I will be benefiting the study of the effects of music on females.

I understand that I have the right to refuse to participate in, or to withdraw from, this research at any time without penalty. Also, the researcher may stop the study at any time.

I hereby acknowledge that no representations, warranties, guarantees or assurances of any kind pertaining to the procedure have been made to me by the University of Wisconsin - La Crosse, the officers, administration, employees or by anyone acting on behalf of any of them.

I understand that if I have further questions, comments, or concerns

about the study or the informed consent process, I may write or call
Karen Leanne Smith at home: 226 West Ave. N., La Crosse, WI 54601,
Tel: 782-8304. I acknowledge that I have received a copy of this form.

Signed at _____ this _____ day of _____
_____, 19____, in the presence of the witness whose signature
appears below opposite my signature.

Witnessed by:

(signature)

APPENDIX D

RAW DATA

VARIABLES

ID	HR1	HR2	HR3	HR4	HR5	HR6	VO1	VO2	VO3	VO4	VO5	VO6	BP1	BP2			
BP3	BP4	PE1	PE2	PE3	PE4	PE5	PE6	DUR	RHR	RVO	SUHR	STHR	HR80	VO80	PE80	WT	AGE
011	108	136	150	163			0.723	1.325	1.579	1.804			099	44	096	56	
	128	70	104	68	06	07	09	12		09	123	0.809	60	094	167	1.899	12 121 22
012	096	130	140	154	167		0.489	0.967	1.158	1.328	1.354		098	54	098	66	
	136	76	110	74	06	07	10	13	13	10	111	0.564	64	083	167	1.354	13 121 22
013	100	128	135	150	167		0.740	1.317	1.611	1.780	1.935		104	58	094	68	
	132	72	120	84	07	09	10	12	12	09	110	0.739	54	074	167	1.935	12 121 22
021	098	143	158				0.764	1.683	2.000				096	54	106	70	
	148	72	104	74	07	09	10		06	107	0.939	65	060	158	2.000	10 160 28	
022	101	150	167				0.696	1.657	2.164				092	62	090	72	
	138	80	100	54	06	10	12		06	113	0.907	52	073	167	2.164	12 164 28	
023	085	143	158				0.734	1.797	2.149				096	64	114	78	
	154	84	122	84	07	10	13		06	099	0.916	48	052	158	2.149	13 162 28	
031	081	115	129	145	154		0.665	1.250	1.625	1	902	2.164	090	50	100	66	
	136	84	104	70	07	08	12	13	14	11	092	0.846	53	063	158	2.228	14 129 24
032	093	115	128	140	154		0.698	1.340	1.610	1.879	2.049		094	60	096	70	
	124	80	104	74	07	07	11	12	13	11	097	0.900	65	073	158	2.049	13 128 24
033	088	120	129	148	158		0.489	0.936	1.183	1.392	1.469		094	60	092	66	
	128	70	098	68	07	11	11	12	13	10	095	0.571	57	068	158	1.469	13 128 24
041	105	141	156				0.867	1.561	1.967				106	74	118	88	
	164	92	120	76	08	12	15		07	110	0.898	70	086	162	2.067	15 148 22	
042	110	143	162				1.017	1.932	2.423				112	76	126	86	
	168	88	140	84	09	13	15		06	114	1.107	66	076	162	2.423	15 148 22	
043	122	163					0.939	1.971					134	78	124	86	
	166	92	156	70	06	12	12		05	124	1.091	80	090	167	2.140	12 148 22	
051	095	133	148	162			0.623	1.153	1.529	1.655			098	50	100	76	
	136	74	114	76	07	09	10	10		08	103	0.712	56	063	162	1.655	10 122 26
052	093	136	150	158			0.801	1.607	1.984	2.186			094	56	106	68	
	140	84	116	76	06	09	10	11		08	106	0.916	50	060	158	2.186	11 123 26
053	114	150	156				0.928	1.828	2.028				112	74	110	80	
	156	74	122	84	06	09	11		07	108	0.946	63	060	158	2.102	11 120 26	
061	101	124	130	140	154		0.686	1.412	1.817	2.058	2.414		096	64	098	64	
	144	76	104	74	07	09	11	12	14	11	101	0.915	60	083	158	2.511	16 148 23
062	090	108	118	136	146	161	0.766	1.376	1.652	1.992	2.301	2.600	100	70	100	74	
	150	76	112	80	07	09	10	11	12	13	13	0.933	60	080	167	2.761	13 148 23
063	086	115	121	136	156		0.710	1.437	1.729	2.015	2.316		098	70	106	68	
	140	72	108	70	08	09	10	11	12	11	098	0.897	60	070	162	2.380	12 146 23
071	104	155					0.710	1.627					114	64	110	68	
	146	76	124	48	09	12		05	107	0.915	70	080	167	1.882	12 128 24		
072	102	156					0.872	1.581					112	68	112	62	
	130	72	118	74	09	14		05	110	0.949	66	080	162	1.740	14 128 24		
073	105	153					0.731	1.587					106	58	106	66	
	132	52	130	72	08	12		05	107	0.991	70	080	162	1.862	12 129 24		
081	111	133	145	162			0.846	1.406	1.667	1.902							
			08	09	10	10		08	124	0.852	60	070	162	1.902	10 109 23		

082 114 145 152 167	0.730 1.299 1.618 1.797
08 10 12 13	08 126 0.851 80 080 167 1.797 13 109 23
083 109 132 142 158	0.792 1.228 1.732 2.023
07 10 12 14	09 117 0.907 80 090 162 2.097 14 109 23
091 087 119 136 148	0.635 1.206 1.460 1.628 1.834
142 74 114 82 06 08 11 13	10 106 0.711 60 070 162 1.834 13 101 23
092 097 125 135 148 161	0.464 0.828 0.991 1.135 1.318
136 68 118 76 06 08 09 11 13	11 110 0.502 70 070 167 1.393 13 101 23
093 099 135 143 158	0.798 1.431 1.620 1.815
156 56 104 68 06 07 08 11	08 108 0.789 70 070 158 1.815 11 101 23
101 103 154	0.727 1.600
148 76 126 76 06 07	05 115 0.909 70 080 162 1.805 07 141 20
102 101 147 162	0.773 1.524 1.808
134 70 120 86 06 07 08	06 115 0.867 70 080 162 1.808 08 141 20
103 103 160	0.784 1.670
148 76 120 74 06 08	05 111 0.918 60 070 162 1.835 08 141 20
111 110 140 167	0.883 1.529 1.986
126 70 114 86 06 07 07	06 115 0.955 70 080 167 1.986 07 142 20
112 115 136 150 167	0.932 1.674 2.084 2.271
130 64 118 76 06 07 09 09	08 121 0.811 80 090 167 2.271 09 144 20
113 115 150 163	0.836 1.576 2.029
138 74 114 66 06 07 08	07 123 0.947 70 080 167 2.087 08 142 20
121 098 125 136 148 154	0.658 1.430 1.747 2.051 2.287
06 07 09 11 12	11 105 0.893 70 070 158 2.370 12 128 25
122 100 129 143 152 158	0.813 1.378 1.735 1.925 2.086
06 06 07 10 11	10 107 0.829 70 070 158 2.086 11 126 25
123 095 124 135 143 158	0.712 1.385 1.770 1.981 2.103
06 09 11 12 12	10 108 0.901 60 080 158 2.103 12 125 25
131 092 138 150 162	0.778 1.456 1.796 1.650
142 78 114 72 09 11 13 14	08 106 0.814 50 060 162 1.650 14 125 21
132 104 140 150 160	0.780 1.415 1.722 1.950
122 56 090 78 07 09 10 13	09 119 0.896 70 090 162 2.009 13 124 21
133 118 152 167	0.839 1.465 1.669
120 68 102 62 06 07 09	06 127 0.872 91 100 167 1.669 09 124 21
141 094 130 140 150 160	1.113 2.073 2.449 2.743 3.161
160 66 112 68 09 11 13 14 17	11 109 1.388 50 060 162 3.330 17 155 19
142 100 135 145 152 167	0.889 1.951 2.207 2.480 2.740
140 72 124 82 08 10 11 13 15	10 111 1.170 60 070 167 2.740 15 154 19
143 123 142 150 167	1.122 1.988 2.392 2.455
146 96 126 74 10 12 13 13	08 112 1.136 60 080 167 2.455 13 157 19
151 094 133 154	0.764 1.409 1.798
140 64 096 68 07 09 09	06 109 0.904 60 070 154 1.798 09 119 31
152 106 150	0.763 1.485
124 66 098 70 07 09	05 116 0.876 70 070 154 1.649 09 119 31
153 106 150	0.684 1.319
154 72 116 78 07 10	05 115 0.769 70 080 154 1.483 10 120 31
161 111 154 162	1.179 2.218 2.614
144 68 110 62 07 08 08	06 114 1.247 60 103 162 2.614 08 166 20
162 108 152 162	1.217 2.319 2.652
134 76 104 70 06 07 07	06 117 1.371 60 090 162 2.652 07 166 20

163 111 163	1.220 2.377	096 60 092 72
150 80 114 78 07 09	05 121 1.366 70 107 167 2.571	09 166 20
171 116 158	0.613 1.305	114 70 124 86
152 84 116 84 08 13	05 125 0.741 70 090 162 1.489	13 121 21
172 116 150 163	0.753 1.322 1.691	104 70 110 84
164 94 138 86 11 13 15	07 125 0.763 70 080 167 1.831	15 122 21
173 115 156	0.868 1.379	106 74 120 88
176 98 132 86 07 13	05 124 0.798 80 100 162 1.570	13 122 21
181 109 150 162	0.668 1.297 1.608	
07 11 11	06 111 0.816 60	162 1.608 11 118 19
182 098 142 156	0.713 1.393 1.720	
07 09 11	07 106 0.823 60 070 162 1.744	11 118 19
183 110 150 162	0.770 1.383 1.675	
07 09 09	06 118 0.859 70 070 162 1.675	09 118 19
191 101 143 158	0.705 1.430 1.745	094 58 090 74
120 70 096 66 06 07 10	06 113 0.904 60 080 158 1.745	10 123 25
192 106 123 154	0.776 1.517 1.848	088 60 088 56
136 68 110 76 07 11 12	07 103 0 900 60 070 158 1.938	12 125 25
193 106 150 162	0.780 1.536 1.754	100 64 102 74
136 70 120 68 06 09	06 109 0.894 60 080 162 1.754	09 124 25
201 095 128 136 150 158	0.841 1.706 2.027 2.330 2.598	102 56 110 68
150 58 120 78 06 09 11 12 13	11 093 0.896 50 060 162 2.688	13 143 24
202 094 125 136 145 158	0.855 1.623 2.004 2.288 2.266	096 60 102 74
158 70 114 78 09 09 10 13 13	10 099 0.830 50 060 158 2.266	13 143 24
203 091 124 135 152 167	0.833 1.783 2.208 2.436 2.437	094 58 098 74
156 80 106 72 07 10 11 13 13	10 104 1.007 50 060 167 2.437	13 143 24
211 089 120 135 147 154	0.991 1.932 2.388 2.862 3.163	098 60 112 70
166 74 120 76 07 10 12 14 14	10 106 1.246 60 070 154 3.163	14 161 30
212 085 125 132 143 154	0.886 1.712 2.251 2.592 2.835	108 68 104 78
154 66 122 72 06 09 11 13 13	10 100 1.048 50 080 154 2.835	13 162 30
213 103 125 136 154	1.060 2.005 2.538 2.868	102 68 110 78
136 80 130 74 09 12 12	09 104 1.265 60 070 158 3.023	12 160 30
221 088 123 133 145 156	0.773 1.647 1.999 2.245 2.321	106 62 122 78
134 70 120 70 07 09 11 13 13	11 096 0.935 60 060 158 2.377	13 131 25
222 088 123 125 136 146 154	0.819 1.667 1.987 2.217 2.423 2.697	110 82 134 62
180 78 142 84 06 09 11 13 13 14 13 095	0.898 60 060 158 2.693	14 131 25
223 099 127 135 145 154	0.844 1.462 2.050 2.286 2.481	112 66 126 80
152 82 138 72 09 10 12 13 13	11 106 0.973 60 080 158 2.582	13 131 25
231 102 132 136 152	0.733 1.458 1.723 1.916	
07 07 09 09	09 104 0.868 70 070 154 2.026	09 125 28
232 093 142 150 158	0.680 1.501 1.760 1.899	
07 08 09 09	08 116 0.892 60 060 158 1.899	09 125 28
233 105 136 148 154	0.715 1.598 1.809 1.911	
06 07 08 08	08 117 0.867 70 080 154 1.911	08 126 28
241 116 152 161	0.995 1.823 2.229	104 74 104 84
130 88 110 80 07 09 10	07 115 1.042 50 080 167 2.376	10 138 19
242 102 140 154 167	0.877 1.644 2.136 2.267	100 66 094 74
144 82 118 78 06 09 10 10	08 106 1.007 55 070 167 2.267	10 138 19
243 108 147 156 167	0.887 1.627 2.133 2.307	100 66 098 66
120 70 098 70 06 09 09 11	08 108 0.992 60 080 167 2.307	11 138 19

251	089	128	138	150	158	0.651	1.351	1.674	1.926	2.187					
		07	10	12	15	15	10	094	0.775	60	070	158	2.187	15	121 28
252	093	125	138	150	154	0.596	1.250	1.639	1.917	2.183					
		09	10	11	14	15	10	093	0.784	50	065	154	2.183	15	120 28
253	087	125	140	148	162	0.578	1.301	1.573	1.846	1.986					
		08	10	12	13	13	10	096	0.768	60	060	162	1.986	13	121 28
261	102	159				0.822	1.627							098	56 106 70
	136	64	100	62	06	07	05	114	0.872	70	080	167	1.952	07	130 27
262	111	161				0.698	1.514							102	62 104 70
	120	70	100	72	07	11	05	116	0.810	80	100	167	1.684	11	130 27
263	099	148	162			0.646	1.447	1.667						090	62 090 72
	128	76	104	72	06	09 12	06	110	0.761	70	080	162	1.667	12	130 27
271	088	118	127	136	158	0.672	1.158	1.514	1.713	1.970				104	62 104 76
	150	76	130	76	07	09 12 13 14	11	103	0.808	65	075	162	2.044	14	115 25
272	099	124	136	150	158	0.600	1.177	1.493	1.593	1.689				104	68 112 82
	128	62	104	64	08	11 11 12 14	10	102	0.748	71	083	158	1.689	14	113 25
273	090	128	145	156		0.613	1.277	1.591	1.693					106	66 104 78
	140	70	122	80	09	11 12 13	09	102	0.708	58	064	158	1.755	13	114 25