The Effect of Music on the Cortisol Response to Endurance Exercise

Haley Olcott
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Mentor: Brad Smith
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Abstract

Concentrations of cortisol, a glucocorticoid stress hormone, increase when the body is introduced to both physical and psychological stress, and is therefore often used to infer levels of stress. Music has been found to lower perceived levels of stress. This experiment studied the effect of music, including different music genres, on the cortisol response in endurance athletes. Cross-country running athletes participated in three treatments in which they ran a four-mile course listening to an upbeat hip-hop rap playlist, a slow acoustic soft rock playlist, or a control run with no music. Salivary cortisol levels were determined for each participant both before and after the run. One-way ANOVA and Tukey Pairwise comparison analysis revealed no significant change in the cortisol response among any of the treatments (P=0.507).

Keywords: cortisol, stress, endurance athletes, cross-country running,

Introduction:

Cortisol is a glucocorticoid stress hormone that functions in energy metabolism (Skoludaa et al. 2012), immune system regulation (Palacios and Sugawara 1982), and suppression of inflammatory systems (Bradley et al. 1980). Blood cortisol levels fluctuate on a circadian rhythm, reaching their peak early in the morning and a lower second peak later in the evening. Levels are typically higher during the day where more stressors are encountered (Florant and Weitzman 1980). When an organism encounters a psychological or physiological stressor, cortisol is released from the adrenal glands (Skoludaa et al. 2012) to sustain elevated serum glucose levels, which can aid an organism in their flight-or-fight response (Leach and Taylor 1980).

Endurance exercise such as running or cycling at a high intensity can cause a significant increase in cortisol levels in athletes (Skoludaa et al. 2012). In an exercise session, both the level and duration of physical activity affect how much cortisol levels are increased (Robson et al. 1999). Vigorous physical activities cause significant increase in cortisol (Gerber et al. 2013). Additionally, longer workouts increase cortisol levels more than shorter workouts, even if the shorter workout is at a higher intensity (Robson et al. 1999).
When exposed to stressors, anxiety levels decrease when the subject is listening to specific types of music (Labbe et al. 2007). A correlation between a decrease in post-psychological stress cortisol levels and listening to music (Khalfa et al. 2003). Furthermore, the monotony of is less when listening to music (Ladenberger-Leo 1986) Athletic performance is enhanced (Edworthy and Waring 2006) if the music is synchronized with the movements of the workout (Schwartzmiller 2003). Enhanced athletic performance occurs regardless of the genre or preference of the music (Simpson and Karageorghis 2006). Self-selected and classical music lowers stress levels more than heavy metal suggesting that not all genres of music may elicit equal responses (Labbe et al. 2007). In general, music increases endurance performance, lowers perceived exertion (Copeland and Franks 1991), and lowers stress levels in all activities (Kreutz et al. 2004). The genre, tempo, or preference of the music may have a significant influence. The purpose of this study was to look at the effects of various genres of music on the cortisol response in endurance exercise.

Methods:

The Institutional Review Board of BYU-Hawaii approved the methods of this experiment. Six female volunteers from the Brigham Young University-Hawaii Cross Country team, between the ages of 18 and 22 participated in this study. The fitness level of each volunteer was determined using a Modified Cooper test (Protocol). Based upon their VO2 max level, each participant was assigned a set pace in order to ensure equal effort levels. Two music playlists were prepared; a soft, easy listening music playlist, and an upbeat, energizing playlist. Over two weeks, each participant ran three four-mile runs, one with each playlist, and a control run without any music. To test cortisol levels, saliva samples were taken before and after each run, and cortisol levels were determined using a Salimetrics assay.
kit. Statistical significance between and among music and without music groups was examined by One-way ANOVA and post-hoc Tukey Pairwise comparisons tests.

Results

The average reported cortisol levels prior to running were 1.206 ± 0.472, 1.352 ± 0.376, 1.263 ± 0.428 for the control of no music, slow playlist, and fast playlist treatments respectively. Post running average cortisol levels were 1.356 ± 0.567, 1.688 ± 0.173, and 1.413 ± 0.507 for the control of no music, slow playlist, and fast playlist treatments respectively. However, a one-way ANOVA revealed no statistically significant differences among treatments (p=0.507), and Tukey Pairwise comparisons found no statistically significant differences (p>0.05) between treatment pre and post cortisol levels.
Discussion

There was no significant change in salivary cortisol concentration levels between the control run, and the slow and fast music playlists. The lack of significant change suggests that music does not have an effect on the rise of cortisol concentration levels during physical stress. Studies following the effect of music on stress levels often determine stress based upon perceived stress levels. The lack of effect on the rise of salivary cortisol concentration levels may suggest that the effect of music only affects the perceived stress, and not the concentration of cortisol, a stress hormone. However, the fact that no significant difference was reported in the control pre and post cortisol levels indicates that the exercise was not extensive enough to cause a measurable cortisol stress response. Therefore, if no measurable cortisol response was observed in the control it is unlikely that it would have been observed in the treatments with music, thus limiting the ability of this study to draw meaningful conclusions about the relationship between cortisol stress levels and music. The sample size of this study may have also been a factor. Future experiments should utilize both longer and more vigorous physical activities to ensure an increased cortisol response in participants (Robson et al. 1999, Gerber et al. 2013).
Works Cited


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