The Effect of Warm Up Music Compared to No Warm Up Music in Collegiate Anaerobic Athletes

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May 2015

To the Dean of the Graduate School:

We are submitting a thesis written by Mallory Zappitelli entitled THE EFFECT OF WARM UP MUSIC COMPARED TO NO WARM UP MUSIC IN COLLEGIATE ANAEROBIC ATHLETES.

We recommend acceptance in partial fulfillment of the requirements for the degree of Master of Science in Sports and Fitness Administration through the Richard W. Riley College of Education.

Thesis Advisor

Committee Member

Committee Member

Dean, College of Education

Dean, Graduate School
THE EFFECT OF WARM UP MUSIC COMPARED TO NO WARM UP MUSIC IN COLLEGIATE ANAEROBIC ATHLETES

A Thesis
Presented to the Faculty
Of the
Richard W. Riley College of Education
In Partial Fulfillment
Of the
Requirements for the Degree
Of
Master of Science
In Sport and Fitness Administration
Winthrop University

May, 2015

By
Mallory Zappitelli
Abstract

Music is a very influential part of life. Music has been linked to psychological effects on exercise, however, there are mixed outcomes when it comes to its effects on exercise performance. The purpose of this study was to test music’s influence on anaerobic performance on the Wingate test. Subjects included 20 track and field athletes at a Division I school in South Carolina.

The methodology used in this research was a blind randomized cross over design. Twenty college-age track and field athletes participated in two Wingate tests. Each involved a warm-up with music and a warm-up without music. The warm-up took place on the Wingate bike and lasted two minutes using personal headphones that supplied music chosen by the subject. After the warm up, subjects were prepped for the test with verbal instructions and cues that would be given to start the test. Resistance was applied to the flywheel prior to the start based on body weight (kg) of the subject. All data were analyzed using SPSS. Peak power (PP)(W)(watts), average power (AP)(W), PP work (KPM), AP work (KPM) and revolutions per minute (RPM) were calculated. All Wingate performances that involved a music warm up showed significantly higher performance ($p < .01$) compared to the Wingate performances of the same subject without a music warm-up in all variables: RPM 5 seconds with music ($M=13.00$) without (11.90), RPM 30 seconds with music ($M=62.65$) without (M=57.00), PP with music ($M=673.55$W) without ($M=616.07$W), AP with music ($M=540.52$W) without ($M=491.51$W), PP work with music ($M=343.52$KPM) without ($M=314.25$KPM), and AP work with music ($M=1654.17$ KPM) without ($M=1504.30$KPM). The results of this study are very beneficial for athletes and coaches looking for ways to improve anaerobic performance.
Dedication

To my loving family and fiancé:

You have always believed in my dreams and helped me to achieve my goals by showing me endless support and I can never thank you enough. I appreciate you all more than you will ever know.

Thank you.
Acknowledgements

I would like to thank my thesis committee for always being available and guiding me through this process. You all have dedicated your time to helping me complete this thesis and I am extremely grateful for your help.
# Table of Contents

Abstract ................................................................................................................................. i

Dedication ............................................................................................................................ ii

Acknowledgements ............................................................................................................ iii

List of Tables ....................................................................................................................... vi

List of Figures ..................................................................................................................... vii

**Chapter 1 – Introduction** ................................................................................................. 1
   Statement of the problem ................................................................................................. 2
   Research Hypotheses ....................................................................................................... 2
   Delimitations ..................................................................................................................... 3
   Limitations ......................................................................................................................... 3
   Definition of Terms ......................................................................................................... 3

**Chapter 2 – Review of Literature** .................................................................................. 6
   The Wingate Test ............................................................................................................. 6
   Music’s Psychological Effect on Exercise ........................................................................ 8
   Music’s Influence on Aerobic Performance .................................................................... 10
   Music’s Influence on Anaerobic Performance ................................................................ 11
   Music Administered Before the Exercise ....................................................................... 12
   Music Administered During the Exercise ...................................................................... 13
   Conclusion ....................................................................................................................... 14

**Chapter 3 – Methods and Procedures** .......................................................................... 17
   Introduction ....................................................................................................................... 17
   Participants and Setting Context ................................................................................... 17
   Research Design ............................................................................................................. 18
   Procedures ......................................................................................................................... 19

**Chapter 4 – Results** ...................................................................................................... 22
   Revolutions Per Minute ................................................................................................. 22
   Peak Power ...................................................................................................................... 23
   Average Power ............................................................................................................... 23
   Work ................................................................................................................................. 23

**Chapter 5 – Discussion** ................................................................................................ 30

References ............................................................................................................................... 51
Appendices.........................................................................................................................33
A: IRB Forms.......................................................................................................................34
B: Per-participation Instructions.......................................................................................43
C: Pre-participation Agreement ......................................................................................44
D: Permission to Conduct Research .................................................................................45
List of Tables

Table 1: Descriptive Statistics...........................................................................................................24
Table 2: Paired Sample T-Test..........................................................................................................29
List of Figures

Figure 1: Peak Power and Average Power .................................................................25
Figure 2: RPM ..............................................................................................................26
Figure 3: Average Work .............................................................................................27
Chapter 1

Introduction

Music is often a large part of one’s everyday life. Music is played in grocery stores, at sporting events, in business and medical offices and during exercise. Any person would be hard pressed to go to a sporting event, whether it be at the high school, collegiate or professional level, and not hear some type of music. Music’s effect on exercise has been long studied. The studies that research music and exercise have mainly focused on anaerobic or aerobic exercise, music administered before or during the exercise, the tempo and duration of the music, and using trained or untrained subjects (Brownley, McMurray, & Hackney, 1995; Terry, Karageorghis, Saha, & D’Auria, 2012; Jarraya, Chtourou, Aloui, Hammouda, Chamari, & Chaouachi, 2012; Waterhouse, Hudson, Edwards, 2010).

Aerobic performance has been shown to improve with the use of music; however, the effects of music on anaerobic performance have not produced the same results (Terry, Karageorghis, Saha, & D’Auria, 2012). In aerobic exercise, music is most easily and appropriately described as a distraction (Brownley at al., 1995; Jarraya et al., 2012; Waterhouse et al., 2010). Music provides an escape for individual’s focus while he or she are exercising, and allows the person to focus more on the music and less on the pain or effects of the exercise (Brownley at al., 1995; Jarraya et al., 2012; Waterhouse et al., 2010). However, if the work load is high enough, as in maximal testing or anaerobic exercise, then the individual’s attention is directed to the painful effects of the exertion;
attention cannot be focused on the music, and it becomes a negative distractor (Waterhouse et al., 2010).

Athletes were the focus of the Waterhouse et al. study (2010) study, and for that reason, music was administered before anaerobic performance. Therefore, administering music during a warm-up may benefit an athlete’s performance more than listening to the music during the exercise because the athlete does not have the opportunity to listen while he or she is performing. Determining if something as simple as playing athlete’s favorite songs, allows him or her to perform better would be a great advantage for many athletes and coaches. Thus, using an anaerobic testing procedure such as the Wingate Power Test and comparing a music warm-up to a non-music warm-up will help to answer this question.

**Statement of the Problem**

The purpose of this experiment is to determine the effects of a music warm-up and a non-music warm-up on Wingate Power Test performance in college-age athletes.

**Research Hypotheses**

The following research hypotheses were tested:

1. There will be a significant difference in revolutions per minute between music warm up Wingate performances and non-music warm up Wingate performances.

2. There will be a significant difference in peak power measured in watts between music warm up Wingate performances and non-music warm up Wingate performances.
3. There will be a significant difference in average power measured in watts between music warm up Wingate performances and non-music warm up Wingate performances.

4. There will be a significant difference in Work measured in kilopond meters between music warm up Wingate performances and non-music warm up Wingate performances.

**Delimitations**

The study was delimited by the following:

1. Only college athletes were included in this study.

2. Only athletes participating in track and field were included in this study.

3. Athletes with hearing disabilities were excluded from this study.

**Limitations**

The study was limited by the following:

1. The researcher was unable to control the familiarization that can occur with the first time the subjects performed the Wingate.

2. The researcher was unable to control the subjects’ natural assumptions that they should perform better with music.

**Definition of Terms**

For the purpose of this study, the following terms were operationally defined:

**Anaerobic capacity.** The maximal amount of adenosine triphosphate resynthesized via anaerobic metabolism (by the whole organism) during a specific mode of short-duration maximal exercise (Green & Dawson, 1993).
Anaerobic exercise. Physical exercise that relies on anaerobic metabolism (without the use of oxygen) that lasts less than 90 seconds utilizing an exhaustive effort (Zupan et al., 2009).

Anaerobic sport. An officially recognized sport of the University that requires short bursts of energy more than long duration exercise (basketball, baseball, soccer, sprinting etc.).

Collegiate athlete. Any individual that participates on an officially recognized interscholastic anaerobic sports team for one complete season.

Kilogram. The SI base unit of mass (NIST, 2014); equal to 1,000 grams.

Peak power. A measure of muscular strength and speed (Zupan et al., 2009).

Performance. The completion of the Wingate test.

RPE. Rating of perceived exertion. A scale from 0-10 used to measure the subjects perceived intensity of an exercise (Borg, 1982).

RPM. Revolutions per minute obtained by the subject during the Wingate Power Test.

Warm-up. Warm-up is defined as the time the subjects are preparing themselves for the Wingate test and the pedaling they perform on the bike before the actual protocol is begun.

Warm-up music. Warm-up music will be defined as the music chosen by the subjects that they will listen to during the warm-up and before performing the Wingate test.
Wingate Power Test. A 30 second, all-out, supramaximal task that can be performed by either cycling or arm cranking, which is highly reliable and valid when compared with anaerobic running (Inbar & Bar-Or, 1986).
Chapter 2

Review of Literature

Introduction

Music is often a very large part of one’s everyday life. Music is played in the grocery stores, at sporting events, in business and medical offices and during exercise. Music is used to uplift people, change their mood or thought process. A number of studies have examined the ergogenic effect of music, particularly prior to or during high intensity exercise, during which, the synchronizing of physiological and motor responses during exercise with music may be one means by which music is influential (Brownley et al., 1995). Studies have previously focused on music’s psychophysical effects, such as feelings of pleasure or displeasure during exercise or their rate of perceived exertion. The focus of this study was not on how music makes someone feel during exercise, but the effect that music has on how someone performs. If music is administered during a warm up, can it elevate one’s performance?

Validity of the Wingate Test

The Wingate Anaerobic Test, often abbreviated WAT or WanT, was developed at the Wingate Institution for Sport and Physical Education in Israel (Inbar & Bar-Or, 1986). The Wingate test is well standardized, simple to administer, and is independent of body mass (Del Coso & Mora-Rodriguez, 2006). The test measures both peak power output and mean power output (Del Coso & Mora-Rodriguez, 2006). Two major energy sources are required during the Wingate anaerobic test. The first is the adenosine-triphosphate-phosphocreatine (ATP-PCr) system, and the second is anaerobic glycolysis
(Wilmore & Costill, 2004). Sports including football, track and field, soccer, baseball and any sport that involves sprinting demonstrates anaerobic metabolism similar to what is required in the Wingate test (Zupan, Arata, Dawson, Wile, Payn, Hannon, 2009). In order to record both the peak power, and mean power, the Wingate test lasts for 30 seconds, because the peak power is obtained within the first few seconds (5 seconds), and mean power is obtained throughout the test (Del Coso & Mora-Rodriguez, 2006). The Wingate test is highly reliable if enough time, at least one week, is given to recover (Del Coso & Mora-Rodriguez, 2006; Inbar & Bar-Or, 1986; Zupan et al., 2009).

In a study done by Zupan et al. (2009), they designed a classification system to rank athletes’ Wingate scores to rate their anaerobic capacity. The researchers wanted some type of ranking system for NCAA coaches to see their athletes’ anaerobic capacities based on Wingate performance scores. This study involved 1,585 subjects, all of whom were NCAA athletes. The researchers did not have to administer the Wingate because as part of their training, the athletes were required to perform the test, and the researchers used the results from those tests.

The test results were put into a scale designed by the researchers and ranked either poor, fair, below average, average, above average, excellent, and elite. Peak power had to exceed 1,163 Watts (W) for men, and 730 W for women and anaerobic capacity had to be above 823 W for men and 541 W for women, to be considered elite. For men, peak power had to be less than 739 W and anaerobic capacity less than 549 W to be ranked as poor. For women, peak power had to be less than 467 W and anaerobic capacity less than 351 W to be ranked as poor. Coaches, clinicians, and athletes used this scale as a tool to
evaluate power output and provide comparisons from a set of reliable standards. With this information converted into a ranking, it allowed athletes and coaches to compare Wingate performances. This is one example of how the Wingate test was used as a reliable and valid measure of collegiate athletes’ peak power and anaerobic capacity.

**Music’s Psychological Effect on Exercise**

Many studies have examined the psychological effects that music has on exercise. In Karageorghis et al. (2013), music’s psychological, psychophysical and ergogenic effects were studied in swimming. 26 participants were administered three experimental trials that consisted of one 200-m freestyle swimming time trial while listening to motivational music at 130 beats per minute (bpm), one 200-m freestyle swimming time trial while listening to oudeterous music at 130 bpm and one 200-m freestyle swimming time trial while listening no music. One song was chosen to be categorized as motivational based on the Brunel Music Rating Inventory-2 and was administered to all subjects. Oudeterous music is defined as music that is neutral and isn’t motivational or de-motivational (Karageorghis & Mouzourides et al., 2009). This study concluded that participants, whether they listened to motivational or oudeterous music, reported higher state motivation and more dissociative thoughts. This study concluded that music, whether categorized motivational or odeterous, can have an ergogenic effect on high intensity exercise and is responsible for higher self-reported motivation and dissociative thoughts.

In Terry, Karageorghis, Saha and D’Auria (2012), researchers demonstrated the effects of synchronous music on treadmill running in elite triathletes. 11 triathletes ran to
motivational music, a neutral equivalent and a no-music during submaximal and exhaustive treadmill running. The subjects were given tracks and they rated the tracks using the Brunel Music Rating Inventory-2 to choose which track was most motivational to them. All songs that were provided were at least 80-97 bpm. Results showed that time-to-exhaustion was 18.1% and 19.7% longer when running to motivational or neutral music compared to no music, mood responses and feeling states were more positive with motivational music compared to neutral or no music, RPE was lower for neutral music and motivational music compared to no music. This study concluded that although neutral music did not produce the same level of psychological benefits as motivational music, it was equally as beneficial in some variables. This study proved that the motivational qualities of music are not as important as the beat and the ability of the participant to synchronize their running with the music.

In Potteiger, Schroeder & Goff (2000), different types of music were analyzed to see their effects on RPE scores during 20 minutes of moderate intensity exercise. 27 participants performed four separate graded exercises on a cycle ergometer. Once with fast music, once with classical music, once with self-selected music and once without music. Rate of perceived exertion was measured every five minutes during each separate test using the Borg Scale. This study found that each type of music resulted in reduced overall RPE when compared to no music. This study concluded that different types of music can act as an effective distractor during exercise and therefore can lower the scores of perceived exertion.
These studies have demonstrated that music can be associated with ergogenic and psychological effects on music. Psychological effects show how music influences our mood, emotion, attitude, and behavior. Some evidence indicates that during all out exercise, the motivational qualities of exercise have little effect on performance outcomes, but do positively influence psychological factors (Terry et al., 2012). The influence of music on the actual performance of exercise is where previous research is sparse and has produced mixed results. Most importantly, research that can cross over into real-life sport performance is needed.

**Music’s Influence on Aerobic Performance**

The studies that have been conducted in the past using aerobic exercise to determine the effects of music have had positive correlation and outcomes (Terry et al., 2012). The most common way in which the aerobic exercises were administered were a treadmill (Barwood, Weston, Thelwell, & Page, 2009; Terry et al., 2012), walking outside (Styns, Van Noorden, Moelants, & Leman, 2007) or a cycle ergometer (Waterhouse, Hudson, & Edwards, 2010). The subjects of the studies were exposed to their music control stimuli during their exercises (Barwood et al., 2009; Syns et al., 2007; Terry et al., 2012; Waterhouse et al., 2010). A positive relationship and outcome was found when music was associated with the aerobic exercise as compared to no music (Barwood et al., 2009; Styns et al., 2007); however, music did not show to benefit the majority of subjects in the study done by Terry et al. (2012).

Many of the research articles used in the literature of these studies showed a much stronger impact between aerobic exercise and music. If work load was high enough, then
the individual’s attention was directed to the painful effects of the exertion; attention cannot be focused on the music, and it becomes a negative distractor (Waterhouse et al., 2009). For this reason, many of the studies used sub-maximal testing or allowed the subjects to exercise at their own pace, which avoided maximal testing, and too high of a work load, so that their attention was kept on the music, and not differed to the intensity of the exercise.

**Music’s Influence on Anaerobic Performance**

Music’s influence on short-term maximal exercise has not been researched heavily and has produced mixed results (Chtourou, Jarraya, Aloui, Hammouda & Souissi, 2012). In Eliakim, Meckel & Eliakim (2007) music’s effect on anaerobic performance was tested in adolescent volleyball players with the Wingate Anaerobic Test. 24 players, 12 male and 12 female participated in a randomly assigned music or non-music warm up that lasted for 10 minutes prior to the test. This study found that music positively influenced the peak power, but had no significant effect on mean or average power.

In the study Karageorghis, Priest, Williams, Hirani, Lannon & Bates (2010) the effects of synchronous music during circuit type exercise was studied. This study had 26 participants, 13 men and 13 women who performed a circuit type exercise while listening to three different music conditions: motivational, oudeterous and a metronome control. This study concluded that in regards to performance (total repetitions and exercise repetitions) there was no significant main effects between the conditions. This study suggested that the reason there were no significant effects of music found in any of the conditions, was how physically demanding the exercises were in the circuit.
In Pujol and Langenfeld (1999), 12 men and 3 women completed two Wingate Anaerobic Tests. Each subject performed a series of three different Wingate Anaerobic Tests to a music condition and to no music. All music was set at the same tempo. Mean power output, maximum power output, minimum power output and fatigue index were compared between music conditions. This study resulted in no significant differences between the music and non-music trials for any measures.

**Music Administered Before the Exercise**

In studies done by Jarraya et al. (2012) and Chtourou et al. (2012) music was administered to the subjects before their exercise, during a warm-up. In Chtourou et al. (2012) the subjects performed a Wingate test, after a 10 minute warm up, where music was either played or not played. The music was played through personal headsets and was high tempo (120-140 beats per minute). During the Wingate test, the peak power ($P_{peak}$) and mean power ($P_{mean}$) were recorded.

The study by Chtourou et al. (2012) found that ($P_{peak}$) and ($P_{mean}$) were significantly higher after the warm up with music compared to the warm up with no music. The findings of this study are important for real world applications because it demonstrates that warming up with music can have a motivational factor on participants and lead to an enhanced work output. Music may be considered as a legal method and additional aid for young male sprinters during warm-up prior to competitive games. The results of this study specifically benefited athletes, because they can only listen to music before or after competitions, not during.
In a study by Jarraya et al. (2012), 12 male athletes with high physical fitness participated in the investigation. High intensity tempo music (120-140 beats per minute) was administered during their warm up through personal headphones. On two occasions the subjects performed a Wingate test; one test was following a warm up with music, and one test was following a warm up with no music. The two sessions were conducted at least 48 hours apart. Heart rate was recorded during the warm up and immediately after the Wingate test, along with rate of perceived exertion using the Borg scale.

Jarraya et al. (2012) found that \( P_{\text{peak}} \) and \( P_{\text{mean}} \) during the Wingate tests significantly increased with the music warm up as compared to the non-music warm up. They also found that muscle power output was higher following the music warm up than the non-music warm up. The experimenters could not find a significant difference in RPE between the music and non-music groups. Coaches and practitioners interested in short-term supramaximal performances may be well advised to incorporate arousing music during warm up in attempt to augment subsequent power output (Jurraya et al., 2012).

**Music Administered During the Exercise**

Music administered during the actual exercise was examined in a majority of these studies. The preferred method of administration was through personal headphones (Brownley et al., 1995; Styns et al., 2007; Waterhouse et al., 2009), and some subjects listened from speakers or a computer (Barwood et al., 2009; Brooks & Brooks, 2010; Karageorghis et al., 2010; Terry et al., 2012). These studies used more untrained individuals than the studies who administered music before the exercise. The studies that
administered music before the exercise were focused mainly on athletes, because that is the only time an athlete who is competing could listen to music (Terry et al., 2012).

In studies where there was motivational music, non-motivational music and no music groups (Barwood et al., 2009; Brownley et al., 1995; Terry et al., 2012), they found that the music, both motivational and non, showed effects on the participants more than no music at all. The results from these studies made it hard to tell what kind of music was needed to enhance performance. Does the music need to be something motivational, or does it just need to be music of any type?

When researchers used only music and non-music groups (Brooks & Brooks, 2010; Karageorghis et al., 2010; Styns et al., 2007; Waterhouse et al., 2010) the results were mixed. The researchers that let their subjects decide what musical pieces were most motivational to them (Brooks & Brooks, 2010; Karageorghis et al., 2010) found that the music did in fact have a positive effect on the subject’s performance. Researchers who chose the music for their subjects (Barwood et al., 2009; Brownley et al., 1995; Styns et al., 2007; Terry et al., 2012; Waterhouse et al., 2010) did not have conclusive results. Terry et al. (2012) was unable to find an effect of music on exercise for the majority of subjects involved in the study.

**Conclusion**

Music has had mixed results when it comes to anaerobic exercise (Chtourou et al., 2012). Researchers have had trouble determining the actual cause of increased performance in anaerobic exercise when music is involved. When research has shown positive effects of music on anaerobic exercise, there are other factors that may have had
an equal or greater effect than the music on the output, such as gender or physical fitness. With aerobic exercises, the work load is not as high and music can be used as a distraction, but if the work-load is high enough then the individual’s attention is directed to the intense effects of the exertion. If attention cannot be focused on the music, it becomes a negative distracter (Waterhouse et al., 2010).

Music has been shown to benefit untrained individuals more than trained individuals because a trained person usually will not display as much improvement to an exercise as an untrained person who is more likely to be motivated by the music (Brownley et al., 1995). Although the relationship is not as evident in their exercise as it may be in an untrained individual, trained individuals may still be motivated by music. Music has been shown to be equally beneficial whether it is administered through headphones, a computer, or during or before an exercise. When researchers looked at types of music whether it was fast tempo, slow tempo, motivational, or sedative, results showed that fast tempo and motivational music created the greatest effect on exercise. When researchers used motivational music, sedative music and no music groups, they often found motivational and sedative music groups had greater performances than non-music groups, but could not determine if the positive effect was coming from motivational music or just music in general.

Music and exercise has been studied for many years now and will continue to be studied because of how influential music is. In today’s world, athletes and recreational exercisers alike are constantly looking for healthy, legal ways to improve their performance. If simply listening to their favorite songs before or during an important
event can prove to be beneficial, it can very easily be implemented. Music provides an escape for an individual’s focus while they are exercising, and allows the person to focus more on the music and less on the pain or effects of the exercise (Brownley et al., 1995; Jarraya et al., 2012; Waterhouse et al., 2010). The biggest divide found within the literature was evidence for music’s influence on the psychological aspect of aerobic exercise but the lack of evidence supporting its influence on performance; specifically high intensity exercise and music that is administered during a warm up.
Chapter 3

Methods and Procedures

Introduction

Music has been shown to benefit the psychological aspect of exercise, primarily in aerobic exercise, but it has not been as beneficial on improving exercise performance. The purpose of this study was to determine if warm-up music had a positive effect on Wingate anaerobic performance in college athletes compared to Wingate performances with no warm up music.

Participants and Setting Context

After reviewing the literature for this experiment, the ideal number of participants for a study similar to this was 20-25 participants to create strong evidence and to account for possible subject attrition. This study involved 20 participants. All subjects were recruited from a collegiate track and field team. All participants were required to fill out informed consent and debriefing forms (Appendix E) before their first Wingate test. This study was conducted at a small Division I school in northern South Carolina and approved by their Institutional Review Board (IRB) (Appendix A). Permission to use the track and field athletes was obtained from the athletic director, head coach and assistant head coach via email (Appendix D). The participants were all undergraduate track and field student athletes ranging in age 18-22 years. This included track athletes competing in sprinting, mid distance, jumping and throwing events. The participants were as evenly distributed in regards to gender, with a total of 11 males and 9 females.
In order to create a random assignment for the participants, the order in which they signed up determined which warm-up they completed first. The sign-up sheet used for the participants had lines with numbers next to them where the subject would print their name. If the subject signed up on an even numbered line, they completed the music warm-up first, and the warm-up without music second. If the subject signed up on an odd numbered line, they completed a warm-up without music first, and the music warm-up second. This ensured that the subjects were unaware, upon arrival, of which warm-up they would be doing. This also ensured an even number of subjects who warmed up with music during their first test and who warmed up with no music during their first test to minimize the limitation of familiarization producing a better second test than first test.

**Research Design**

The type of research conducted in this study was a randomized crossover experimental design. The subjects performed two separate Wingate tests. The first test they performed was either followed by a warm-up with music or a warm-up without music. Then they performed the second test one week later. The subjects were randomly assigned to a warm-up with or without music based on the order in which they signed up.

The independent variables were the two protocols; warm-up with music and warm-up without music. The music was chosen by the subject and varied with each individual. The dependent variables were the revolutions per minute (RPM) at five seconds, the RPM at 10 seconds, the peak power (W), the average power (W), the peak work (KPM) and the average work (KPM) of each subject on the Wingate test. Data was collected from the Wingate test and analyzed using SPSS statistical analysis software.
The instrument used in the experiment was the Wingate anaerobic test. The Wingate test is a 30 second, all-out, supramaximal task that can be performed by either cycling or arm cranking, which is highly reliable and valid when compared with anaerobic running (Inbar & Bar-Or, 1986). The Wingate anaerobic test is well standardized, simple to administer, and is independent of body mass (Del Coso & Mora-Rodriguez, 2006). The Wingate test is highly reliable if enough time, at least one week, is given to recover (Del Cosa & Mora-Rodriguez; Inbar & Bar-Or, 1986; Zupan et al., 2009).

Procedures

The results for this study were obtained from the Wingate test itself, and how each athlete performed during the test. The work and power measurements were based on how many revolutions (RPM) the subject completed in 30 seconds. The workload for the subjects was based on their body weights (in kg). The lab where the Wingate testing took place was located within the University’s recreational facilities in the Human Performance Laboratory. Each subject received a warm-up period of two minutes on the cycle ergometer. The subject was instructed to maintain a pace of 50 revolutions per minute.

The subjects for this research were members of the track and field team. The majority of the subjects were short sprinters, mid sprinters and jumpers. Once the subjects volunteered for the study, they were given pre-participation instructions in order to complete the test (Appendix B) (Appendix C). Once the subjects arrived in the lab, their weights (in kg) were measured and recorded. The subjects were then randomly
assigned to either a music warm-up, or a non-music warm-up. The tests were conducted one week apart.

Based on the order in which the subjects participated determined if they had a music warm-up or a warm-up without music. The subjects were given a period of familiarization, in which they could sit on the cycle ergometer, ask any questions they may have, and become familiar with the test. At that time, the seat height was adjusted, and they were given verbal instruction on how the test would be administered. They were then instructed to begin their two minute warm-up on the cycle ergometer at a resistance of 1.5 to 2.5 kp. If the subject was assigned to a music warm-up, they were told to put their personal headphones on and listen to the music of their choice during that time.

At the conclusion of the two minute warm-up has concluded, the subjects were instructed to remove their personal headphones. At that time, the subjects were instructed to attain 120 revolutions per minute as quickly as possible. Once they reached 120 rpm’s, the subject is queued, using the word “Go” to pedal as fast as possible and the appropriate resistance was simultaneously applied to the fly wheel. The administrator of the test then queued the timer to start the stopwatch by saying “Start.” The timer would tell the subjects when they have 15 seconds remaining and five seconds remaining. There were no verbal cues given by the researchers, besides “go,” “stop,” “15 seconds” and “five seconds.” It was very important that the researchers refrained from giving any type of verbal encouragement or motivation.

If the subjects were assigned to the no music warm-up, the subjects warmed-up on the bike for two minutes, however they had no form of music playing during this time.
The subjects were given the same verbal instruction and the same verbal cues by the administrator and timer. The same assessment team performed both trials.

At the conclusion of the Wingate test, the subjects remained on the bike, for a cool down of their own desired length of time. After the cool down, the subjects were reminded to return to the lab and complete the second Wingate test exactly one week from that day. Whichever warm-up the subjects had completed the first time, music or non, they did the opposite for their second test. Weight was not taken before the second Wingate test. It was assumed that the subject’s weights remained the same or close enough to the same where the resistance on the fly wheel would not need to be changed.

All data collected from this study was stored on a home computer with a password. No one had access to the data but the researchers. The data numbers were de-identified to replace the names of the subjects so their identities were kept confidential.
Chapter 4

Results

This study consisted of 20 collegiate Track and Field athletes; 11 male and nine female. All participants were randomly assigned music or non-music warm ups based on when they came to perform the test. All music was chosen by the participants and was played through personal head phones during a two minute warm up. There was a time period of seven days between each Wingate test. Subject’s body weight was taken before their first Wingate test in order to determine the weight placed on the fly wheel. Results were then inputted and analyzed using SPSS. The purpose of this study was to determine if music warm-ups had a positive effect on Wingate performance when compared to non-music warm ups in Division 1 college, anaerobic athletes.

Descriptive statistics were run to analyze mean values of all variables (Table 1). All outcome values produced from the Wingate tests performed with a music warm up were significantly higher than the mean values of the tests without a music warm up. The greatest increases in mean values between the music and non-music tests were found in average work (KPMs) (Figure 1) and peak power (Watts) (Figure 2).

Revolutions per minute

Table 1 and Figure 2 present revolutions per minute (RPM) after five seconds increased from an average of 11.9 without music to 13.00 with music. This supports the hypothesis that subjects would complete more revolutions per minute in five seconds with a music warm up then without a music warm up. Table 1 presents revolutions per minute after 30 seconds increased from an average of 57.00 without music to 62.65 with
music. This supports the hypothesis that subjects would perform more revolutions per minute in 30 seconds with a music warm up than without a music warm up.

**Peak Power**

Table 1 and Figure 1 present peak power (W) increased from an average of 616.07 (W) without music to 673.55 (W) with music. This supports the hypothesis that subjects would produce greater peak power (W) with a music warm up than without a music warm up.

**Average Power**

Table 1 Figure 3 present average power (W) increased from an average of 491.51 (W) without music to 540.52 (W) with music. This supports the hypothesis that subjects would produce greater average power (W) with a music warm up than without a music warm up.

**Work**

Table 1 presents peak work (KPM) increased from an average of 314.25 (KPM) without music to 343.52 (KPM) with music. This supports the hypothesis that subjects would produce greater work (KPM) with a music warm up than without a music warm up. Table 1 presents average work (KPM) increased from an average of 1504.30 (KPM) without music to 1654.17 (KPM) with music. This supports the hypothesis that subjects would produce greater work (KPM) with a music warm-up than without a music warm-up.
Table 1

*Descriptive Statistics*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (KG)</td>
<td>20</td>
<td>53.50</td>
<td>89.70</td>
<td>70.58</td>
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</tr>
<tr>
<td>Force (KP)</td>
<td>20</td>
<td>3.50</td>
<td>5.25</td>
<td>4.35</td>
<td>.597</td>
</tr>
<tr>
<td>Music RPMs 5s</td>
<td>20</td>
<td>10.00</td>
<td>17.00</td>
<td>13.00</td>
<td>1.88</td>
</tr>
<tr>
<td>No music RPMs 5s</td>
<td>20</td>
<td>9.00</td>
<td>17.00</td>
<td>11.90</td>
<td>1.88</td>
</tr>
<tr>
<td>Music RPMs 30s</td>
<td>20</td>
<td>47.00</td>
<td>80.00</td>
<td>62.65</td>
<td>8.71</td>
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<td>No music RPMs 30s</td>
<td>20</td>
<td>42.00</td>
<td>76.00</td>
<td>57.00</td>
<td>8.22</td>
</tr>
<tr>
<td>Music (P) Power (Watts)</td>
<td>20</td>
<td>411.00</td>
<td>1050.00</td>
<td>673.55</td>
<td>168.22</td>
</tr>
<tr>
<td>No music (P) Power (Watts)</td>
<td>20</td>
<td>370.00</td>
<td>1050.00</td>
<td>616.07</td>
<td>163.69</td>
</tr>
<tr>
<td>Music (A) Power (Watts)</td>
<td>20</td>
<td>363.70</td>
<td>823.50</td>
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<tr>
<td>No music (A) Power (Watts)</td>
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<td>782.00</td>
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<td>Music (P) Work (KPM)</td>
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<tr>
<td>Music (A) Work (KPM)</td>
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<td>1113.00</td>
<td>2520.00</td>
<td>1654.17</td>
<td>413.01</td>
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<tr>
<td>No music (A) Work(KPM)</td>
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<td>1008.00</td>
<td>2394.00</td>
<td>1504.30</td>
<td>380.31</td>
</tr>
</tbody>
</table>

*Peak (P), Average (A), revolutions per minute (RPM) and kiloponds per minute (KPM)*
Figure 1. Mean comparison of peak power (PP), average power (AP) with music and no music. Pair 3, $p = .006$, Pair 4, $p = .000$
Figure 2. Mean comparison of revolutions per minute (RPMs) at 5s and 30s with music and no music. Pair 1, \( p = .005 \), Pair 2, \( p = .000 \)
Figure 3. Mean comparison of average work with music and no music. Pair 6, $p = .000$
A paired-samples $t$ test (Table 2) was calculated to compare: music RPM’s in five seconds to no music RPMs in five seconds, music RPMs in 30 seconds to no music RPMs in 30 seconds, music peak power to no music peak power, music average power to no music average power, music peak work to no music peak work and music average work to no music average work. Significance was found between all music variables compared to non-music variables at the $p < .05$ level.
Table 2

*Paired-Sample t Test*

<table>
<thead>
<tr>
<th>Pair</th>
<th>Description</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>Music RPMs 5s &amp; No music RPMs 5s</td>
<td>3.168</td>
<td>19</td>
<td>.005*</td>
</tr>
<tr>
<td>Pair 2</td>
<td>Music RPMs 30s &amp; No music RPMs 30s</td>
<td>6.823</td>
<td>19</td>
<td>.000**</td>
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<tr>
<td>Pair 3</td>
<td>Music P Power &amp; No music P Power</td>
<td>3.067</td>
<td>19</td>
<td>.006*</td>
</tr>
<tr>
<td>Pair 4</td>
<td>Music A Power &amp; No music A Power</td>
<td>6.225</td>
<td>19</td>
<td>.000**</td>
</tr>
<tr>
<td>Pair 5</td>
<td>Music P work &amp; No music P work</td>
<td>3.062</td>
<td>19</td>
<td>.006*</td>
</tr>
<tr>
<td>Pair 6</td>
<td>Music A work &amp; No music A work</td>
<td>6.240</td>
<td>19</td>
<td>.000**</td>
</tr>
</tbody>
</table>

*Significance found at $p < .01$

**Significance found at $p < .001$
Chapter 5

Discussion

The purpose of this study was to examine music’s effect on the Wingate performance in college-age track and field athletes. The subjects performed two separate Wingate tests in random order; one that included a warm up with the music of their choice, and one that did not involve music during their warm up. Obtaining information on how music can influence anaerobic exercise performance could be very beneficial to coaches, athletes, and anyone involved in increasing performance in athletics. The key difference in this study, compared to previous studies, was that the music was administered before the Wingate, during the warm-up phase, which can be more applicable to an athletic setting than music administered during exercise.

Previous research had primarily shown that music can be beneficial during aerobic exercise (Barwood et al., 2009; Syns et al., 2007; Waterhouse et al., 2009). However, when it comes to anaerobic exercise, the literature is mixed. One theory as to why the results are more consistent with aerobic exercise when compared to anaerobic exercise is because the exertional efforts are much greater in anaerobic exercise, and therefore, the participant’s attention is focused on the pain from the high intensity exercise and not on the motivational music (Waterhouse et al., 2009).

When studies that involve music administration during exercise are compared with those who administer music during a warm up, the results are also very inconsistent (Brooks & Brooks, 2010; Karageorghis et al., 2010; Styns et al., 2007; Waterhouse et al., 2010). In studies where the music was successful in creating higher performance when
administered during the exercise, it was thought that music acted as a distraction from the exercise and allowed the participant to take their minds off of the exercise and focus on the music, therefore, allowing them to exercise harder and longer (Barwood et al., 2009; Brooks & Brooks 2010; Brownley et al., 2010; Karageorghis et al., 2010; Styns et al., 2007; Waterhouse et al., 2010).

This study was designed to control factors that produced conflicting or inconsistent results found in previous studies. By randomizing the music and non-music warm ups, gathering a gender and fitness level balanced sample, administering the music during the warm up so that results can be applied to athletic settings, and allowing subjects to choose their own music. This study added to the body of knowledge that shows music has a positive effect on exercise.

The Wingate tests were randomized using a crossover design. This was a crucial aspect of the study so that familiarization was not credited in producing greater results over the music. Music that was administered during a warm up allowed for the performance enhancement to potentially be applied to athletic events and sport performance. Athletes are unable to listen to music during sport performance, so the administration of the music to the warm up is more applicable to athletes and sport related performances. The finding that the music warm up Wingate tests produced significantly higher results in RPMs, peak power, average power, peak work and average work when compared to the non-music warm up Wingate performances showed a strong relationship between motivational music during a warm up and increased performance during anaerobic activity.
Future research should address different anaerobic exercises such as interval or circuit training to see if music is a motivating factor. Also, a larger sample group in future research designs will help to produce more significant results. Using different athletes from different anaerobic sports is also a consideration for future research.
Appendices
Appendix A

Winthrop University

REQUEST FOR REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS
Institutional Review Board

RESEARCHER OF RECORD: Mallory Zappitelli
College/Department: College of Education
PHONE NUMBER: HOME: 803-323-4647
EMAIL: zappitiem2@winthrop.edu CELL PHONE: 803-323-4647
ADDRESS: 216 West Center, Rock Hill, SC 29732

CO-RESEARCHERS: Dr. Wojcik
FACULTY ADVISOR: Dr. Charles Bowers
ADVISOR PHONE: HOME: 803-323-4647
EMAIL: bowers@winthrop.edu
ADDRESS: 216 West Center, Rock Hill, SC 29732

STATUS:  Faculty or Staff
(If a student, complete faculty advisor section)
☐ graduate student
☐ undergraduate student

TITLE OF RESEARCH: The effects of warm-up music on Wingate performance compared to no warm-up music.

DATES OF THE RESEARCH PROJECT:
Approval Requested for Start Date: 2/1/2014 (The requested start date should be at least 2 weeks after the next scheduled meeting of the IRB)
End Date: 2/1/2015 (Maximum of one year; must be renewed annually)

IS THIS RESEARCH BEING FUNDED BY RESEARCH GRANT?
☐ YES; Sponsor:
☐ Funding Applied for; Sponsor:
☐ NO

☐ Yes ☐ No Is this activity being carried out by student as a classroom assignment to be reviewed by the faculty member.

☐ Yes ☐ No Will the information gathered or developed in this activity be used in a presentation or publication outside of the classroom?
If you checked yes to both questions above, please explain how the information will be used outside of the classroom: This is being used for a Masters thesis for a graduate program and could be published or presented at a conference.

INDICATE THE TYPES OF MEMBERS OF THE RESEARCH TEAM WHO WILL HAVE DIRECT CONTACT WITH HUMAN SUBJECTS:

☐ FACULTY MEMBER
☐ STAFF MEMBER
☐ UNDERGRADUATE STUDENT
☐ GRADUATE STUDENT
A. BRIEFLY DESCRIBE THE PURPOSE OF THE RESEARCH IN NON-TECHNICAL LANGUAGE: The purpose of this research is to find if music has a positive influence on an athlete's performance. Specifically, music being played in headsets during a warm-up period, and their performance on a Wingate test. A Wingate test is a 30 second test performed on a stationary bike in which the subject pedals as hard and as fast as they can for 30 seconds.

B. DESCRIBE RESEARCH PROTOCOL OR METHODOLOGY TO BE USED: An athlete will willingly volunteer for the study, and will be given a pre-exercise protocol that they must strictly follow in order to participate. The athlete will complete two separate Wingate tests within one week of each other. The athlete will choose a number, either 1 or 2, which correlates with whether or not they will be listening to music for their first Wingate performance. If the athlete chooses the number that correlates with the music warm-up, they will be given a warm-up period, that will start as soon as they are ready, and will end right before they perform the Wingate test. During this warm-up period, music of their choice will be played through personal headphones. If the subject chooses the number that correlates with no music warm-up, the athlete will be given the same warm-up period, but there will be no music administered. The athlete's performance on both Wingate tests will be recorded and analyzed to see if the subject performed better with the music warm-up than with the no-music warm-up.

EXPLAIN BRIEFLY BUT COMPLETELY WHAT TASKS OR ACTIVITIES THE SUBJECTS IN THIS RESEARCH WILL BE DOING (If a survey/questionnaire is to be used, state how many questions will be asked and the expected time to complete the survey): The subjects in this research will be performing a Wingate test. A Wingate test is a test of fitness that is performed on a stationary bike. The subject will pedal as hard and as fast as they possibly can for 30 seconds.

DESCRIBE SUBJECTS FOR THIS RESEARCH, INCLUDING A STATEMENT OF WHO WILL BE RECRUITED AND THE ANTICIPATED POPULATION SIZE: Only athletes participating in anaerobic sports at Winthrop University will be recruited for this research. In this research, the athletes will be participants of the following anaerobic sports: women's and men's basketball, track and field, and women's and men's soccer. Preferably a population size of 40 athletes, including an even distribution of gender (20 men and 20 women).

DO YOUR SUBJECTS INCLUDE ANY OF THE FOLLOWING:

- Yes ☐ No ☑ Infants and children younger than 7 years?
- Yes ☐ No ☑ Institutionalized mentally impaired people?
- Yes ☐ No ☑ Students enrolled in your own classes?
- Yes ☐ No ☑ Students enrolled at Winthrop University?
- Yes ☐ No ☑ Prisoners?
- Yes ☐ No ☑ Other special populations? Specify -

DESCRIBE HOW SUBJECTS WILL BE RECRUITED FOR THIS RESEARCH: Subjects will be recruited for this research through their athletic teams. I will be approaching entire teams and asking for participants.

HOW WILL YOU ASSURE THAT PARTICIPATION OF THE SUBJECTS IS VOLUNTARY? I will be sure to include that participation is completely voluntary and there is no type of reward for participating in the study. The subject's will be given feedback on whether or not the music was beneficial for them or not.

CAN THE HUMAN SUBJECT BE DIRECTLY IDENTIFIED BY: (For any responses of "yes", indicate in the
8a. **Space provided how the subject's privacy will be protected.**

<table>
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<th>Yes</th>
<th>No</th>
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</table>

**8b.** If you checked yes to any item in 8a; then:

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>☐</td>
<td>☑</td>
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<tr>
<td>☐</td>
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</tr>
</tbody>
</table>

**THE RESEARCHER SHALL MAKE EVERY POSSIBLE ATTEMPT TO MAINTAIN CONFIDENTIALITY OF THE RESEARCH AND THE HUMAN SUBJECTS. IF FOR SOME REASON, THE RESPONSES, INFORMATION, OR OBSERVATIONS OF THE SUBJECT BECOME KNOWN TO PERSONS OTHER THAN THE RESEARCHERS, COULD THIS INFORMATION POTENTIALLY PLACE THE SUBJECT AT RISK OF:

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
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<tbody>
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</tbody>
</table>

**EXPLAIN ANY "YES" ANSWERS AND STEPS THAT HAVE BEEN TAKEN TO MINIMIZE RISK:**

**9.**

**ARE ANY OF THE TECHNIQUES LISTED BELOW INVOLVED IN THE RESEARCH?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>☐</td>
<td>☑</td>
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</tbody>
</table>

**EXPLAIN ANY "YES" ANSWERS AND STEPS THAT HAVE BEEN TAKEN TO MINIMIZE RISK:**

**10.**

**11a.**

**DESCRIBE HOW LEGALLY EFFECTIVE INFORMED CONSENT WILL BE OBTAINED AND ATTACH A COPY OF THE CONSENT FORM. IF MINORS ARE TO BE USED AS RESEARCH SUBJECTS, DESCRIBE PROCEDURES USED TO GAIN CONSENT OF THEIR PARENT(S), GUARDIAN(S), OR LEGAL REPRESENTATIVE(S).**

**Legally effective informed consent will be obtained through a document which will explain all that will be done in the research and will be signed by each participant.**

**11b.**

**WAIVER OF SIGNED INFORMED CONSENT REQUIREMENT**

TO REQUEST A WAIVER OF A SIGNED INFORMED CONSENT, COMPLETE THE FOLLOWING:

- ☐ The only record linking the subject and the research would be the consent document, and the principal risk will be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation.
linking the subject with the research, and the subject’s wishes will govern.
Section 46.117(c)(1)

☐ The research presents no more than minimal risk of harm to the subjects, and
involves no procedures, for which written consent is normally required outside of the
research context. Section 46.117(c)(2)

☐ The research or demonstration project is to be conducted by or subject to the
approval of state or local government officials and is designed to study, evaluate, or
otherwise examine (i) public benefit or service programs; (ii) procedures for obtaining
benefits or services under these programs; (iii) possible changes in or alternatives to
these programs or procedures; or (iv) possible changes in methods or levels of payment
for benefits or services under these programs; and the research could not practically
be carried out without the waiver or alteration. Section 46.116(c)

☐ The research involves no more than minimal risk to the subjects, the waiver will not
adversely affect the rights and welfare of the subjects, the research could not
practically be carried out without the waiver, and whenever appropriate, the subjects
will be provided with additional pertinent information after participation.
Section 46.116(d)

In cases where the documentation requirement is waived, the IRB may require the
investigator to provide subjects with a written statement regarding the research.

12. STORAGE AND DISPOSAL OF DATA AND OTHER RESEARCH MATERIALS:
A. How and where will the data and other research material be stored until no longer
needed? Data and other research will be stored in a locked cabinet until no longer needed, in
which case it will be shredded.

B. When will the disposal of data and research materials take place? Disposal of the data and
research materials will take place 3 years after the completion of the research.

At a minimum, investigators must maintain research records for at least three (3) years after completion of the
research. All records must be accessible for inspection and copying by authorized representatives of the IRB, any
federal department or agency supporting the research, and sponsor, if any. (Source: 45CFR46.115) If the Principal
Investigator is a student, then the faculty advisor will be responsible for the record retention. If you are a member of
a professional association or society, you may be required by their practices to keep records longer than 3 years.

C. How will data and research materials be disposed of? Data and research materials will be
shredded.

13. INDICATE ON THE CHECK LIST BELOW, ANY DOCUMENTS THAT APPLY TO YOUR RESEARCH AND ATTACH TO THIS
PROTOCOL A COPY OF THE APPLICABLE DOCUMENT.
☐ SURVEY INSTRUMENT AND/OR INTERVIEW QUESTIONNAIRE
☐ INFORMED CONSENT AGREEMENT
☐ PARENTAL OR GUARDIAN PERMISSION FOR A MINOR CHILD TO PARTICIPATE IN A RESEARCH STUDY
☐ ASSENT TO PARTICIPATE IN A RESEARCH STUDY (AGES 7-14 YEARS)
☐ ASSENT TO PARTICIPATE IN A RESEARCH STUDY (AGES 15 - 17 YEARS)
☐ COPIES OF ANY OTHER MAIL TO BE DELIVERED TO RESPONDENTS OR SUBJECTS (E.G. COVER LETTERS,
☐ SCRIPTS OF VERBAL INSTRUCTIONS, ETC.

14. ☐ Yes ☐ No DO YOU CONSIDER THIS RESEARCH EXEMPT FROM REVIEW BY THE HUMAN SUBJECTS
COMMITTEE? IF YES, PLEASE CHECK THE REASON FOR EXEMPTION FROM THE LIST
below:

a. ☐ Research conducted in established or commonly accepted educational settings, involving normal educational practices,
such as (a) research on regular and special education instructional strategies; or (b) research on the effectiveness of or
the comparison among instructional techniques, curricula, or classroom management methods [45CFR46(b)(1)]
b. ☐ Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement) survey procedures, interview procedures or observation of public behavior, unless (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subject at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation. [45CFR46(b)(2)]

Research involving children (subjects that have not attained the age of 18 years) is not exempt under this category unless the research involves only the observation of public behavior and the researchers do not participate or impact the activities being observed. [45CFR46.40(b)]

c. ☐ Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior if (a) the human subjects are elected or appointed public officials or candidates for public office; or (b) federal statute(s) without exemption that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter. [45CFR46(b)(3)]

d. ☐ Research involving the collection study of existing data, documents, records, pathological specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. [45CFR46(b)(4)]

e. ☐ Research and demonstration projects which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine; (a) public benefit or service programs; (b) procedures for obtaining benefits or services under those programs; (c) possible changes in methods or technologies to those programs or procedures; or (d) possible changes in methods or levels of payment for benefits or services under those programs. [45CFR46(b)(5)]

f. ☐ Taste and food quality evaluation and consumer acceptance studies, (a) if wholesome foods without additives are consumed; or (b) if a food is consumed that contains a food ingredient at or below the level found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. [45CFR46(b)(6)]

Certifications

By my signature below, I certify that each of the named co-researchers has accepted his/her role in this study. I agree to not begin any research activity on this study until written approval by the IRB has been received. I agree to a continuing exchange of information with the Institutional Review Board (IRB). I agree to obtain IRB approval before making any changes or additions to the project. I will provide progress reports at least annually, or as requested. I agree to report promptly to the IRB all unanticipated problems or serious adverse events involving risk to human subjects. A copy of the informed consent will be given to each subject and the signed original will be retained in my files, unless a waiver of a signed informed consent has been granted.

I further certify that I have successfully completed the following Human Subjects Training Course:
☐ CITI – Biomedical Research Investigator
☐ CITI – Social and Behavioral Research Investigator
☐ CITI – Undergraduate Researcher
☐ CITI – IRB Member

[Signature of Researcher] [Date] 1/21/14

By my signature below, I certify that I have reviewed this research study and agree to counsel the student researcher in all aspects of the research study.

I further certify that I have successfully completed the following Human Subjects Training Course:
☐ CITI – Biomedical Research Investigator
☐ CITI – Social and Behavioral Research Investigator
☐ CITI – IRB Member

[Signature of Faculty Advisor] [Date] 1-21-14
Approval by Department Chair of Researcher of Record

(Dean, if Chair is the Researcher or if Chair is otherwise unable to review)

I have reviewed this research study. I believe the research is sound, that the study design and methods are adequate to achieve the study goals, and that there are appropriate resources (financial and otherwise) available to the researcher. I support the study, and hereby submit it for further review by the IRB.

[Signature]

Date: 1-27-14

Note: Do not use personal home addresses and phone numbers on Informed Consent, Assent, Parental Permission or Debriefing statements.
Debriefing Form

Thank you for participating in our The Effect of a warm-up with music on Wingate performance compared to no music in college anaerobic athletes study!

The purpose of this study was to research the effects of music during a warm-up on Wingate performance and compare it to a performance with no music in the warm-up. The Wingate is a 30 second all out test that is performed on a stationary bike, where the subject is asked to pedal as fast and as hard as they can for 30 seconds. The results of this study will be used to provide performance benefiting information to those student athletes who performed better with a music warm-up.

If you are interested in learning the results of this study, please contact the researchers after August of 2014.

**Researchers:**

Mallory Zappitelli – zappitellim2@winthrop.edu  
Dr. Charles Bowers – bowersc@winthrop.edu  
Dr. Janet Wojcik – wojcikj@winthrop.edu

If you have any concerns regarding this study, please contact the faculty advisor or the Director of Sponsored Programs and Research.

**Faculty Advisor:**  
Dr. Charles Bowers  
(803) 323-4647  
bowersc@winthrop.edu

**Sponsored Programs & Research:**  
Teresa Justice, Director  
(803) 323-2460  
justicet@winthrop.edu

If anything about this survey caused you to feel uncomfortable, health and counseling services are available to you on the 2nd floor of Crawford. You can reach Counseling
Services at (803) 323-2233 or get information at http://www.winthrop.edu/hcs/counselingservices-home.htm.
All counseling services are free and confidential.
Winthrop University Informed Consent Agreement

Researcher: Mallory Zappitelli Graduate Student Undergraduate Student
Faculty Advisor: Dr. Charles Bowers Faculty Advisor’s Position: Professor of Exercise Science in the Department of Physical Education, Sport, and Human Performance and Exercise Science Program Coordinator
Title of Study: The effects of warm-up music on Wingate performance compared to no warm-up music.

You are invited to take part in a research study. Before you decide to be a part of this study, you need to understand the risks and benefits. This consent form provides information about the research study. I will be available to answer your questions and provide further explanations. If you take part in this research study, you will be asked to sign this consent form. Your decision to take part in this study is voluntary. You are free to choose whether or not you will take part in the study. If you should decide to participate, you may withdraw from the study at any time.

Purpose of the research study:
To identify if warm-up music has a positive effect on the performing the Wingate test, which is a 30 second, maximal effort test which takes place on a stationary exercise bike, when compared to the same performance with no music during the warm-up.

Procedures or methods to be used in the study:
The Wingate anaerobic test. The Wingate test is used to measure fitness levels in anaerobic athletes. An exercise is considered anaerobic if it requires short, explosive bursts of energy, and lasts less than 60 seconds. The Wingate is performed on a cycle ergometer, and requires the subject to pedal as hard and as fast as they possibly can for 30 seconds.

Possible Risks/Benefits Associated with Participating in Study:
The Wingate is a high intensity, strenuous exercise and does include the following risks: muscle or tendon strain or ligament sprain, nausea, vomiting, extreme fatigue or fainting. However, these risks are greatly decreased if you are an anaerobic athlete because you are already very accustomed to high intensity exercise. In the event that any of these risks do take place, we will be sure to provide the proper care and further care if necessary.

Possible Costs/Compensation Associated with Participating in Study:
There is no cost to the athlete for participating in the study. There is a time commitment that comes along with participating in this study as you will be asked to perform two tests, within one week of each other. There is no type of compensation for any subjects participating in this study. You will not be paid or rewarded in any way for participating in this study.
Number of questions in the survey/questionnaire and anticipated time to complete the survey/questionnaire: 0

Right to withdraw from the study:
Subjects have the right to withdraw from this study at any point with no consequences or penalty what so ever.

Privacy of records or other data collected in the study:
All data will be recorded in a way that no one else can identify the subjects of the study. The information from the study will be kept private and will not be accessed by anyone else but the researcher.

Questions – contact information:
If you have any questions about this study, you may contact me using my Winthrop email account: zappitellim2@winthrop.edu Or through my faculty advisor:
Address: 216 West Center - Winthrop University - Rock Hill, SC - 29732
Work Phone: 803-323-4647 Email: bowersc@winthrop.edu

You may also contact:

Teresa Justice,
Director Sponsored Programs and Research
Winthrop University
Rock Hill, SC 29733
803-323-2460
justicet@winthrop.edu

Signatures:
By signing this consent agreement, you agree that you have read this informed consent agreement, you understand what is involved, and you agree to take part in this study. You will receive a copy of this consent form.

Signature of Participant______________________________Date__________

Signature of Researcher______________________________Date__________
Appendix B

This study requires you (the subject) to be fully prepared for the Wingate test. The following is a list of guidelines that you must follow in order to complete the test and be part of the study:

- You must not consume alcohol within 24 hours of the test
- You must not participate in strenuous activity within 24 hours of the test
- You must not eat within 30 minutes prior to the test.
- You must get an ample amount of sleep the night before the test
- You must eat a small meal at least two hours prior to the test
- You must properly hydrate yourself in the 24 hours prior to the test

If the subject does not comply with the guidelines above, it may lead to a faulty Wingate test and therefore cannot be used as part of the study. As the subject, it is crucial that you abide by these guidelines in order to deliver an accurate test.

As part of your warm-up for one of your Wingate tests, you will be instructed to play a song of your choice through your own personal headphones. This song must be accessible on the device of your choice on the day of testing. Please bring the device with you along with a set of your own personal headphones.
Appendix C

I (the subject) have complied fully to the instructions given to me prior to my test including:

- No alcohol consumption within 24 hours
- No strenuous exercise within 24 hours
- An ample amount of sleep
- A small meal eaten at least 2 hours ago
- Proper hydration within the past 24 hours

By signing below, I affirm that I have complied to the stipulations above, I am going to give an honest effort while completing my Wingate test and I have not, in any way, been compensated for participating in this study.

_______________________________________                                        _____________
Signature of subject                                                             Date
Appendix D

Zappitelli, Mallory, Mon, Nov 18, 2013 at 2:09 PM

I am a graduate student Athletic Trainer. I am currently working on my thesis project and I was contacting you because I need your permission. My thesis will involve athletes and whether or not music has an influence on their anaerobic performance. They will be performing a Wingate Test, which is a test done on a stationary exercise bike where the person pedals for 30 seconds as hard as they can. I am currently the graduate assistant Athletic Trainer for the track & field teams, so I will want to use most of those athletes for my study. I need your permission to use the athletes. If you want to meet with me to discuss the project further, I would gladly do so.

Thank you,

Mallory Zappitelli ATC
Graduate Assistant Athletic Trainer
Cross Country and Track and Field

Mon, Nov 18, 2013 at 4:43 PM
To: "Zappitelli, Mallory"
Mallory,

It will be okay with me to use our student-athletes in your study. However, I would ask that you get separate permission from each head coach of the teams you wish to include in your testing. Please keep me informed as to when the testing is scheduled and when it has been completed. Thank you.
For my thesis project, I am going to be looking at the effects of music on anaerobic exercise. I am going to have my subject's perform a Wingate test, which is a 30 second, all out test performed on a stationary exercise bike. They will perform two separate Wingate tests, one involving a warm up where they can listen to music, and one without. I am hoping to pull a majority of my subject's from the track team, because they are great examples of anaerobically fit athletes. I was just asking for your permission to use your student athletes in my research.

Thank you,

Mallory Zappitelli ATC

Graduate Assistant Athletic Trainer

Cross Country and Track and Field
Paxton, Benjamin A.  

Thu, Nov 21, 2013 at 9:03 AM

To: "Zappitelli, Mallory"

Mallory,

You have my permission to pursue your research with my team.

Thank and good luck,
From: Zappitelli, Mallory

Sent: Tuesday, November 19, 2013 1:48 PM

To: 

Subject:

Coach Schreiner,

I will be conducting a research project on the effects of music on anaerobic performance. The student athletes will be doing a Wingate test, which is a 30 second all out test performed on a stationary bike. They will be doing two separate tests, one with music and one without music. The tests will be approximately one week apart. I am hoping to use mostly track athletes and I need your permission to use your athletes for my study. I would greatly appreciate it.

Thank you,

Mallory Zappitelli ATC

Graduate Assistant Athletic Trainer

Cross Country and Track and Field
Mallory,

This is fine – I am willing to have the track student-athletes participate.

Let me know when you would like to collect your data.
References


doi:10.1016/j.psychsport.2010.06.004


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