Effects of Self-Selected Music on Strength, Explosiveness, and Mood

Matthew S. Biagini, Lee E. Brown, Jared W. Coburn, Daniel A. Judelson, Traci A. Statler, Martim Bottaro, Tai T. Tran, and Nick A. Longo

Department of Kinesiology, Human Performance Laboratory, Center for Sport Performance, California State University, Fullerton, California

Abstract

Biagini, MS, Brown, LE, Coburn, JW, Judelson, DA, Statler, TA, Bottaro, M, Tran, TT, and Longo, NA. Effects of self-selected music on strength, explosiveness, and mood. *J Strength Cond Res* 26(7): 1934–1938, 2012—There has been much investigation into the use of music as an ergogenic aid to facilitate physical performance. However, previous studies have primarily focused on predetermined music and aerobic exercise. The purpose of this study was to investigate the effects of self-selected music (SSM) vs. those of no music (NM) on the mood and performance of the athletes performing bench press and squat jump. Twenty resistance trained collegiate men completed 2 experimental conditions, one while listening to SSM and the other with NM. The subjects reported their profile of mood states (POMS) and rating of perceived exertion (RPE) before and after performing 3 sets to failure of the bench press at 75% 1 repetition maximum (1RM) and 3 reps of the squat jump at 30% 1RM. Statistical analyses revealed no differences in squat jump height or relative ground reaction force, but the takeoff velocity (SSM-2.06 $\pm$ 0.17 $m \cdot s^{-1}$; NM-1.99 $\pm$ 0.18 $m \cdot s^{-1}$), rate of velocity development (SSM-5.92 $\pm$ 1.46 $m \cdot s^{-2}$; NM-5.63 $\pm$ 1.70 $m \cdot s^{-2}$), and rate of force development (SSM-3175.61 $\pm$ 1792.37 $N \cdot s^{-1}$; NM-2519.12 $\pm$ 1470.32 $N \cdot s^{-1}$) were greater with SSM, whereas RPE (SSM-5.71 $\pm$ 1.37; NM-6.36 $\pm$ 1.61) was greater with NM. Bench press reps to failure and RPE were not different between conditions. The POMS scores of vigor (SSM-20.15 $\pm$ 5.58; NM-17.45 $\pm$ 5.84), tension (SSM-8.40 $\pm$ 3.99; NM-6.07 $\pm$ 3.26), and fatigue (SSM-8.65 $\pm$ 4.49; NM-7.40 $\pm$ 4.38) were greater with SSM. This study demonstrated increased performance during an explosive exercise and an altered mood state when listening to SSM. Therefore, listening to SSM might be beneficial for acute power performance.

Key Words power, explosive, velocity

Address correspondence to Lee E. Brown, leebrown@fullerton.edu.

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Introduction

Resistance exercise has been shown (2) to have a profound influence on strength and power. These adaptations stem from the ability to manipulate a progressive amount of resistance in an explosive manner. Optimizing time and maximizing effort in the weight room can also improve athletic performance. Because of this, the use of ergogenic aids has become common place in most exercise programs and weight rooms. An ergogenic aid can be defined as an external influence with the ability to increase capacity for bodily or mental labor especially by eliminating fatigue symptoms (2) and can range from articles of clothing to imagery, caffeine, steroids, or music (1,6).

There is a significant amount of research that supports the use of music as an ergogenic aid (3–5,7,8,11,14,20,22). It has been previously reported that music might allow an individual to dissociate from exercise (1,9,10,12). The most common positive outcomes when combining music and exercise appear to be decreased ratings of perceived exertion (RPEs), increased performance measures, improved mood, and increased arousal. In contrast, there is research that suggests that music does not elicit an ergogenic effect on performance and that it may even have detrimental effects (6,19). Although the mechanism is still unclear, it has been suggested that music serves as an ergogenic aid by altering focus of attention to external information (17).

The majority of investigations on the effects of synchronous, asynchronous or oudeterous (neutral in terms of motivational qualities) music tend to focus on aerobic rather than on anaerobic exercise, whereas a limited amount of research has examined resistance exercise, demonstrating mixed results (11,18). In addition, nearly all previous studies examining the effects of music on physical and psychophysical measures have used a predetermined selection of music (1,3,5–12,14,15,18,22) in an attempt to find fundamental characteristics that elicit positive responses. However, the individuality and psychological differences of humans suggest that using self-selected music (SSM) may yield the most beneficial effects (13,23). We hypothesize that if the music is individually chosen, it may have a greater effect, regardless of the type of music. Therefore, the purpose of this study was to investigate the effects of SSM on strength, explosiveness, and mood.

Methods

Experimental Approach to the Problem

This study sought to investigate the effects of SSM on strength, explosiveness, and mood during an acute bout of exercise in resistance trained college men. Each subject completed 3 visits. The first was used to obtain the bench press and back squat 1 repetition maximum (1RM). The following 2 experimental visits, which were identical to each other with the exception of SSM being played or not being played, measured bench press reps to failure, squat jump performance, and mood.

Subjects

Twenty men (22.95 ± 1.90 years, 177.57 ± 7.07 cm, 83.85 ± 15.15 kg, bench press 1RM 104.65 ± 19.95 kg, back squat 1RM 134.77 ± 26.02 kg) who were resistance trained (having ≥years of experience in the parallel back squat and bench press exercises) volunteered for this study. Any subject reporting current health limitations or the current use of anabolic steroid supplements was excluded from participation. Before participation, all the subjects read and signed an informed consent document approved by the University Institutional Review Board.

Procedures

To assess the effects of SSM on bench press, squat jump and mood, the subjects completed 2 experimental conditions in a counterbalanced order separated by at least 48 hours and performed on the same time of day. One condition was completed with SSM delivered through ambient speakers measured at 80 dB (Scosche SPL1000F 135DB Max Spl Meter, Oxnard, CA, USA), whereas the other condition had no music (NM). Throughout the experiment, the subjects were advised not to add any new exercises to their current routine and were informed to refrain from exercise, alcohol, or stimulants 36 hours before each visit. To ensure adequate hydration, the subjects drank approximately 1 L of water the night before and 0.5 L of water the morning of each trial. Before the experimental conditions, each subject was instructed to compile a minimum of 1 hour of SSM on a blank CD that they would like to listen to while exercising.

For each condition, the subjects completed a Profile of Mood States (POMS) questionnaire preexercise and postexercise, which quantified their individual levels of fatigue (F), tension (T), vigor (V), anger (A), confusion (C), and depression (D) (16). Rating of perceived exertion was recorded 9 times during each condition using the OMNI Resistance Exercise Scale (21) measuring 0–10 (after warm-up, after each squat jump rep, after each bench press set, and after the completion of the postexercise POMS).

Before the first experimental visit, the subjects reported to the laboratory, and their height was measured in centimeters using a stadiometer (Seca, Ontario, CA, USA), and body mass was measured in kilograms using a digital scale (Ohaus, ES200L, Pine Brook, NJ, USA). The subjects then performed a 5-minute warm-up on a cycle-ergometer (Monark 828E, Varberg, Sweden) at a self-selected workload and cadence. Their 1RM was obtained for the parallel back squat and bench press (counterbalanced order) via a Muscle Maxx squat rack (Power-Systems Fitness Equipment, Knoxville, TN, USA) following National Strength and Conditioning Association guidelines (2), where participants progressively increased resistance after each successful lift until their 1RM was achieved.

When the subjects returned to the laboratory for the first experimental visit, a preexercise POMS was completed, after which they were instructed to warm up for 5 minutes on the cycle ergometer using the same

Table 1. Bench press reps per set and RPE between conditions (mean ± *SD*).*

	Self-selected music	No music
Set 1	14.15 ± 1.95	13.90 ± 1.83
Set 2	7.80 ± 1.67	7.35 ± 1.56
Set 3	3.95 ± 1.46	4.00 ± 1.29
RPE	8.81 ± 1.18	9.06 ± 1.09

*RPE = rating of perceived exertion.

Table 2. Squat jump values for JH, TOV, RVD, rGRF, RFD, and RPE between conditions (mean ± *SD*).*

	Self-selected music	No music	Effect size
JH (cm)	24.65 ± 4.05	24.22 ± 5.20	
rGRF ($N\cdot kg^{-1}$)	12.94 ± 2.61	12.39 ± 2.50	
TOV ($m\cdot s^{-1}$)	2.06 ± 0.17†	1.99 ± 0.18	0.142
RVD ($m\cdot s^{-2}$)	5.92 ± 1.46†	5.63 ± 1.70	0.063
RFD ($N\cdot s^{-1}$)	3,175.61 ± 1,792.37†	2,519.12 ± 1,470.32	0.209
RPE	5.71 ± 1.37	6.36 ± 1.61†	0.310

*JH = jump height; TOV = takeoff velocity; RVD = rate of velocity development; rGRF = relative ground reaction force; RFD = rate of force development; RPE = rating of perceived exertion.
†Significantly greater than other condition.

TABLE 3. Profile of mood states values between time and SSM and NM for F, T, V, A, C and D (mean ± *SD*).*

	Pre-exercise		Postexercise		Condition average	
	SSM	NM	SSM	NM	SSM	NM
F	2.45 ± 2.56	3.55 ± 3.39	8.65 ± 4.49†	7.40 ± 4.38		
T	6.45 ± 2.96	4.50 ± 3.37	10.35 ± 5.02	7.65 ± 3.16	8.40 ± 3.99†	6.07 ± 3.26
V	21.15 ± 5.88	18.10 ± 6.47	19.15 ± 5.28	16.80 ± 5.22	20.15 ± 5.58†	17.45 ± 5.84
A	2.35 ± 1.89	2.00 ± 2.47	5.00 ± 4.69	3.05 ± 4.29		
C	3.05 ± 2.50	3.10 ± 2.42	3.70 ± 2.45	3.60 ± 2.62		
D	0.50 ± 1.23	0.85 ± 1.38	1.90 ± 2.67	1.60 ± 3.56		

*SSM = self-selected music; NM = no music; F = fatigue; T = tension; V = vigor; A = anger; C = confusion; D = depression.
†Significantly greater than the NM condition.

procedure as that on the 1RM day. Immediately after the warm-up, the subjects performed either 3 sets of the bench press exercise or 3 squat jump reps (counterbalanced order). The bench press consisted of 3 sets at 75% 1RM for reps to failure with 2 minutes rest between sets. Failure was determined when the bar traveled in the down direction during the concentric phase. The squat jump consisted of 3 reps at 30% back squat 1RM with 1 minute rest between reps. All the jumps were performed on an AMTI force plate (Advanced Mechanical Technology, Inc., Watertown, MA, USA) measuring jump height (JH), takeoff velocity (TOV), rate of velocity development (RVD), relative ground reaction force (rGRF), and rate of force development (RFD) were all measured via the force plate. Squat jump data were sampled at 1,000 Hz and analyzed by custom LabVIEW software (version 7.1, National Instruments Corporation, Austin, TX, USA). At the end of each experimental visit, they completed a postexercise POMS. During the second experimental visit, the condition not performed in the first visit was used. On the SSM visit, their music was played during the preexercise POMS and continued throughout the condition until the completion of the postexercise POMS.

Statistical Analyses

Descriptive statistics were calculated for all variables and intraclass correlation coefficients (ICCs) were calculated for bench press and squat jump reliability. A 2 × 9 (condition × time) repeated measures analysis of variance (ANOVA) was used to analyze RPE. Six 2 × 2 (condition × time) repeated measures ANOVAs were used to analyze POMS scores of F, T, V, A, C, and D. Five 2 × 3 (condition × rep) repeated measures ANOVAs were used to analyze squat jump JH, TOV, RVD, rGRF, and RFD. A 2 × 3 (condition × set) repeated measures ANOVA was used to analyze bench press reps to failure. The Statistical Package for the Social Sciences (SPSS 19.0 for Windows, SPSS, Inc., Chicago, IL, USA) was used for all analyses, and Alpha was set a priori at 0.05 for significance.

RESULTS

Bench press reps to failure (ICC, 0.81) and RPE during bench press revealed no interactions or main effects (Table 1).

Squat jump revealed no interactions or main effects for JH (ICC, 0.95) or rGRF (ICC, 0.93). However, TOV (ICC, 0.84), RFD (ICC, 0.72), RVD (ICC, 0.93), and RPE all exhibited a main effect for condition. One-way ANOVA demonstrated that TOV, RFD, and RVD were greater for SSM, whereas RPE was greater for NM (Table 2).

The POMS scores revealed an interaction of condition and time for fatigue. This was followed-up by two 1 × 2 ANOVAs for each time between conditions, which revealed no difference in the preexercise POMS, but fatigue was significantly greater postexercise in SSM compared with that for NM. There was also a main effect of condition for tension and vigor with both being greater for SSM compared with NM. There were no interactions or main effects for anger, confusion, or depression (Table 3).

DISCUSSION

The purpose of this study was to investigate the effects of SSM on strength, explosiveness, and mood during the bench press and squat jump exercises. The primary findings were that SSM increased squat jump explosiveness and feelings of vigor, tension, and fatigue. In contrast, squat jump RPE was greater for NM. Bench press reps to failure and associated RPE were not different between conditions. Therefore, the use of SSM might enhance acute power performance.

A previous study by Karageorghis et al. (11) investigated different types of predetermined music on grip strength. They used stimulative and sedative music in which stimulative music was characterized by 134 b·min^{-1}, whereas sedative music measured 90 b·min^{-1} and found stimulative music to have a positive effect on strength. Our current study allowed the subjects to listen to SSM while performing a bench press strength exercise, and we found no advantage. A possible explanation for this might be that the SSM chosen by our subjects was not stimulative enough to overcome the physically taxing demands of a prolonged strength exercise.

In a study conducted by Lim et al. (15), the subjects completed three 10-km cycling time trials on an ergometer in a control condition, or music delivered from 0 to 5 km or music delivered from 5 to 10 km. The subjects reported no difference in RPE, interpreting all the trials as being equally difficult. As in our current study, the subjects reported no difference in the bench press RPE between conditions, which may have been so because of the extended length and intensity of the exercise.

We found SSM to have a positive effect on squat jump TOV, RVD, and RFD. Our findings are similar to that of Eliakim et al. (8) who used the Wingate Anaerobic Test to measure power of elite adolescent volleyball players. Their subjects were exposed to arousing predetermined music characterized by 140 $b \cdot min^{-1}$ for 10 minutes before performing the Wingate test, and they found increased peak anaerobic power in the first 5 seconds. Based on these results, it appears that motivating and or SSM may be beneficial during acute explosive, high-intensity exercise.

Previous research suggests that listening to music while exercising provides dissociation from the fatigue and discomfort that is inherent with exercise (1,9,10,12) by altering the focus of attention to the external information (17). Similar to the findings of Hayakawa et al. (10), our subjects reported having increased vigor with SSM compared with that in NM. Our subjects also reported greater tension during the SSM condition compared that in NM while reporting no difference in anger, confusion, or depression between conditions. Different from the findings of Hayakawa et al. (10), feelings of fatigue in our study were greater in the SSM condition postexercise. This might be partly explained by our study showing increased squat jump explosiveness, which suggests that the subjects were exercising at their maximal level during the SSM condition. Therefore, the increased feelings of fatigue might have been associated with the greater performance measures, which were related to the dissociative focus of the attention effect of the SSM as evident in their feelings of increased vigor.

Because the mechanism as to why the use of music may improve performance is still unclear, some research has suggested varied arousal levels or motivational factors. Ferguson et al. (9) examined the effects of positive and negative music on performance of a karate drill. They had subjects perform a kata after a 1-minute exposure to positive music, negative music, or white noise. Their results revealed a greater performance on exposure to music with there being no differences between positive or negative music conditions. Postexperimental evaluation of the subject's self-perceived performance indicated that 11 subjects felt more comfortable and 10 subjects felt more relaxed after listening to music.

Another study evaluated weightlifters for 6 months to 3 years while they listened to music during training (14). Weightlifters were asked about their attitude toward training; mood, quality of work, general state at the beginning of training, general state at the end of training, intensity of training, and satisfaction with training. The results indicated that 89% of the weightlifters improved the quality of their training with the accompaniment of music, with 97% increasing the volume, and 98% increasing the intensity.

In conclusion, many studies have examined the potential benefits of incorporating music into exercise, but this study is one of the few to demonstrate improved anaerobic performance. SSM was able to alter mood and enhance acute explosive physical performance while decreasing perceived exertion, yet it had no effect on reps to failure in a multiple-set strength exercise. This incongruity of results should be further investigated by having subjects self-select music specifically for either a strength or power exercise.

Practical Applications

Enhancing performance is a common goal for strength and conditioning specialists, coaches, and athletes. Our study demonstrates that SSM alters mood state, and it increases acute explosive performance but provides no change in strength training. Therefore, those interested in increasing explosive exercise performance might want to allow athletes to use SSM to enhance acute power.

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