EFFECTS OF MUSIC ON WINGATE PERFORMANCE

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ABSTRACT

Brohmer RM, Becker CA. Effects of Music on Improving Wingate Test Performance. Journal of Undergraduate Kinesiology Research. 2006; 2(1):49-54. Purpose: Over the years, much research has been done on the effects of music on improving performance. Although much of the research has been done on improving cardiovascular performance (aerobic), not much has been done to see if music can improve anaerobic performance. The purpose of our study was to see if music has any effect on improving Wingate performance. Methods: 17 physically fit college students (8 males, 9 females) from 20-23 years old were tested on Wingate performance. One test is with music (ACDC-Thunderstruck) and the other is without music, no encouragement was allowed during both tests. Results: The results of the testing show that there was a significance in peak power relative to Watts of .018 (P<.05) and relative to Watts/kg of .049 (P<.05). We found the subject’s peak power on the music test was 755.7 W (±272.1) and 9.9 W/kg (±1.8). The subject’s non music tests were 717.6 W (±238.6) and 9.5 W/kg (±1.6). Conclusion: Our findings show that music can physiologically improve anaerobic exercise performance.

Key terms: Anaerobic, Power, Physiology, Energy Exertion, Encouragement, Aerobic

INTRODUCTION

Over the years many people look in many different directions to try to improve performance. Some individuals may choose to use music as that aid in physiological performance. The aid of music may even be used by some athletes to enhance their performance on the field. It all depends on how an individual feels and their preference of music on how they react to it; some individuals find they perform better without it. Regardless of what athletes feel either way, in this study we will examine if music can actually improve physiological performance. Over the years, considerable research with mixed results has been done on music and the effects on cardiorespiratory exercise performance (1). Cardiorespiratory exercise is classified as aerobic, as measured by volume of oxygen uptake or one’s
ability to consume oxygen during exercise (1). The term anaerobic means without oxygen, high intensity and high rate of exercise that does not require oxygen for energy production (2).

Pottieger took athletes and had them do twenty minute exercise bouts at a moderate level of intensity, increasing work loads every two minutes of the training session. This was completed with and without music stimulation (3). He found that during both exercise bouts there was no significant change in subject’s rate of perceived exertion (RPE) or exercise heart rate (3). The idea of rate of perceived exertion is to gauge fatigue during exercise (3). A study was done by De Bourdeaudhuij I. and it was found that when distracting obese adolescent children with music, they were able to run much farther and harder (4). They found that with distraction (music) run time was able to increase 664 (+/- 133) to 719 (+/- 121). Not only that, but VO\textsuperscript{2} peak increased from 33.6 ml/min/kg (+/- 6.37) to 35.43 ml/min/kg (+/- 6.10). When looking at those results it shows that music can enhance cardiorespiratory performance. Not only is there discrepancy in the field of whether music has the ability to improve physiological performance, but also the type of music that is used to improve performance. Copeland and Franks looked at whether soft, slow, easy listening, popular music can improve cardiorespiratory performance over loud, fast, exciting, popular music (5). In their results they found that soft, slow, easy listening music does actually improve cardio respiratory performance (5). One can see that there is some discrepancy between whether music can improve cardiorespiratory performance. Even less has been done on whether music can affect anaerobic performance.

Even with these mixed results, few have researched if music improves performance in anaerobic exercise (1). There has not been much done as far as music affecting anaerobic capacity. Although, Pujol found in his supermax Wingate anaerobic study that music had no real effect on improving physiological performance (1). A Wingate test is a thirty second test that tests anaerobic capabilities via power. Although they found no significant difference in improvement of performance, they found music did have some affect on performance. This study was the only one we found on anaerobic performance and the effects of music. Due to the results although not significant, but important, it shows there is still controversy and reason for diving into this issue.

With the lack of evidence in the literature of music and the effects on anaerobic exercise, there is a need for further research, which is why we choose to look deeper into this research problem. Being involved in intercollegiate athletics ourselves, we decided to test and discover whether music will affect our anaerobic performance or not. This problem is significant for any athlete who participates in anaerobic training. The purpose of this study is to look at the effects of music on collage-aged athletes performing a maximal anaerobic Wingate test. We hypothesize that music will physiologically improve the performance of an athlete.

**METHODS:**

**Subjects**

17 subjects ranging from ages 20-23 volunteered to participate in our study (8 men, 9 women). All the subjects were college students who were physically fit and healthy individuals. For them to be physically fit, means that every subject met the guidelines for exercise based on ACSM recommendations. To be considered healthy the subjects had to be free of all illnesses that may affect performance. Once subjects had procedures explained to them, they all provided written consent with accordance to the University of Human Subject Institutional Review Board. See subject demographics on Table 1.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age (yrs)</th>
<th>Weight (kg)</th>
<th>Height (cm)</th>
<th>BMI (kg/m\textsuperscript{2})</th>
</tr>
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Instrumentation
For this test we used a Monark 894Ea cycle ergometer. We also used the Monark anaerobic test computer software program that records all the information from the bike during the duration of the test. We also used a Detecto scale to measure body weight.

Procedures
We made sure in our consent form that subjects did not do any intense exercise two days prior to the test, as well as inform them to stay hydrated and not have eaten two hours before the test. Then the subjects came into the physiology lab where in which we took their height measured in centimeters. We used a stadiometer and marked the level height from the top of their head without shoes on. For their weight, we used a Detecto scale in the lab and converted it into kilograms. To measure their body composition, we used the height and weight to figure out Body Mass Index. After getting the subjects demographics, we then proceeded to have the subject’s warm-up for 5 minutes by riding the bike at their own pace. Once the subjects were warmed up efficiently, we then had them perform a Wingate maximal anaerobic power test. After the test, we had the subject cool down for 5-10 minutes, depending on the specific individual and the time it took them to cool down efficiently. We then brought the subjects back in 24 hours, but no later than 48 hours to perform another Wingate maximal anaerobic power test. During the two Wingate tests, one was performed with music and the other with none. The order of music or non-music first was selected randomly to prevent an order effect. The song used for testing was Thunderstruck by ACDC. We chose this song because of its upbeat tempo and it is also familiar to the demographic group we studied.

Statistical Analyses
Our results were measured in maximum power output (W and W/kg), minimum power output (W and W/kg), and power output drop (%). Paired t-tests were used to determine the mean differences between peak power, minimum power, and power drop with and without music. The level of significance was set at p < 0.05.

RESULTS
We found that there was a significance of .018 (p<0.05) in peak power (W) with music compared to peak power without music. There was also a significance of .049 (p<0.05) in peak power (W/kg) with music when compared to peak power with no music. The means and standard deviations are described in table 2. The difference between the two test averages were 38.1 W and 0.4 W/kg.

### Table 2. Performance during Wingate testing (with and without music).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Music Test</th>
<th>Non-Music Test</th>
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<tbody>
<tr>
<td>Peak Power (W)</td>
<td>755.7 ±272.1</td>
<td>717.6 ±238.6</td>
</tr>
<tr>
<td>Peak Power (W/kg)</td>
<td>9.9 ±1.8</td>
<td>9.5 ±1.5</td>
</tr>
<tr>
<td>Min. Power (W)</td>
<td>414.9 ±134.7</td>
<td>408.9 ±143</td>
</tr>
<tr>
<td>Min. Power (W/kg)</td>
<td>5.5 ±1</td>
<td>5.5 ±1</td>
</tr>
<tr>
<td>Power Drop (%)</td>
<td>43.98 ±8.3</td>
<td>42.87 ±6.6</td>
</tr>
</tbody>
</table>

Mean ± SD
DISCUSSION:
Our study compared music and non-music effects of performance in an anaerobic Wingate test. After completing our study, the results showed that music did improve physiological performance in terms of peak power and the improvement was significant (p< 0.05). Although, Pujol found that music didn’t have any effect on his subjects during his study, which looked at the effects of music on supermax Wingate testing. This difference in our results could be due to the duration of his testing and intensity. In his study his subjects were asked to perform a maximal effort test 3 times in a row with 30 second rest periods, where as with our study subjects only had to do a maximal effort once per test session (1). Due to the extreme workload Pujol’s subjects had to give, his subjects may have just wanted the test to be done with, while not really worrying about giving a full performance. Music selection could play into this difference as well. In his study the music was selected by the beats per minute (1). Pujol did not have any set music to play. His music selection only dealt with the tempo of the song which was about 120 beats per minute (1). Music of that tempo is very fast and up beat. Our music selection of ACDC Thunderstruck is not as up beat and fast, with its tempo being about 85-90 beats per minute. Also, our music selection was a very edgy type of rock music, where as anything he would have chosen would be a very fast tempo type of music. The music difference and the extreme intensity of his testing may have very well been the reason our findings are different.

Figure 1. Mean difference in Peak Power with and without Music.
Even though Pujol didn't find significance in his study, many others have studied music and its performance enhancing abilities. These studies only covered cardiovascular performance (aerobic). Copland and Franks found that the use of soft, slow, relaxing music can improve exercise performance (5). They found that this type of music can help individuals focus better and that enhances their ability to perform. In two other studies, one done by Dunway and another done by De Bourdeaudhuij, they found that by just distracting individuals with music they can perform better and are more willing to perform exercise (4, 6). All three of these studies choose a similar type and tempo of the music which was around 100 beats per minute. As mentioned in our study, our song was around the same tempo of about 90 beats per minute. This could mean that the tempo of the music plays a factor on being able to improve performance. When looking at these studies, the similar tempo of our music could be why we found that music improved performance, even though our study was looking at anaerobic exercise performance and their studies looked at cardiovascular exercise performance.

Our results then show that music can physiologically improve a college aged student's anaerobic performance. This significance proves that anaerobic exercise can be physiologically enhanced by the use of music. When looking at the significance the best illustration of this is the mean difference between peak power of the music and the non music test, this difference is 38.1 W.

All studies are going to have their issues with validity and reliability. Ours is no different and those issues are covered in our assumptions and limitations section below. To keep this study reliable we gave our subjects a protocol for the testing duration. We also explained to them any delimitation that needed to be adhered to, prior to the tests. The process of data collection and test procedures kept this study's results valid.

Throughout the study we assumed a few different things. First of all we assumed that all our participants would follow the guidelines we set for them. One of the most important assumptions we had was that participants would give 100% maximal effort and after testing our subjects, we had no reason to believe they did not. They were also required to not do any strenuous workouts two days prior to the test, as well as stay hydrated and not eat two hours before the test. Participants were asked whether they fit ACSM guidelines for exercise and all answered yes. Based off their answers all participants were in the category of being physically fit and healthy individuals. In similar future testing we would suggest that the assumptions be more specific than ours. For example, by defining strenuous exercise more clearly we would possibly have slightly different results because everyone has their own opinion on what is strenuous and what is not. We could also have checked their hydration level before testing to ensure they were hydrated and if they were not, we would not include them in the study.

One of the biggest limitations was time. Our goal was to get the testing done between 24 and 48 hours of each test. This was more challenging than we thought because of the busy schedules of college students with classes. We did end up being able to test every subject within that time frame, but we would have liked to either have had a shorter range of hours or an exact number of hours of rest before the second Wingate test. We also were limited in the access to the testing facility and equipment. In the lab we performed our testing in, many times there were classes scheduled to be in there and we needed to find open time in the lab where we could do the test without distraction from other people.

What we discovered in this study can be helpful to college students who want to improve their performance in anaerobic activities. We discovered that anaerobic activities include various types of exercises such as resistance training, agility training, and specific sports. An example of a specific sport would be gymnastics or track. These two sports are specifically anaerobic. When doing a bar routine in gymnastics, the routine only lasts for 20-30 seconds, which is categorized as anaerobic. Or the vault, which takes less than 10 seconds to execute, is very focused on anaerobic power. In track, the same idea applies as far as sprinting short distances and doing events where one repetition is in a short period of time. In some sports, such as cross country our study would not be applicable
because of the aerobic aspect of that sport. College students can benefit in any of these activities, as well as other anaerobic exercise.

In the future for anyone wanting to replicate or do a study similar to this, we would suggest testing a different demographic group such as athletes to see if that would affect the results of the study. Another important factor to look at would be the type of music you use in your study. We used a song that we thought was appropriate for our target demographic group. Special consideration should be used also for the type of music you will use and whether it will be slow and soothing or fast and upbeat. In future studies there are other variations of our study that can be done to find information on other aspects of performance that are also important. We would be interested to find out if music can affect physiological performance not just in a lab, but in actual participation of a particular sport and how it would vary from sport to sport. We also are curious of whether or not music has physiological effects in other areas of training, such as weight training or marathon training. Much can be done in future studies in determining what effect, if any music can have on the different aspects of exercise.

CONCLUSIONS

Our results show that music can physiologically improve anaerobic exercise performance. Although these findings disagree with Pujol who found that during supermax Wingate tests music has no effect on performance, we have shown that music is able to aid specifically in anaerobic performance. The use of music in various types of anaerobic exercise is definitely possible. Individuals could listen to music during their resistance training workouts. Many athletes could use music to help them focus at practice; this would be great because the more productive their practice is, the better they will perform in competition. One type of athlete that this would be applicable to is one doing field events or sprinting in track and field. This can also be helpful for any college-aged person interested in improving their performance anaerobically. In conclusion, we found that music can enhance anaerobic exercise performance.

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