

An investigation into the acute effect of exercise on physiological and psychological responses to musical performance

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Musicians experience anxiety and stress as an occupational hazard. Various approaches are available to the individual that may mitigate perceptions of excessive anxiety. Acute exercise (EX) has been shown to reduce the level of psychological and physiological response to laboratory stressors, although its impact on music performance anxiety (MPA) is less clear. Twelve classically trained musicians completed a baseline familiarization session, with 20 minutes of EX and quiet rest (NEX) in a counterbalanced order prior to a performance, videoed as part of a performance competition. Cardiovascular measures (heart rate [HR], heart rate variability [HRV], and blood pressure) were collected at baseline, pre-, during, and post-performance. Anxiety and self-reflective performance ratings were collected pre- and post-performance. EX reduced HR reactivity significantly during and post-performance, but not prior to performance. HRV showed signs of vagus withdrawal during and post-performance in EX. Blood pressure changes and anxiety were not significantly different between conditions, nor were reflective appraisals with the exception of “importance of winning the competition,” which was lower in EX. Acute exercise appears to alter cardiovascular responses to a musical performance, although not how individuals perceive anxiety.

Keywords: musical performance; exercise; anxiety; cardiovascular

Musical performance has long been associated with elevated levels of anxiety and stress (Fishbein *et al.* 1988), and studies have identified various elevated physiological responses to these events (Abel and Larkin 1991, Valentine *et al.* 1995). While some of these responses may be adaptive, extreme levels may

impact the performance experience for the musician and the listener. Acute exercise has been shown to impact physiological and psychological responses to laboratory stressors (Probst *et al.* 1997, Steptoe *et al.* 1993), but there is limited evidence using a psychosocial real-world stressor such as musical performance. Four studies have utilized speech preparation/performance as a parallel to a real-life stressor (Bartholomew 2000, Ebbesen *et al.* 1992, Rejeski *et al.* 1992, Steptoe *et al.* 1993), with some evidence that acute exercise alters individuals' responses to the stressor. This study evaluated the effect of 20 minutes of acute exercise on the psychological and physiological responses of classical musicians to an assessed performance.

METHOD

Participants

Twelve classically trained musicians (2 men with mean age=22 ± 1 years, 10 women with mean age=23 ± 2 years) with an average 17 years of musical experience took part in the study. The participants were either violinists (n=3) or pianists (n=9). All provided consent to take part, and there were no drop-outs.

Materials

State anxiety was assessed using the short, 10-item version of the original 20-item State Anxiety Inventory (SAI, Spielberger *et al.* 1983) due to its suitability for repeat-measures as required in this protocol.

Self-reflective ratings of the importance of the performance situation and confidence were obtained prior to the performance using six questions, each with a visual analogue scale. The questions assessed the importance that the musicians placed on playing in general and on the forthcoming performance, as well as the importance they attached to winning the competition in which they were about to take part. Their perceived self confidence in their general musical ability and in their ability to win the competition was also rated, as was their satisfaction with their pre-performance preparation.

Procedure

Participants completed four sessions: (1) a baseline fitness and laboratory stressor assessment, (2) a protocol familiarization session, (3) 20 minutes of exercise at 70% HR_{max} pre-performance (EX condition), and (4) 20 minutes of quiet rest control pre-performance (NEX condition). Exposure to the EX and NEX conditions was counterbalanced across individuals. Heart rate (HR),

heart rate variability (HRV), and blood pressure were measured pre-, during, and post-performance, while state anxiety was measured pre- and post-performance. The reflective ratings were obtained pre- performance. After the second performance, they selected the recording that they preferred (EX or NEX) to be entered into a competition where performance quality was to be evaluated. Seven participants chose their NEX performance, while five their EX performance.

RESULTS

HR reactivity to the musical performance was significantly lower in EX than in NEX ($F_{2,22}=21.12$, $p<0.001$). Post-hoc analyses (with Bonferroni correction) revealed that there was significantly higher reactivity in the NEX condition during musical performance ($p<0.05$) and post-performance ($p<0.05$) but not pre-performance (see Figure 1). High frequency HRV was significantly lower in the EX condition in pre- versus during performance ($Z=2.67$, $p<0.01$) and pre- versus post-performance ($Z=3.06$, $p<0.01$). However, no differences in blood pressure response between EX and NEX conditions were observed.

Anxiety, as assessed through the SAI, was lower pre- and post-performance in the EX condition, although not significantly so from the NEX condition. Reflective ratings were lower in EX, with the “importance of winning the competition” reaching significance ($t_{11}=2.63$, $p<0.05$).

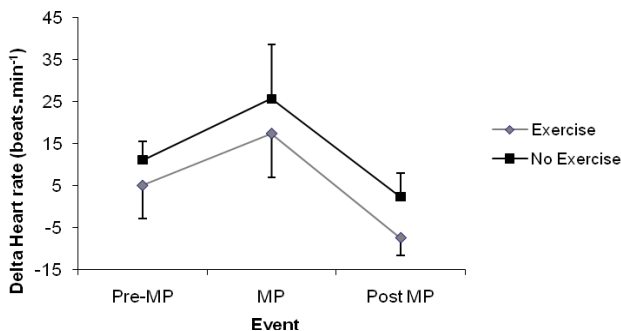


Figure 1. Mean and standard deviation of heart rate reactivity during experimental events by condition.

DISCUSSION

A 20-minute bout of exercise alters the HR during and after but not prior to a musical performance, demonstrating some agreement with other psychosocial stressors (Bartholomew 2000, Ebbesen *et al.* 1992, Rejeski *et al.* 1992, Steptoe *et al.* 1993). However, blood pressure alterations were not observed in tandem with these changes, suggesting that vascular adjustments are distinct to stressor types as reported by, among others, Bongard *et al.* (1997), Prkachin *et al.* (2001), and Suarez *et al.* (1993). A reduction in reactivity is generally seen as desirable, but in combination with the reduced HRV, the effect appears to be caused by vagus withdrawal which is not considered an indication of relaxation (Long and Verrier 1976, Tsuji *et al.* 1996). The trend for lower state anxiety in the EX condition may be welcome, but the concomitant reduction in importance attached to winning the competition may suggest that exercise interfered with musicians' normal behavior; however, after reviewing their performance recordings, five of the participants chose the EX performance, which suggests an alternative view to this. Overall, there appears to be support for further investigation of the effects of acute exercise on the physiological and psychological responses of musicians to performance.

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