Effects of Preferred vs. Nonpreferred Music on Resistance Exercise Performance

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Abstract

Ballmann, CG, McCullum, MJ, Rogers, RR, Marshall, MR , and Williams, TD. Effects of preferred vs. nonpreferred music on resistance exercise performance. *J Strength Cond Res* 35(6): 1650–1655, 2021—The purpose of this study was to examine the effects of listening to preferred vs. nonpreferred music on resistance exercise performance. Twelve resistance-trained college-aged males (age = 20.5 ± 1.24 years, height = 183.9 ± 6.8 cm, and body mass = 97.0 ± 18.2 kg) were recruited for this study. In a within-groups counterbalanced study design, subjects either listened to preferred or nonpreferred music during a bench press exercise test. Subjects completed as many repetitions as possible at 75% of their 1 repetition maximum with maximum explosive intent. Power and velocity of the barbell movement was measured for the first 3 repetitions using a linear position transducer. Motivation was measured using a visual analog scale immediately after exercise. Each exercise trial was separated by a 48-hour washout period. Results indicate that listening to preferred music increased overall bench press repetitions completed (p = 0.005; effect size [ES] = 0.84). During the first 3 repetitions, mean velocity (p = 0.001; ES = 1.6), relative mean power (p = 0.012; ES = 0.55), peak velocity (p = 0.011; ES = 0.99), and peak power (p = 0.009; ES = 0.35) were higher while listening to preferred music vs. nonpreferred music. Finally, motivation during the lift ($p < 0.001$; ES = 5.9) was significantly higher while listening to preferred vs. nonpreferred music. Current findings suggest that listening to preferred music by the individual results in greater performance than nonpreferred during resistance exercise. Athletes may benefit from the option to listen to their preferred music to increase motivation and resistance exercise performance.

Key Words bench press, power, velocity, motivation

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Introduction

Resistance exercise is commonly practiced by individuals seeking to increase muscular hypertrophy, endurance, power, and strength (13). Essential to these adaptations are both volume and intensity of training because increasing these may lead to greater adaptation (33,34). Optimizing training regimens to maximize these facets may lead to increased performance. Thus, the use of ergogenic aids, substances, or phenomena believed to increase performance have become popular to enhance training techniques and can range from substances such as caffeine and creatine to external influences such as music (1,39).

Music has been studied extensively and evidence largely supports the use of music as an ergogenic aid (1,2,12,25,29). Many of these studies have largely focused on aerobic and endurance-based activities and commonly report dampened rating of perceived exertion (RPE) levels during exercise (32,40). For example, Potteiger et al. (32) reported that peripheral, central, and overall RPE was lower during a 20-minute submaximal cycling test while listening to music. Together, these studies suggest a "distraction effect" by which music detracts attention from exercise, which may be the underlying mechanism of using music as an ergogenic aid. Other studies have also reported changes in mood and motivation levels when music is combined with endurance exercise, which may also lead to increases in performance (12,18). However, there are mixed results in that some investigations have found no increase in performance or even a decrease in performance leaving the need for further study (8,35). Although there have been numerous examinations of music and its influence on aerobic exercise performance, there is comparatively less literature on music and the influence it plays on resistance exercise performance.

A few studies on music, resistance exercise, and strength have focused on the effect of both predetermined and self-selected music selections on performance (2,4,24,31). For example, Karageorghis et al. (24) found that predetermined stimulatory music increased grip strength in both males and females, whereas others have reported that predetermined sedative music may cause a decrease in strength performance (31). These studies largely suggest that the type of music may be important in determining strength

Table 1. Descriptive characteristics ($n = 12$).*

Characteristic	Mean ± *SD*
Age, (yrs)	20.5 ± 1.2
Height, (cm)	183.8 ± 6.8
Body mass, (kg)	95.1 ± 17.8
Bench press 1RM, (kg)	127.9 ± 40.2
Relative bench press, (1RM [kg]/ BM [kg])	1.35 ± 0.1

*1RM = 1 repetition maximum.

enhancement by music. The effect of self-selected music on resistance exercise and strength has been investigated by multiple groups (2,4). Biagini et al. (4) reported that listening to self-selected music vs. no music enhanced acute power performance but did not have an effect on bench press repetitions to failure. By contrast, Bartolomei et al. (2) reported that self-selected music increased bench press repetitions to failure with no increases in 1 repetition maximum (1RM) strength when compared to no music. Altogether, these effects observed with self-selected music may be due in part to increased motivation and effort. Thus, based on these observations, selection of music may play an important role in determining whether music acts as an ergogenic aid. However, the effect of music preference on motivation along with power and velocity during resistance exercise has not been studied.

Musical preference and exercise performance has been studied in aerobic type activities and has revealed mixed results (10,29). Nakamura et al. (29) reported that individuals listening to preferred music had increased exercise duration during cycling and also lower RPE when compared to listening to nonpreferred music. However, other studies comparing preferred vs. nonpreferred music during treadmill exercise found no changes in RPE, attentional focus, and exercise enjoyment (10). The contrast in these findings leaves a need for further study of music preference and exercise performance. Furthermore, the effect that preferred vs. nonpreferred music has on resistance exercise performance is currently unknown. Therefore, the purpose of the current study was to investigate whether listening to preferred vs. nonpreferred music during resistance exercise influences motivation and performance.

Methods

Experimental Approach to the Problem

This study used a repeated-measures within-groups study design to investigate the effects of preferred (PREF) vs. nonpreferred (NON-PREF) music on resistance exercise performance. Resistance-trained males were recruited and assigned to either PREF or NON-PREF music in a randomized and counterbalanced manner. Comparisons were drawn between PREF or NON-PREF music trials including motivation and bench press repetitions to failure during the duration of the trials. Mean relative power, mean velocity, peak power, and peak velocity were obtained during the first 3 repetitions of the exercise bout and compared between trials that were separated by a 48-hour washout period.

Subjects

Resistance-trained males ($n = 12$) between the ages of 18–24 years were recruited to participate in this study. Resistance-trained was defined as accruing at least 2–3 days of resistance exercise a week (28). Ability to participate was evaluated using a physical activity readiness questionnaire, which excluded those who reported an upper-extremity injury in the past 6 months, cardiovascular disease, musculoskeletal disease, metabolic disease, or other health problems. All subjects had previous experience performing resistance exercise and bench press in particular. All subjects provided written informed consent and the experimental protocol was approved by the Samford University Institutional Review Board.

Procedures

Preferred and Nonpreferred Music Selection. During the first session, a music preference survey with a list of 6 music genres was given to each individual with instructions to rank the genres from their favorite to least favorite. Genres in the survey included rock and roll/hard rock, rap/hip hop, pop, rhythm and blues, country, and dance/electronic. A list of 5 songs from the Billboard Top 10 singles of 2017 in that category was provided with each genre. The selected favorite genre was used for the PREF trial and the selected least favorite genre was used for the NON-PREF trial. A song was chosen by each of the subjects for the PREF trial out of the list of 5 songs under the corresponding genre. For the NON-PREF trial, a song was randomly selected from the least favorite genre list. Eleven of 12 subjects selected rap/hip hop as their PREF music selection, whereas one other selected rock and roll. For the NON-PREF selection, 10 of 12 subjects selected country, whereas 2 others selected dance/electronic. The mean rhythm for the preferred song selection was $127 \pm 28\ \text{b}\cdot\text{min}^{-1}$, whereas the mean rhythm for the NON-PREF song selection was $126 \pm 25\ \text{b}\cdot\text{min}^{-1}$.

One-Repetition Maximum Bench Press and Familiarization. During the first session, subjects completed a light warm-up of bench press exercise before performing the 1RM test. After the warm-up, the barbell weight was progressively increased by 2.5–20.0 kg for one attempt until the subject could not complete the bench press. The 1RM weight was determined within 4 attempts with a rest period of 3–5 minutes between attempts (28). Subjects were also

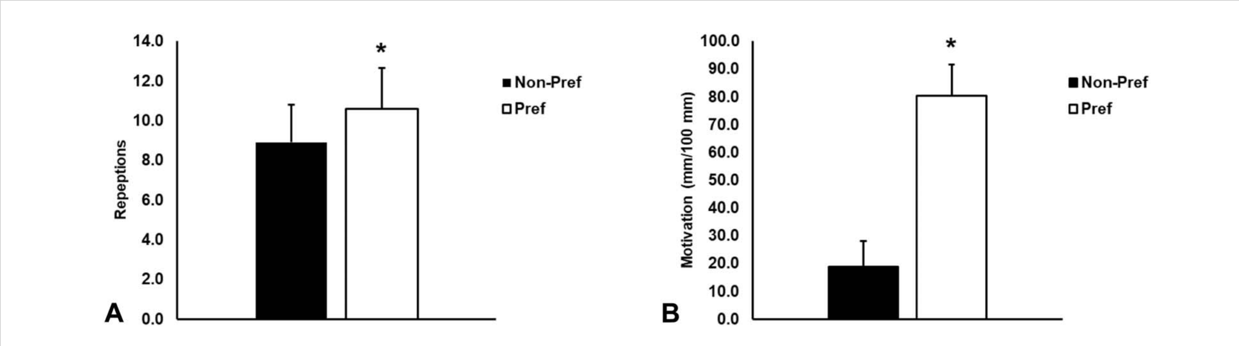

Figure 1. Repetitions to failure and motivation during bench press exercise. Data are presented as mean ± *SD*. *Significantly different from nonpreferred music ($p < 0.05$).

familiarized with the protocol of lifting as explosively as possible. Subjects were asked to lift a standard 20-kg Olympic bar as fast and explosively as possible for 3 repetitions, which was repeated for a total of 3 sets.

Protocol. For each exercise trial, subjects completed bench press repetitions to failure while listening to either PREF or NON-PREF music. Music was played using headphones and volume was adjusted by the subject to a comfortable level. The bench press exercise was performed using a standard 20-kg Olympic bar and Hammer Strength HD Athletic Half Rack (Life Fitness, Rosemont, IL). For each trial, subjects began with a brief warm-up that consisted of 30% 1RM for 5 repetitions followed by one set of 50% of 1RM for 3 repetitions. After 5 minutes of rest, the music was started and subjects immediately lifted 75% of their previously obtained 1RM for as many repetitions as possible. Subjects were also instructed to complete these repetitions as explosively as possible. A linear position transducer (GymAware; Kinetitech Performance Technology, ACT, Australia)

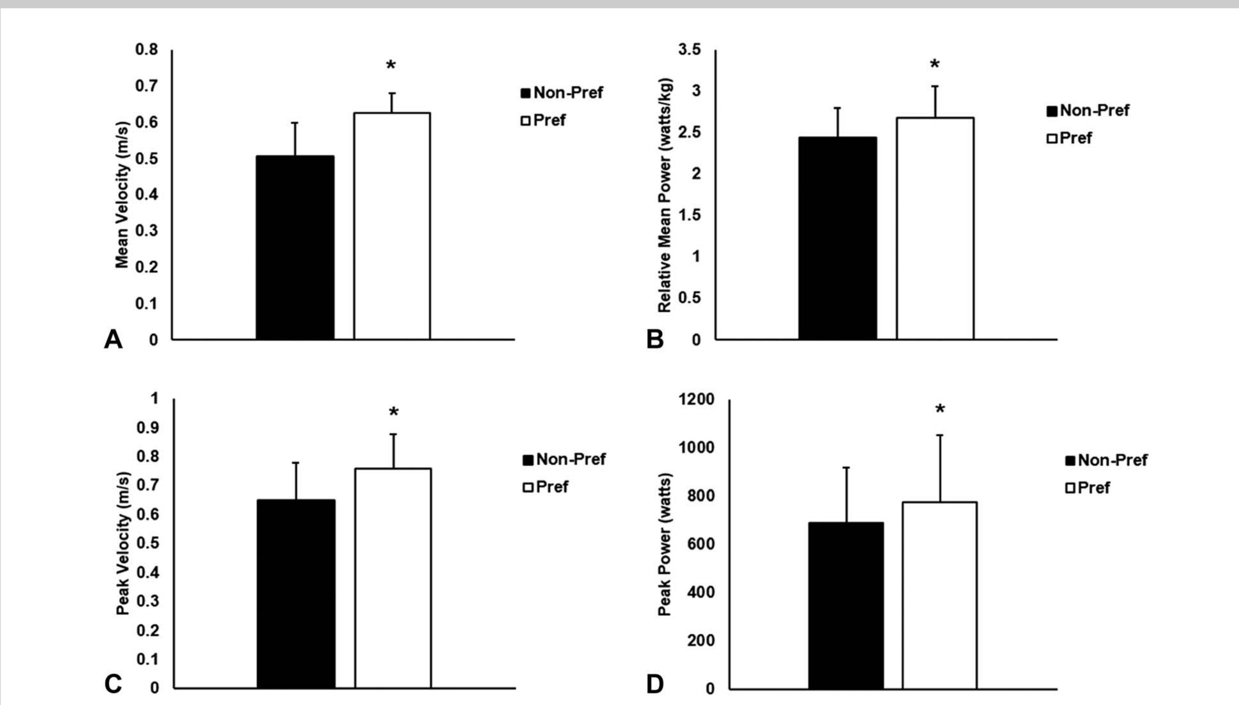

Figure 2. A) Mean velocity, (B) relative mean power, (C) peak velocity, and (D) peak power over the first 3 repetitions during bench press exercise. Data are presented as mean ± *SD*. *Significantly different from nonpreferred music ($p < 0.05$).

Table 2. Effect sizes for performance and motivational measures.

Measure	Effect size	Interpretation
Repetitions to failure	0.84	Large
Motivation	5.90	Large
Mean velocity	1.60	Large
Mean relative power	0.55	Medium
Peak velocity	0.99	Large
Peak power	0.35	Small

was attached to the bar during the entirety of the exercise bout to obtain both power and velocity measurements. This device has been previously validated for test-retest reliability as a means of obtaining power and velocity measurements during resistance exercise (20,30). The device was used in accordance with manufacture's instructions in such a manner that when it was attached to the barbell, a perpendicular angle was achieved during the lift (19). The subject's head, feet, hips, and back remained in contact with the bench or ground throughout the movement. A repetition that deviated from the bench press procedure was not counted toward the total. Failure was determined when the subject verbally indicated the need to terminate the test or when the barbell moved downward during the concentric phase of the lift (4). Immediately after the lift, motivation was measured using a visual analog scale that consisted of a 100-mm line. Ranging from least motivated to most motivated ever, subjects marked on the line how motivated they felt during the lift. Motivation scores were obtained by measuring the distance from zero to the point on the line that was marked (15).

Statistical Analyses

All data were analyzed using SPSS 25 (IBM, Armonk, NY). A paired-sample t-test was used to statistically analyze all mean performance and motivational data. Effect sizes (ESs) were calculated using Cohen's *d* ES calculator for *t*-test and interpretation (6,14). Significance was set at $p \leq 0.05$ a priori. All data are presented as mean $\pm$ *SD*.

Results

Descriptive statistics of subjects are shown in Table 1. Repetitions to failure and motivation during the test are presented in Figure 1. Total repetitions to failure during the bench press exercise test (Figure 1A) was significantly higher in the PREF music trial than in the NON-PREF music trial (PREF = 10.58 $\pm$ 2.07, NON-PREF = 8.9 $\pm$ 1.8; $p =$ 0.005). Motivation during the lift (Figure 1B) was also significantly higher in the PREF music trial than in the NON-PREF music trial (PREF = 80.4 $\pm$ 11.2, NON-PREF = 18.8 $\pm$ 9.29; $p < 0.001$).

Power and velocity performance measured during the first 3 repetitions of the bench press test are shown in Figure 2. Mean velocity ($m \cdot s^{-1}$) (Figure 2A) was significantly higher during the first 3 repetitions of the PREF trial as compared to NON-PREF (PREF = 0.62 $\pm$ 0.05, NON-PREF = 0.50 $\pm$ 0.09; $p = 0.001$). For mean relative power ($W \cdot kg^{-1}$) (Figure 2B), power development was significantly higher in the PREF trial vs. NON-PREF trial (PREF = 2.68 $\pm$ 0.37, NON-PREF = 2.43 $\pm$ 0.35; $p = 0.012$). Peak velocity ($m \cdot s^{-1}$) (Figure 2C) during the first 3 repetitions of the lift was higher in PREF vs. NON-PREF music trials (PREF = 0.76 $\pm$ 0.11, NON-PREF = 0.649 $\pm$ 013; $p = 0.011$). Finally, peak absolute power (W) (Figure 2D) was significantly higher in the PREF trial vs. the NON-PREF trial (PREF = 776.3 $\pm$ 275.7, NON-PREF = 687.6 $\pm$ 229.4; $p = 0.009$).

Effect sizes for all performance and motivational measures can be seen in (Table 2).

Discussion

Music has been repeatedly reported to have ergogenic properties in both endurance and resistance exercise. Previous evidence has suggested that the music preference of an individual during endurance-based activities may influence efficacy of improving performance. However, the role music preference plays in resistance exercise performance is currently unknown. Thus, the current study sought to describe the effects of listening to preferred vs. nonpreferred music during resistance exercise on both motivation and performance. Findings from this study reveal that listening to preferred music vs. nonpreferred music increased motivation during bench press exercise and resulted in a higher number of bench press repetitions performed until failure. Furthermore, during the first 3 repetitions of the bench press bout, mean velocity, mean power, peak velocity, and peak power were higher when listening to preferred music. Although precise mechanisms for these improvements are not fully clear at this time, these findings hold important implications for individuals engaging in resistance training looking to optimize performance.

One of the mechanisms by which music may impart ergogenic benefits is through disassociation or distraction during exercise. As previously mentioned, multiple studies have reported dampened RPE or changes in enjoyment of exercise when listening to music (32,40). In regard to music preference, previous investigations have reported that listening to preferred music alters focus to external information (i.e., music) rather than focusing on discomfort and fatigue, whereas listening to nonpreferred music does not facilitate this change in focus (16,38). Thus, the higher number of bench press repetitions during the preferred trial may be due in part to the fact that the subjects were able to dissociate from the discomfort and fatigue to a greater extent while listening to the preferred music vs. nonpreferred thereby resulting in better performance. However, the current study did not measure RPE or other measures of attention or focus, leaving the contribution of disassociation to improvements in performance unknown. Furthermore, how dissociation or changes in focus from music may change power and velocity measures that were observed currently is unclear. However, previous evidence has suggested that focusing on external information may increase performance in activities that are ballistic in nature (5). Future investigations should include measurements of RPE, attention, and focus during the resistance exercise bout as well as how changes in these variables may impact power and velocity during exercise.

Another possible mechanism by which preferred music may impart a greater ergogenic benefit vs. nonpreferred music may be due to optimization of arousal during exercise. This idea is rooted in the hypothesis that arousal and performance have an inverted-U shape relationship in which too little or too much arousal will cause decrements in performance, whereas there is a point of optimal arousal that will lead to peak performance (37). Music has previously been shown to increase arousal with accompanying increases in exercise performance (26). Indeed, intrinsic characteristics of the music such as volume and tempo seem to have an impact on degree of arousal (7,36). However, evidence suggests that the ability of music to alter arousal levels is also dependent on other factors related to preference. For example, Dillman Carpentier et al. (7) reported that arousal levels, as measured through skin conductance levels, may be different depending on the genre of the music. In relation to the current study, subjects listened to different genres based on their preference, which may have had an impact on their arousal, thus possibly changing performance. Furthermore, previous evidence also suggests that allowing individuals to self-select “favorite” or preferred music positively impacts arousal (17,27). Thus, preference of genre or favorite music selection may have lead to an optimal arousal level during the exercise bout, thereby increasing performance in the current investigation. Further study is needed to examine the role of music preference, arousal, and resistance exercise performance.

Of particular importance in this study, subjects reported higher levels of motivation while listening to preferred vs. nonpreferred music. This is in agreement with previous research that has shown music to be motivational and may also be dependent on the choice of music by the individual (9,23). Furthermore, increases in exercise performance have been previously reported with motivation from music (3,22). Hutchinson et al. (22) reported that listening to music during a supramaximal cycling test increased both motivation and anaerobic performance. Motivation from music may be a key mechanism for its ergogenic properties. Thus, the increased motivation from the preferred music in the current study may explain the higher performance when compared to the nonpreferred trial, although there may be other contributing factors.

The present investigation provides novel information regarding the effect music preference has on resistance exercise performance and motivation. However, there were several limitations to the current study. The music volume was self-selected rather than kept at a controlled level for all subjects. This is noteworthy because previous evidence has shown that volume may affect arousal and change exercise performance (11,21). However, having subjects self-select volume is more representative of individual habits of using music during resistance training. Also, although subjects were resistance-trained, it is not known how many years of training experience they had or whether they were competitive athletes. Thus, it is unclear whether these results would be generalizable to experienced elite-level athletes. In conclusion, the current study indicates that motivation is higher while listening to preferred music as well as bench press repetitions to failure, power, and velocity. Although exact mechanisms for higher performance is not completely clear, preferred music may cause greater disassociation from exercise, increase motivation, and may increase arousal.

Practical Applications

Music is commonly listened to during exercise by recreational and competitive athletes alike. In many instances, music is played over one community speaker in either the locker room or gym. Although some of the individuals listening to the music may prefer the music being played, there are chances that some athletes may not. Our data suggest that if the individual does not prefer the music they are listening to, their performance may be lower than if they were listening to music they preferred. Thus, coaches and practitioners may consider allowing athletes to listen to preferred music to enhance performance.

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