THE EFFECT OF MUSIC TEMPO ON ENDURANCE TRAINING AND AEROBIC PERFORMANCE

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INTRODUCTION: Music has been shown to positively impact endurance performance for athletes (Szabo et al., 1999; Bigliassi et. al, 2016; Biagini et. al, 2012; Eliakim et. al, 2007; Waterhouse, Hudson, & Edwards, 2009). Furthermore, the literature states that heart rate (HR) is unaffected by music (Nakamura, Pereira, Papini et. al, 2010; Dyrlund & Wininger 2008; Yamashita et. al, 2006; Jarraya, Chtourou, Aloui et. al, 2012; Karageorghis, Jones & Low, 2006). There have been many tests studying the impact of music on performance, however, few have evaluated the applied effects of music tempo on endurance performance (Biagini et. al, 2012; Eliakim, Eliakim, Meckel, & Nemet, 2007). Therefore, the aim of this study was to determine the effect of music tempo using self-selected music on running distance performance in recreationally trained athletes.

METHODS: Eleven recreationally trained female soccer players (19.50±1.10y; 164.1±5.40 cm; 64.30±10.90 kg; 23.0±7.20 %BF) were assessed over three different conditions as previously described (Brownley, McMurray, & Hackney, 1995; Karageorghis, Jones & Low, 2006). The three conditions were no music (CONT), moderate tempo (MOD: 110-120bpm), and high tempo (HIGH: 145+ bpm). Each condition used a 12 Minute Cooper Test (12MCT) around a 183-meter perimeter artificial turf field (Figure 1) to evaluate endurance distance performance. This field test was chosen specifically for the sample of study and its focus on aerobic performance. All participants provided informed consent and the study was approved by the Internal Review Board.

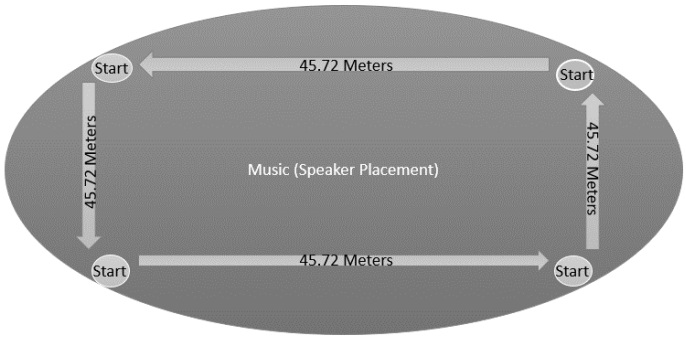

FIGURE 1. Turf field 183m perimeter for the 12 Minute Cooper Test.

Prior to the completion of the test, the testing protocol was explained, subjects consented, height and weight were measured with body fat percentage estimated from bioelectrical impedance. All athletes arrived in a fasted state and were asked to refrain from training at least 24 hours prior to the testing. The subjects were fitted with First Beat® heart rate (HR) monitors and guided through a 10-minute standardized warm-up by a trained researcher. The standardized dynamic warm-up consisted of 15 exercises that progressed in an orderly fashion from low

intensity to high intensity for a distance of 14 meters. Examples include range of motion kicks, high bounds, lunges, and 50%, 75%, and 95% of maximal sprint effort. The subjects ran a best distance 12 MCT for all trials as a group in standardized fashion: no music (CONT), moderate music tempo (MOD), and high music tempo (HIGH) while monitoring HR. For the second and third trials (MOD and HIGH respectively), subjects ran a best distance 12MCT while playing music from a group selected, single track compilation of songs standardized to 110-120 bpm tempo (MOD) and 145+ bpm (HIGH) (Dyrlund & Wininger, 2008, Nakamura et al, 2010). Music was played through two amplified speakers placed in the center of the field. Subjects marked their distance with a small plastic cone at the completion of the 12 minutes. Subjects were given the cone at the 10-minute mark to avoid any limiting factors that may have been caused by the running with the cone. All trials were separated by a minimum of 24 hours. Separate 1x3 repeated measure ANOVAs were used to evaluate dependent variables (distance and average HR [HRavg]) across conditions. The LSD post hoc test was used when statistical relevance was observed. Significance was set to ($p < 0.050$) and all data are presented as mean ± SD.

RESULTS: A significant main effect revealed that music tempo had a positive effect on running distance ($F_{2,10} = 15.31$, $p = 0.001$; $\eta^2 = 0.76$). Pairwise comparisons revealed that music tempo significantly increased distance performance compared to CONT shown in Figure 2 (CONT: 1876.5±168.2 m; MOD: 1966.5±188.2 m; $p = 0.020$; HIGH: 2133.9±73.7 m; $p = 0.040$). Interestingly, no differences in HRave ($p > 0.050$) were observed across all three conditions shown in Figure 3 (CONT= 185.3±8.5 b/min, MOD= 182.0±6.7 b/min, HIGH= 182.2±9.2 bpm) despite the increase in distance performance.

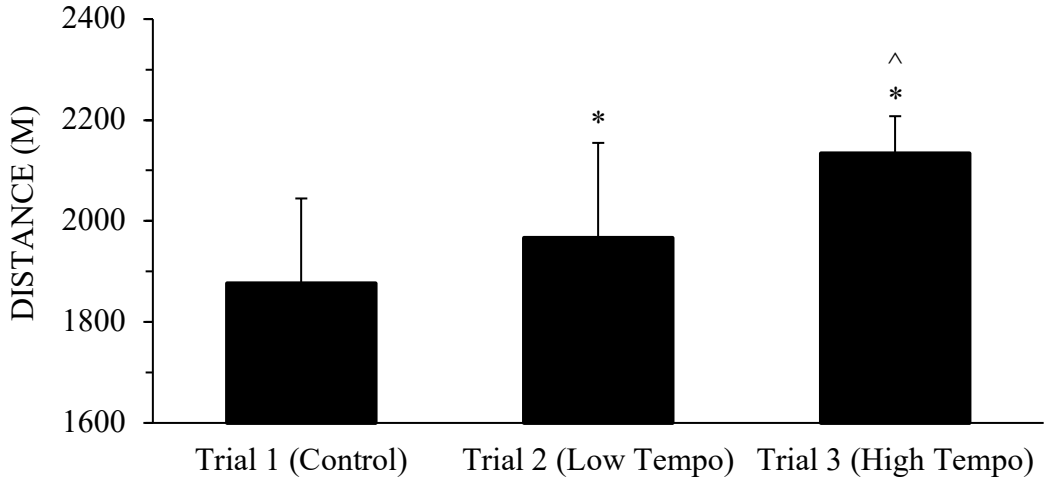

FIGURE 2: Mean distance ran for all three conditions during the 12 Minute Cooper Test. Notes: Trial 1: control condition with no music; Trial 2 low tempo condition (110-120bpm); Trial 3: high tempo condition (145+bmp). All values are represented as mean ± SD. *Denotes Significance from CONT; ^Denotes Significance from low tempo condition.

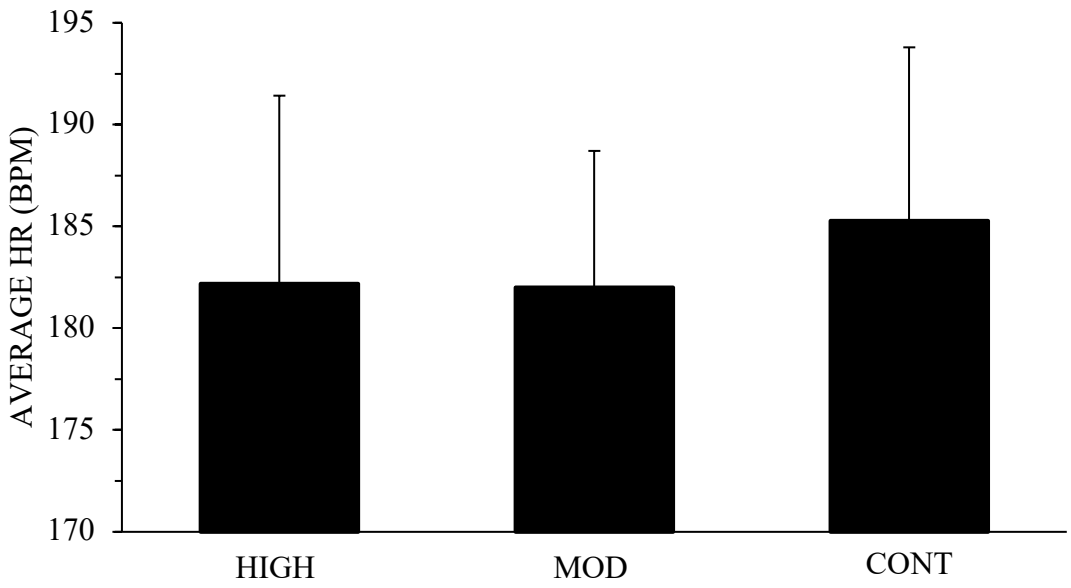

FIGURE 3: Average heart rate in beats per minute (BPM) for all three conditions during the 12 Minute Cooper Test. No Music (CONT), Moderate Tempo (MOD: 110-120bpm), High Tempo (HIGH: 145+ bpm). Values are represented as mean ± SD.

CONCLUSION: Our results confirm that music tempo present during endurance training can be used as a psychological distraction for different training conditions that may effectively increase distance running performance (Szabo et. al, 1999). As music tempo increased, distance running performance also increased suggesting that high tempo music is a better psychological distraction than moderate tempo music or no music at all. Therefore, a dose-response relationship with music tempo and distance running performance may exist. Furthermore, the presence of music during endurance training significantly increased distance performance while HR was unaffected across all three conditions, which is in agreement with previous literature (Karageorghis, Jones & Low, 2006 and Yamashita et. al, 2006). While there is a strong effect of music tempo on distance performance, the lack of randomization across the trials is a limitation as a learning effect could be apparent.

PRACTICAL APPLICATIONS: Music can be used as a distraction during aerobic exercise possibly decreasing time to fatigue and positively increasing the amount of work performed. Furthermore, music was not shown to have a physiological effect on HR during endurance exercise. This study can be applied into facets where endurance training and time to exhaustion is of consideration to effectively increase performance without increasing cardiovascular demand. Therefore music, and more importantly the rate of music tempo, can increase running performance while maintaining exercise intensity in recreationally trained athletes.

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