Explicit Music Lyrics Improve Psychological Responses to Endurance Exercise but Not Performance

Original Research

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Abstract

Introduction: Music has been repeatedly shown to impart ergogenic and psychological benefits (e.g., motivation, enjoyment) during aerobic and anaerobic exercise. Recently, our lab showed that explicit lyrical content in music results in improved performance and imparts psychological benefits during weightlifting exercise. However, it is unknown if these effects translate to other modes of exercise, such as endurance activities. The purpose of this study was to examine the effects of explicit vs censored music on psychological responses and performance during endurance rowing exercise.

Methods: In a counterbalanced crossover manner, physically active females (n=15) completed a 2000-m time trial under 2 different conditions: censored music (CENS) and explicit music (EXP). Time to completion (TTC), power output, heart rate (HR), motivation, enjoyment, and rating of perceived exertion (RPE) were collected. Visits were separated by at least 48 hours and standardized for time of day.

Results: Findings show that TTC (p=0.078; d=0.48), power output (p=0.092; d=0.46), HR (p=0.883; d=0.03), and RPE (p=0.685; d=0.10) were unaltered during exercise regardless of condition. Motivation (p= 0.004; d=0.88) and enjoyment (p= 0.013; d=0.73) levels were higher during the EXP condition compared to CENS.

Conclusions: Findings suggest that EXP had no impact on endurance exercise performance compared to CENS. However, EXP resulted in enhanced motivation and enjoyment during exercise versus CENS. Thus, listening to EXP music may serve as a practical means to improve psychological responses to endurance exercise.

Key Words: Rowing, Motivation, Enjoyment, Censored music

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Introduction

The presence of music has been well established to impart ergogenic and psychological benefits (e.g., motivation, enjoyment, arousal) during a myriad of exercise modalities [1-4]. However, the complexity of varying musical characteristics is often underappreciated as differences in tempo, genre, volume, and lyrical content may elicit varied responses or determine ergogenic potential [3-9]. In regard to lyrical content, some research has suggested that the presence of lyrics may mediate the ergogenic potential of music during exercise [6,10]. However, there is a paucity of evidence regarding the alteration of how specific lyrical content may influence the ergogenic effects of music. The inclusion of explicit language in music lyrical content is evident in contemporary music, but little is known about how the modification of explicit content in music affects exercise performance.

The majority of research examining explicit language in the context of exercise has been through word verbalization and is thought to be underpinned by psychological mediators [11]. For example, Jiannine et al. showed that repeating explicit words during push-ups to failure and isometric wall sit exercises resulted in enhancement of muscular endurance [12]. Further supporting this, other investigations have similarly shown ergogenic benefits during sprint exercise [13]. Explicit language verbalization may also improve motor coordination and dexterity prior to physical tasks [14]. Improvements to exercise performance and motor processes with explicit language verbalization have been largely attributed to improvements in psychological responses [11,14]. Indeed, verbalization of explicit language has been suggested to serve as a psychological "warm-up" which may lead to improvements in mood, psychological arousal, and dissociation [15-18]. While intriguing, evidence suggests distinct differences in responses to explicit language when verbalized or heard from an external source [19]. Thus, it remains largely unknown how explicit lyrics in music may impact psychological responses and performance during exercise.

To date, few studies have investigated how lyrical alterations in music, especially those with explicit content, affect endurance exercise performance. Sanchez et al. showed that cycling cadence increased during cycling trials with lyrical music versus instrumental [10]. Furthermore, psychological responses during exercise have been shown to be altered with the presence of lyrics in music as evidenced by lower ratings of perceived exertion [20]. Regarding explicit lyrics in music, a recent study revealed that removing explicit lyrics from music results in worsened free-weight bench press performance and psychological responses to exercise, including arousal and motivation [6]. While intriguing, it is currently unknown if these effects translate to other exercise modalities such as endurance-based exercise where effort is expended over a longer period of activity. Furthermore, only males were studied, leaving it unclear if this translates to females. Sex specific differences in responses to music have been well-established and show that females may experience greater ergogenic effects than male counterparts during high intensity exercise [21]. Although mechanisms are largely unknown at this point, recent evidence suggests that males and females may respond differently, particularly in psychological domains, to explicit language which may be dependent on method of delivery suggesting the need for more sex specific study in this context [11,19]. Given recent findings on the vocalization of explicit language and the known ergogenic effects of music, understanding the role of explicit lyrical content in music and its potential ergogenic and psychological effects during endurance exercise is relevant, especially because explicit content is prevalent in contemporary music. Therefore, the purpose of this study was to investigate the effects of censoring explicit lyrical content on rowing endurance performance and psychophysiological responses to exercise in physically active females. We hypothesized that censoring explicit lyrical content would worsen performance and psychological responses to exercise compared with explicit lyrical music.

Methods

Study Design

This investigation utilized a randomized crossover counterbalanced design. Participants completed 2 separate study visits each with a different experimental music condition: explicit music (EXP) and censored music (CENS). For each visit, participants completed a standardized warm-up followed by a 2000-meter rowing exercise time trial while listening to a corresponding music condition. During the exercise bout, time to completion (TTC), power output, heart rate (HR), rating of perceived exertion (RPE), motivation, and enjoyment were recorded. Comparisons were drawn between music conditions. Study visits were standardized to the same time of day separated by at least 48 hours.

Participants

To calculate an adequate sample size, a priori power analysis was conducted using G*Power software (v 3.1) [22]. Previous work from our lab showed improvements in muscular endurance during bench press while listening to EXP versus CENS with an effect size of d=0.9 [6]. Thus, the power calculation was conducted using the following parameters: effect size (d)= 0.9, test= paired samples t-test, alpha= 0.05, and power= 0.8. This yielded an approximate sample size of n=12. To account for a possible attrition rate of 20% and to remain in accordance with sample sizes of previous literature, we recruited 15 participants in the study. No attrition occurred and fifteen physically active females (age= 23 years ± 5, height= 168 cm ± 27, body mass= 63 kg ± 8) completed the study. Inclusion criteria included being a female aged >18 years, being physically active (≥ 150 minutes per week moderate-vigorous activity [23]), having no chronic health conditions, and having no injuries in the past 6 months. Participants completed a physical readiness questionnaire to screen for safety of exercise participation and were asked to refrain from caffeine, nicotine, and pre- or post-workout supplements 12 hours prior to each study visit [23]. Participants were additionally asked to maintain similar dietary and sleep habits prior to each visit. Verbal and written consent were obtained for each participant, and

all experimental procedures were conducted in accordance with ethical approval by the University of Alabama at Birmingham Institutional Review Board (IRB) (UAB IRB-300014808; 15 July 2025).

Music Conditions

Participants completed music selection as previously described by Ballmann and Porrill et al. [6]. Briefly, participants were given a predetermined list of songs with explicit lyrics from different genres and asked to select one song from the playlist, which was subsequently used in both conditions. All lyrics, including explicit lyrics, were included in the EXP condition, and explicit lyrics were censored for the CENS condition in accordance with the U.S. Federal Communications Commission guidelines on the Broadcast of Obscenity, Indecency, and Profanity. Censored lyrics resulted in a "muting" of the language for the given explicit words in the song. Music was played via Bluetooth headphones (Apple Inc., Cupertino, CA, USA) from a single electronic device, and the predetermined music had a minimum tempo of 120 beats per minute. A standardized volume was used across all participants and conditions to minimize external effects.

Protocol

The rowing exercise bout was completed as previously described by Nixon et al. [5]. On the first visit, correct rowing form was demonstrated by researchers and participants were given a short familiarization (2-3 rowing pulls) to rowing form which was corrected as needed. Participants attended one session per music condition, for a total of two sessions: EXP and CENS. Each visit was separated by at least 48 hours, and participants were fitted with a Polar HR strap to track HR during the exercise bout. A warm-up consisting of 5 minutes on a rowing ergometer at 20 strokes per minute was conducted. After the warm-up, participants were instructed to row 2000 meters as fast as they could while listening to either EXP or CENS. Power output, HR, and RPE (1-10 scale) were recorded every minute during the exercise bout. Because participants could not hear the data collector during the exercise bout, the data collector pointed to an RPE scale each minute, and participants reported their RPE aloud. After completion, TTC was recorded, and participants were asked to indicate their motivation and enjoyment levels along a 100-mm line, ranging from no motivation/enjoyment to extreme motivation/enjoyment. Foot positioning and resistance for the rowing ergometer were standardized for all participants. Participants were also blind to all recorded measurements during and after the exercise bout.

Statistical Analysis

All data were analyzed using open-access Jamovi software (v 2.3.28.0) and are displayed as mean ± standard deviation (SD) [24,25]. Data normality was confirmed using the Shapiro-Wilk method. A paired-samples t-test was utilized to detect differences for all variables between conditions. Estimates of effect size were determined using Cohen's D analysis and interpreted as <0.5- small, 0.5-0.8 moderate, and >0.8 large [26,27]. Statistical significance was set at $p \leq 0.05$.

Results

Performance Outcomes

Findings of TTC (s) and power output (watts) are shown in Figure 1. For TTC (Figure 1a), there were no significant differences between CENS and EXP conditions (CENS=660.9 s ± 99.2, EXP=674.7 s ± 106.2; $p=0.078$; $d=0.48$). Similarly, no significant differences were noted for power output (Figure 1b) between CENS and EXP conditions (CENS=86.8 watts ± 35.0, EXP=82.2 watts ± 36.3; $p=0.092$; $d=0.46$).

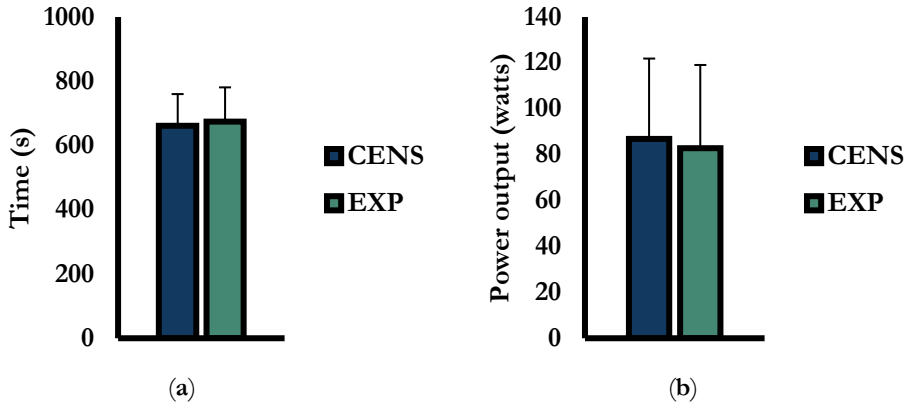

Figure 1. Comparisons of levels of (a) time to completion (TTC; seconds; s) (b) power output (watts) between censored lyrical music (CENS; blue bars) and explicit lyrical music (EXP; green bars) conditions. Data are presented as mean ± SD.

Exercise Intensity Outcomes

Findings of heart rate (bpm) and RPE (arbitrary units, a.u.) are shown in Figure 2. For HR (Figure 2a), there were no significant differences between CENS and EXP conditions (CENS=154.1 bpm ± 23.1, EXP=153.8 bpm ± 19.8; p=0.883; d=0.03). Similarly, no significant differences were noted for RPE (Figure 2b) between CENS and EXP conditions (CENS=5.0 a.u. ± 1.1, EXP=5.1 a.u. ± 1.4; p=0.685; d=0.10).

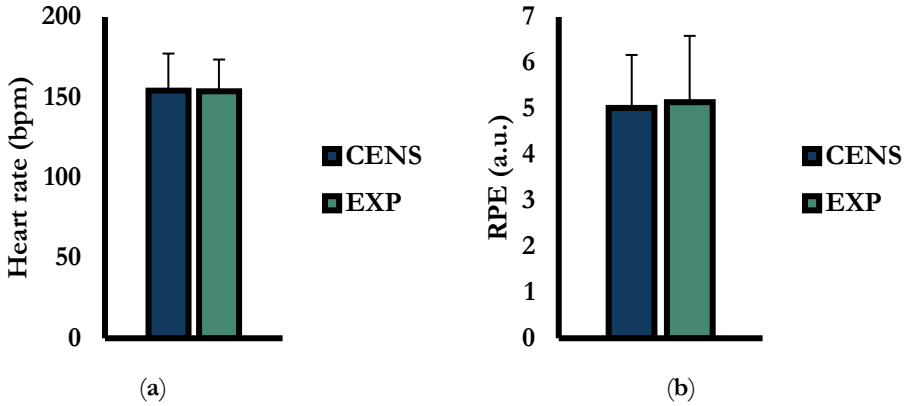

Figure 2. Comparisons of levels of (a) heart rate (beats per minute; bpm), (b) rating of perceived exertion (RPE; arbitrary units; a.u.) between censored lyrical music (CENS; blue bars) and explicit lyrical music (EXP; green bars) conditions. Data are presented as mean ± SD.

Psychological Outcomes

Levels of motivation (arbitrary units, a.u.) and enjoyment (arbitrary units, a.u.) are shown in Figure 3. For motivation (Figure 3a), the EXP condition resulted in significantly higher motivation versus CENS (CENS=68.9 a.u. ± 17.9, EXP=81.2 a.u. ± 8.5; p=0.004; d=0.88). Likewise, for enjoyment (Figure 3b), the EXP condition produced higher feelings of enjoyment compared to CENS (CENS=69.2 a.u. ± 15.5, EXP=77.8 ± 14.4; p=0.013; d=0.73).

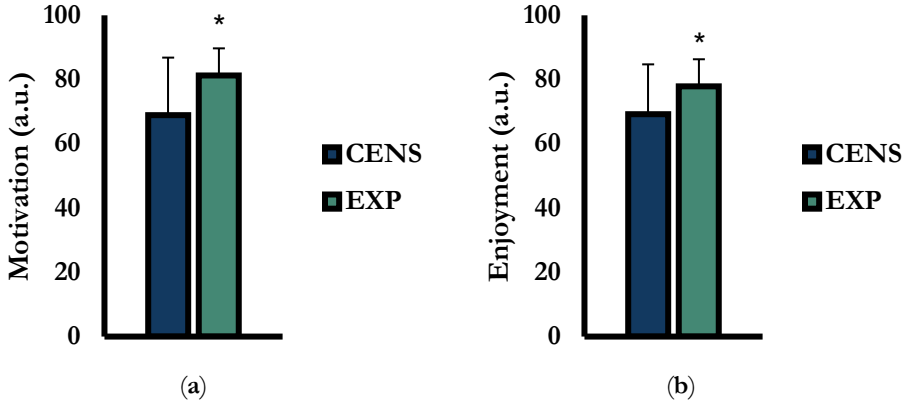

Figure 3. Comparisons of levels of (a) motivation (arbitrary units; a.u.), (b) enjoyment (arbitrary units; a.u.) between censored lyrical music (CENS; blue bars) and explicit lyrical music (EXP; green bars) conditions. Data are presented as mean ± SD. * indicates significantly different from CENS (p<0.05).

Discussion

Censoring explicit lyrics has been previously shown to result in worsened psychological outcomes and bench press performance in resistance-trained men [6]. However, it is unknown if this translates to other modes of exercise such as

endurance-based activities. Thus, the purpose of this study was to identify if censoring explicit music lyrics alters endurance performance and psychological responses in physically active females. Current findings reveal that censored music did not result in changes to markers of endurance exercise intensity or performance outcomes. However, censoring explicit lyrics resulted in a worsening of psychological levels of motivation and enjoyment. While precise mechanisms underlying psychological changes are not fully explainable by current findings alone, these data suggest that censoring lyrics in music may worsen some psychological responses to exercise even without concomitant changes in endurance exercise performance.

Current findings show that markers of exercise performance and intensity, such as time, power output, heart rate, and RPE were unaltered between CENS and EXP music conditions which is in contrast to recent findings by Ballmann and Porrill et al. [6]. Indeed, Ballmann and Porrill et al. showed that listening to censored music resulted in lower repetition volume during bench press exercise versus explicit, albeit velocity remained unchanged. Although disparities in findings are not fully clear, there are multiple rationales for the differences. First, lack of performance changes currently observed versus previous findings may manifest in differing mode and duration of exercise. For example, previous evidence examined the effects of verbalizing explicit versus neutral language on exercise performance and found that resistance-based and sprint exercise was enhanced, but no differences were found for endurance running [12,13,16]. Furthermore, previously reported exercise bouts were short in duration (<30 s) whilst the current endurance rowing protocol was considerably longer and endurance based. It is plausible that the benefits of explicit lyrical music may be more potent during acute explosive exercise rather than endurance exercise due to the acute transient effect of music-induced increases in psychological arousal. Multiple investigations have shown music-induced enhancement of acute psychological arousal during explosive exercise, likely suggesting a music-induced "psyching up" effect [6,28]. Bolstering this, listening to music considered stimulative has been widely suggested to result in acute heightening of sympathetic activity and catecholamine release [1,2,28]. Given the extended nature of the current endurance-based rowing exercise, it is possible that previously reported "psyching up" effects induced by explicit lyrical music may have extinguished or lost ergogenic potency early in the exercise bout leading to negligible effects on performance.

It is also possible that disparities in findings were due to sex differences, although underpinning mechanisms remain elusive. For example, Washmuth et al. showed that explicit language in verbal encouragement during exercise affected male but not female performance [19]. This is further supported by previous evidence suggesting sex differences in explicit language usage whereby males tended to use more explicit language than females [29-31] . While multiple hypotheses have been suggested as explanations for sex differences in regard to explicit language, there is currently little to no relevant evidence to substantiate potential sex-dependent responses to explicit language in music during exercise. Since the benefits of using explicit language have been purportedly linked to social and societal norms, it is possible that differences in norms experienced by males and females affect attitudes and responses to explicit language in music [31]. However, this is speculative and not fully supported as females in the current investigation saw psychological benefits with explicit lyrical music similarly to male counterparts as previously reported [6].

Although no performance changes were noted, current findings showed improved feelings of motivation and enjoyment with explicit versus censored lyrical music. This supports previous findings in resistance-trained males showing higher motivation and psychological arousal levels during bench press with explicit music versus censored [6]. This further suggests explicit-lyric mediated enhancement of motivation and enjoyment during exercise may be more sustaining and persist throughout exercise versus potential transient effects of ergogenic potential. Furthermore, previous music preference studies utilizing an endurance rowing mode of exercise showed psychological benefits (e.g. motivation) in the absence of changes in rowing performance [5]. While not confirmed currently, a potential underpinning mechanism for psychological benefits of explicit lyrical music may be due to changes in emotional state or affect throughout the exercise [32]. Indeed, the verbalizing explicit language has been suggested to alter emotional responses, presumably through alterations in activation of brain regions responsible for emotional regulation (e.g. amygdala) [11,33]. Listening to music has also been suggested to mediate emotional arousal and motivational pathways which may lead to improved motivational state and feelings of enjoyment [2,34]. However, the translation of these mechanisms to current findings are largely speculative. Despite the lack of changes in performance, improvements in psychological responses may still hold important implications. Greater feelings of motivation and enjoyment have been suggested to be favorable for enhancing acute exercise volume, whereby participants may be able to complete higher levels of work with greater duration [35,36]. Higher levels of enjoyment during exercise also have been linked to improved adherence to exercise training programs [37,38]. Given the acute nature of the rowing time trial currently used for exercise assessment, the potential utility of long-term benefits of explicit music may have been elusive and will require longitudinal approaches in future studies.

Although the current investigation presents novel findings in the context of censoring lyrical music and responses to exercise, there were a number of limitations. First, the lack of inclusion of a condition without music in the results may limit some conclusions as definitive comparisons were only made between EXP and CENS music. Thus, it cannot be determined if EXP or CENS music is any worse or favorable than silence alone. However, it should be noted that in general, the body of literature supports the efficacy of music in modifying responses to exercise when compared to no music at all [2]. Another possible limitation is that the current study did not account for preference, expectancy, or history of listening to EXP or CENS music during exercise. It is possible that habituation or expectancy of lyrics may vary by individual or become desensitized to the language overt time and thus altered responses to the EXP or CENS music [15]. Lastly, only female participants were included in the study. Previous evidence supporting the efficacy of EXP music on exercise performance was conducted solely in males. It is possible that males and females respond differently to EXP or CENS music during exercise but definitive conclusions on this cannot be drawn from current data alone.

Conclusions

In conclusion, censoring explicit language in music does not appear to alter endurance performance in physically active females. However, censored music led to lower motivation and enjoyment during exercise, suggesting that explicit lyrics impart psychological benefits to exercise responses. From a practical standpoint, censoring explicit language in music may negatively impact psychological aspects of training which could have consequences on exercise adherence. However, longitudinal studies with larger and more diverse samples are needed to confirm this.

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Conflict of Interest. The authors declare no conflicts of interest.

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