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**Difference In Wingate Power Output In Response To Music As Motivation**

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##### ABSTRACT

**Brooks KA, Brooks KS.** Difference In Wingate Power Output In Response to Music as Motivation. **JEP**online 2010;13(6):14-20. Wingate testing and music have produced mixed results in past studies. The effect of motivational music on anaerobic power is unclear. Therefore, the purpose of this study was to test Wingate performance with the presence of music and without music to identify if the effect of music played a role. Subjects were randomized into a music first trial group and a music second trial group. Subjects were tested according to randomized groups. Results indicated a significant difference when using motivational music on peak power, average power, overall anaerobic power, and on power-drop. It was concluded that motivational music has a positive impact on anaerobic performance during a Wingate test. This can translate into a possible increase in anaerobic sports performance. Future studies should look at non-motivational music and performance.

**Key Words**: Music, Motivation, Exercise, Performance, Anaerobic.

**INTRODUCTION**

Music can be heard at any major sporting event or in any exercise facility. Music during sporting events or exercise can represent or express the individuality of the participant, motivate the participant, or add excitement to the atmosphere (6). It can be inspirational to some. It is said that the music accompaniment to exercise and sporting events provides an important beneficial effect to the exercise and sports experience (11). Music has become a major influence on society, so it is no surprise that music has become prominent in the physical activity arena. With the development of newer, more compact portable music devices, such as MP3 players, I-pods, and Zunes, music has become more accessible and convenient. People have the capability to listen to music throughout any type of exercise program with these devices.

Almost all sporting events allow athletes to warm-up with music, and music may have a transient beneficial effect on anaerobic performance. Many health and fitness instructors consider the addition of music to exercise similarly to an ergogenic aid (13), with the removal of music or an inappropriate selection of music as an automatic indication of an unsuccessful class (15). Music has been said to improve mood state, increase arousal, and help provide a reduced feeling of fatigue. It may come as a surprise that scientific evidence has mixed results when it comes to investigating the effects of music on exercise performance (2). Research has been done on the effects of music on improving cardiovascular performance (aerobic), but not much research has been done to see if music improves anaerobic performance. There is a growing interest in the effects of music upon physical activity in general and, more specifically, music’s effect on performance, thus, this study will examine whether or not music plays a role in performance. The results of Wingate testing with participants listening to motivational music while testing and not listening to music while testing will be examined.

Music is being integrated into physical activity more often and previous research, particularly on anaerobic exercise and performance, has unclear and inconsistent findings, therefore it could be argued that questions about the mechanisms of music and movement are unanswered. The purpose of the study is to determine if a person’s association with the presence of music will have a greater influence on Wingate test performance (peak power, mean power, and peak power per kilogram body weight) compared with silence.

**METHODS**

Healthy male and female volunteers ages 18 to 38 completed an informed consent prior to testing. All individuals considered low-risk by American College of Sports and Medicine’s risk stratification were selected to be tested. Approval from the Institutional Review Board at was secured.

This study examined a pool of voluntary males and females in the age range of 18 to 38. The Brunel Music Rating Inventory (11) was used to determine the motivational quality of the selected musical piece. This song had chart success, associated with a film and with sport. Each subject’s maximum HR, height, and weight were determined. Each subject then performed a 30-second Wingate test twice, once with no music and one with music. Each subject was randomly assigned which specific test would be performed in what order. Subjects were randomly assigned a number and the number determined which order they would perform the tests. A span of at least one day passed before a subject was tested again. Music was administered through Windows Media Player on a laptop at a constant intensity (volume) throughout the entire test.

**Table 1. Subject characteristics.**

|  |  |  |
| --- | --- | --- |
|  | *Male* | *Female* |
| *Age (years)* | 23.5 | 21.25 |
| *Height/Weight (cm/kg)*  *Participants* | 183 cm/95 kg  43 | 165 cm/75 kg  28 |

**Data Collection Protocol**

Seventy one subjects were selected between the ages 18-38. Maximum heart rate, height, and weight were determined for each subject. All subjects performed a Wingate cycle ergometer test without music and again with a musical selection. Orders of testing conditions were randomly assign to each subject. One week passed between each test to allow for proper recovery. Music was administered through a laptop computer at a constant intensity. Subject’s peak power, average power, and power drop were analyzed to determine if the musical selections improved test performance.

**Statistical Analysis**

Level of significance for all statistics was preset at p<.05. Analysis of variance (ANOVA), independent sample t-tests, and descriptive statistics were analyzed to determine the significance between the Wingate test results found with music and without music. The statistical tests also determined significance of results between males and females, activity levels, and age range. The testing order was corrected for and a correlation determining if testing order impacted significance was used.

Data was analyzed using SPSS. Standard statistical methods were used for the calculation of the means and standard deviations (SD). Statistical means were calculated peak power with no music and music, average power with no music and music, and power drop with music and no music.

RESULTS

Table 1 presents the participants’ descriptive statistics. Table 1 indicates that the 71 participants ranged in age from 18 to 38, with the average age being approximately 22 years. Table 2 presents the participants’ peak power, average power, and power drop with the 2 testing conditions.

**Table 2. Participants’ mean cores for all testing**

**conditions.**

|  |  |  |
| --- | --- | --- |
|  | *No Music*  *(Averages)* | *Music*  *(Averages)* |
| *Peak Power (W)*  *Peak Power (W/Kg)*  *Mean Power*  *Mean Power (W/Kg)*  *Power Drop* | 750  9.3  525  7.3  285 | 880  11.2  680  8.2  255 |
| *Power Drop (W/Kg)* | 4.6 | 3.4 |

Table 2 indicates that the participants averaged a peak power of 750 W, average power of 525 W, and power drop of 285 W when testing with no music. It also indicates that the participants averaged a peak power of 880 W, average power of 680 W, and power drop of 255 W while listening to the associative music play list.

There was a significant difference in peak power and average power between tests. Using ANOVA, the music trial (F=16.86, p<.001) and the no-music trial (F=11.21, p<.001) both showed a significant difference in peak power from test 1 to test 2, even though testing order was randomly selected. From test 1 to test 2, there was also a significant difference in anaerobic power (F=13.31, p<.001) between the music versus the no-music trial (Table 3).

Using t-tests, a significant difference in peak power and anaerobic power was found between male and female subjects in both the music and the non-music trial (p<.001). A significant difference in the overall peak power in the music versus non-music group was also discovered (p<.001).

Using a repeated measures ANOVA, a significant difference was found in peak power from test 1 to test 2 in both groups, which included a music first trial group, and a music last trial group (F=15.52, p<.005). There was not a significant difference between male and female subjects in peak power or absolute power, when considering testing order.

Blood pressure from pre-test to post-test was significantly different for each test, whether it was music or non-music trial first (p<.01). There was no significant difference in blood pressure between males and females.

**Table 3. ANOVA Table.**

|  |  |  |
| --- | --- | --- |
| *Peak Power No Music vs. Peak Music* | *Average Power No Music vs. Average Power Music* | *Anaerobic Power No Music*  *vs. Anaerobic Power Music* |
| F=16.86 (p<0.001) | F=11.21 (p<0.001) | F=13.31 (p<0.001) |

Forty-three women and 28 men initially volunteered for the study. Of these women, 39 finished the study, resulting in a 91% completion rate, and 24 males finished, resulting in a completion rate of 86%. In the music first group, there were initially 35 participants, and the other 36 were in the non-music first trial group.

The volunteers were randomly selected into the groups; however, due to time restraint in the participant, one of the volunteers completed both tests in two days and did not wait a week between trials. This subject’s data was not used for statistical purposes.

DISCUSSION

The conflicting nature of the data on Wingate testing, as well as other types of anaerobic power testing, and the use of motivational music inspired this study. The results obtained contribute to the growing body of literature available on the use of music as motivation. Aerobic exercise and its relationship with music as motivation has been studied in further detail and the connection between the two has been substantiated several times by different researchers and in different decades (17). Self selection of music has proven produce the most consistent results in aerobic exercise performance and in oxygen uptake testing, both at maximal and submaximal exertion (23). Intensity, mode, nor duration of aerobic exercise have been factors in limiting the results of these studies (20).

Opposed to aerobic testing and exercise performance, and its relationship with music as motivation, anaerobic testing and exercise performance have produced mixed results (7). There are many reasons for this, and in the current study, we attempted to control for variables that have resulted in conflicting data in the past. By randomizing the testing order, and using songs considered to traditionally be motivational, as well as having the subjects rank the music to determine its motivational value, the quality of the music as a motivational piece was established. The environment while testing in the laboratory was controlled. No motivation was given during the trials without music. No verbal cues as to time left on the test were given, as this tends to motivate subjects, and could be a factor in the inconsistency of data. Music was played at all times as the subject was in the laboratory, which eliminated any question as to the timing of the motivational response, which has been a potential limitation to other studies and their validity.

This study added to the body of literature by supporting data that clearly shows a positive effect of motivational music on sports performance. In the Wingate testing, the motivational music had a positive effect on peak power, average power and on overall anaerobic power (9). Though the Wingate test is only thirty seconds long, the music appears to delay fatigue over the test, as shown by the increase in average power over the time of the test. Peak power is significantly higher, which indicates the music group, whether on music being played during their first or second visit, put forth more effort and increase their performance between trials. /by randomizing the testing order and the groups, we can further substantiate our findings by saying that test familiarization did not occur. Over 85% of subjects had never performed a Wingate test upon enrolling in this study. Familiarization with the test and test anxiety and anticipation was further eliminated by a test being given where no data was recorded, prior to the subject being enrolled in the study. The subject knew what to expect when coming for his test and was very familiar with the protocol of the test.

The effect of music on motivation in anaerobic performance is very important in sports performance. Most of the popular sports in our society are power sports, or have an anaerobic component (3). If music is significant in motivating athletes, it can be used as both a positive and a negative in the sports arena. Intensity of music in anaerobic performance could prove to be positive or negative in athletics. If the motivational music contributes to prove a significant increase in anaerobic performance, it can be said that slow, sad, non-motivational music may have a negative effect on performance (4). The intensity and beats per minute of the music may prove to limit or enhance anaerobic performance, as it does in aerobic performance (3). These are considerations that need to be addressed in future research.

**APPENDIX**

**The Brunel Music Rating Inventory**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***Not at all Motivating*** | | | |  | ***Extremely Motivating*** | | | | |
| Familiarity | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Tempo (beat) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Rhythm | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Lyrics related to physical activity | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Association of music and sport | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Chart success | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Association of music with film or video | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| The artist(s) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Harmony | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Melody | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Stimulative qualities of music | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Danceability | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Date of release | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

*Directions:* Rate the piece of music you have just heard by indicating the extent each of the items below contributes to its motivational qualities. “Motivational qualities” refer to the extent to which the music inspires or stimulates physical activity. Rate each item on a scale from 1 (not at all motivating) to 10 (extremely motivating).

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