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THE EFFECT OF MOTIVATIONAL AND RELAXATION MUSIC ON AEROBIC PERFORMANCE, RATING PERCEIVED EXERTION AND SALIVARY CORTISOL IN ATHLETE MALES

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ABSTRACT

The purpose of this study was to examine the effect of motivational and relaxation music on aerobic performance, rating of perceived exertion (RPE) and salivary cortisol (SC) concentration in trained men. Thirty male physical education college students (ages: 25.66±3.89 yr, height: 176.65±7.66 cm, weight: 78.45±16.20 kg, body fat percent: 12.86±5.74) voluntarily participated in this study and divided to three groups: motivational music, relaxation music, and no music. All subjects run to exhaustion with 80-85 percent of maximal heart rate on the treadmill. For measuring of cortisol, not stimulated samples of saliva collected, 15 minutes before and five and 30 minutes after the exercise. RPE was obtained every five minutes during exercise. Based on the findings, aerobic performance during the motivational music conditions was significantly higher than the relaxation and no music treatment. Furthermore, RPE and cortisol concentration significantly were lowered five minutes after exercise for relaxation music conditions than motivational music and no music conditions. But there were no significant differences in salivary cortisol concentrations at 30 minutes after exercise between three groups. In conclusion, music would result in better aerobic performance and decreased RPE than no-music condition, but aerobic performance in motivational music was better than relaxation music. However, relaxation music decreased cortisol concentration greater than motivational music. This study provided some support for the hypothesis that listening relaxation music reduces physiological and psychological arousal during aerobic performance. In addition, motivational music can be applied to endurance performance non-elite athletes with a considerable positive effect.

Key words: Aerobic Performance; Motivational and Relaxation Music; RPE; Salivary Cortisol

INTRODUCTION

The use of music for exercise and sport participants has attracted considerable interest from researchers (Karageorghis & Terry, 1997). Some studies have shown that music yields ergogenic or psychophysical effects (Copeland & Franks, 1991), although others didn't show any reliable effects (Schwartz et al., 1990).

The results showed that music may have an effect on the cognitive component of the stress response (Burns *et al.,* 2002). All studies looking at the effects of music report that music enhances work output. For example, Jing and Xudong (2008) studied effects of relaxing music on the recovery from aerobic exercise-induced fatigue. They found that relaxing music can effectively eliminate aerobic exercise-induced fatigue. And remove fatigue due to aerobic exercise and has better effects on the rehabilitation of cardiovascular, central, musculoskeletal and psychological fatigue (Jing & Xudong, 2008).

Furthermore previous studies showed that music increase athletics incentive to continue of exercise (Karageorghis *et al.,* 1996; Kayoko & Kazuhito, 2005) and decrease rating of perceived exertion into body delay fatigue (Boutcher & Trenske, 1990; Potteiger *et al.,* 2000). Potteiger *et al.,* (2000) reported effects of different types of music on ratings of perceived exertion (RPE) during 20 min of moderate intensity exercise. They found that each type of music resulted in a reduced peripheral, central, and RPE when comparing with exercising under no music conditions.

Atkinson *et al.,* (2004) examined the effects of music on work-rate distribution during a cycling time trial. Results showed that music improves cycling speed mostly in the first few minutes of a 10-km time trial. In contrast to the findings of previous research, which suggested that music lowers perceived exertion at a constant work-rate, the participants in our time trials selected higher work-rates with music, whilst at the same time perceived these work-rates as being harder than without music. Also, Edworthy and Waring (2006) studied the effects of tempo and loudness music on treadmill exercise. They confirmed that no significant differences for perceived exertion were found across conditions.

Copeland and Franks (1991) reported that soft/slow music increased treadmill endurance in comparison to control conditions. The possible mechanism behind the music-induce improvement in performance may be due to activate the parasympathetic nervous system (PNS) and decreased sympathetic nervous system (SNS) (Gunter *et al.,* 2005; Makoto *et al.,* 2005), narrowing consideration and deviation of mind from exercise-induced fatigue, motivational or relaxation tool during exercise and decrease pressure due to fatigue (Kayoko & Kazuhito, 2005; Yamashita *et al.,* 2006).

However, there are findings that music dose not increment athletic performance. For example, Schwartz et al., (1990) and Pujol and Langenfeld (1999) reported no significant differences in aerobic and anaerobic performance (respectively). The discrepancies between these studies may in part result from differences in the type of music, volume and intensity of training performed.

In addition, previous investigations reported that acute hormonal responses to music. So giving that hormones had physiological and psychological important functions in body, particularly during exercise, any change in hormonal responses due to listen music could affects on exercise performance. For example, after high intensity exercise and listening fast music, plasma levels of cortisol have reported higher than amount of that during listening of relaxation music or no music condition (Brownley *et al.,* 1995). Fukui and Yamashita, (2003) investigated the effects of music and visual stress on testosterone and cortisol concentration in men and women. They observed that the cortisol concentration decreased with music and increased under other conditions.

Likewise, listening of music during submaximum exercise resulted decrease in salivary cortisol concentration (Gunter *et al.,* 2005; Yamashita *et al.,* 2006). Nonetheless because of extensive differences in music types and differential effects of them on physiological and psychological variables need further study in this area, so present study try to investigate three hypotheses: (1) that the motivational music condition would elicit aerobic performance than the relaxation music and no-music control condition; (2) that both music conditions would elicit aerobic performance than no-music control condition; and (3) that comparing the effects of music and no-music conditions on rating of perceived exertion (RPE) and salivary cortisol concentrations (SC).

METHOD

Experimental Design

Thirty physical education college male students (Mean ± SD, age=25.66±3.89 yr, height: 176.65±7.66 cm; body mass=78.45±16.20 kg) volunteered as subjects and randomly divided in to three groups: motivational music, relaxation music and no music group, none of the subjects did not have hormone and hearing disorder background and at the time of study didn't place under pharmaceutical treatment. The subjects run to exhaustion during submaximal running with 80-85% of maximal heart rate on the treadmill. Rythmic tonal or atonal music with 6.7 rhythms and more nominate motivational music and with rhythm of less than 6.7 rhythm nominate relaxation music. Giving that study nature, music that used in this study was chosen from tow different class in regard to music measures. First one is motivational music (Benny Benassi Music) that is international music and used in aerobic dance exercise and the second is relaxation music (Era 2001 music) that is also international music and is very similar to music used for quieting. The rating of perceived exertion (RPE) was measured using a concessionary scale (Borg, 1998) at period of five minutes, from starting time of exercise on the treadmill.

Saliva Collection and Analysis

Saliva samples were collected 15 min before exercise (PRE), 5- and 30- min post-exercise (5P), and (30P). Subjects were instructed to avoid food, drinking hot fluids, and brushing their teeth two hours before assessment and were seated in the laboratory for 20 minutes prior to the resting sample being provided. In each case, 4 ml of saliva was deposited into sterile containers (Labserve, Auckland, New Zealand) and stored at -20° C until assay. At the completion of exercise, subjects remained seated in the laboratory until all samples were collected. During recovery, participants were allowed to drink water ad libitum. Saliva was analyzed in duplicate for cortisol concentrations, using Enzym Immunosorbant Assay kits (RADIM SpA, Via del Mare, 125-00040 Pomezia (Roma) Italia). Inter- and intra-assay coefficients of variances were 6.9% and 6.2% for serum cortisol. Saliva samples for each subject were analyzed in the same assay to eliminate interassay variance. Giving that cortisol release following form boarding rhythm, whole saliva sample collected between 8:30 and 11:30 AM.

Statistical Analyses

Data are expressed as Mean ± SD. Statistical evaluation was performed with SPSS 12.0 (SPSS, Chicago, IL) for windows and one-way ANOVA with repeated measures were used to compare blood samples for the different programs. Multiple comparisons with confidence interval adjustment by the LSD (Least Significant Difference) method were used as post hoc when necessary. Statistical analysis compared the blood samples for each sequence against resting. The significance level was set at $p < 0.05$.

RESULT

In order to determination amount of homogeny of testable one side ANOVA use between amount of vo2max of subject group and not found significant differences between groups that indicate homogeny of that amount of measured variable given in. Running time as a measure of aerobic performance in group of motivational music significantly (41.7%) was higher than relaxation music group ($p<0.01$). there wasn't significant differences between running time of music groups and control (fig. 1). Rating of perceived exertion (RPE) was significantly reduced during lessening of relaxation music in contrast to motivational music and no music condition ($p<0.007$). No significantly differences were found in RPE between motivational and relaxation music groups (fig. 2). Salivary cortisol concentrations were significantly lower at 5 min after exercise in relaxation music compared to motivational- and no- music condition ($p<0.01$). Also, SC concentrations were significantly higher at 30 min post exercise in no music condition compared to both music conditions ($P<0.05$), but no difference was found between motivational- and relaxation- music conditions ($p > 0.05$).

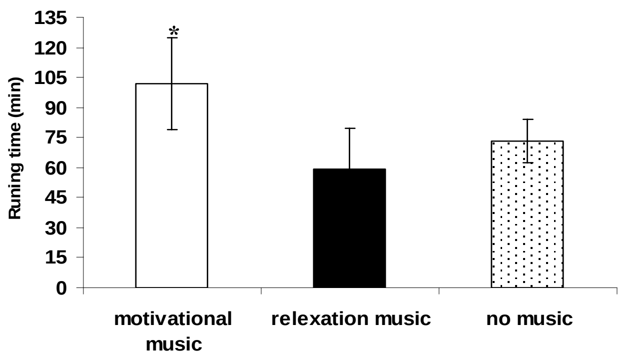

FIGURE 1. **RUNNING TIME IN THE MOTIVATIONAL MUSIC, RELAXATION MUSIC AND NO MUSIC ON TREADMILL**

* Significant difference with relaxation music

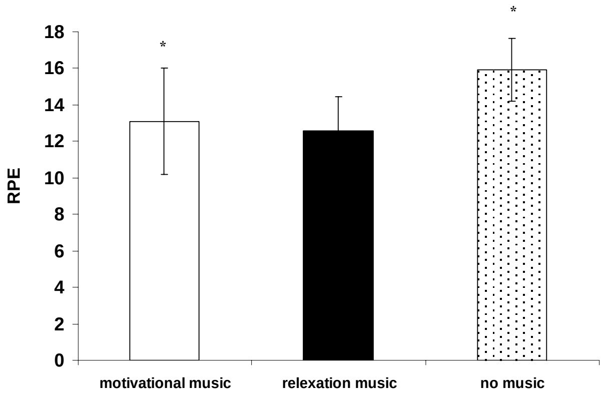

FIGURE 2. **RATING PERCEIVED EXERTION IN THE MOTIVATIONAL MUSIC, RELAXATION MUSIC AND NO MUSIC GROUPS ON TREADMILL**

* Significant difference with relaxation music

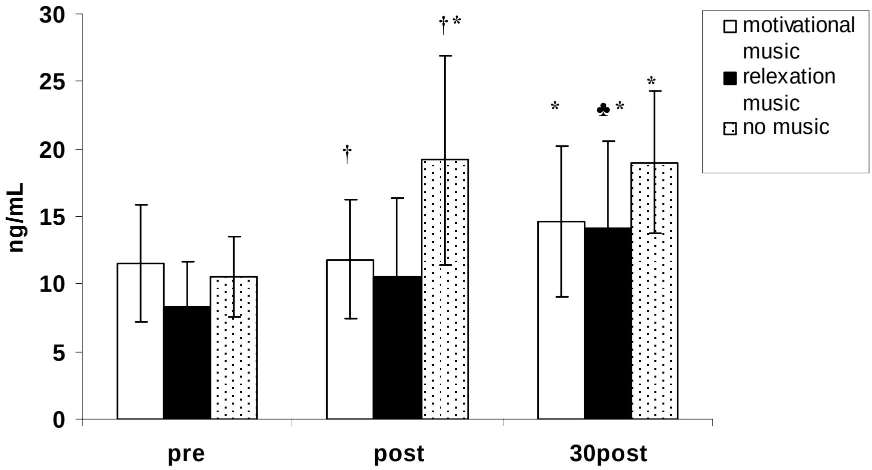

FIGURE 3. **SC CONCENTRATIONS IN THE MOTIVATIONAL MUSIC, RELAXATION MUSIC AND NO MUSIC GROUPS ON TREADMILL**

* P < 0.05 vs. pre -exercise; † P < 0.05 vs. relaxation music;

♣P < 0.05 vs. no music condition

DISCUSSION

The first research hypothesis was supported given that running times in the motivational music condition was higher than those relaxation music and no-music control condition. However, the second research hypothesis was not supported, as there was no significant difference between aerobic performance in response to relaxation music and no-music control condition. Collectively, the present results indicate that synchronization of an aerobic motor task to music can have a strong impact on performance regarding the motivational quality of the music played.

The present findings support those of Anshel and Marisi (1978), observed differences between synchronous and control conditions using a cycle ergometer endurance task. The findings also support Karageorghis and Jones (2000), who reported large differences in cycle ergometry endurance between motivational synchronous music and a flashing light control. The lack of difference between the motivational and oudeterous conditions may, in part, be due to the fact that the present task was exclusively anaerobic in nature. The findings also support Simpson & Karageorghis (2006) who reported synchronous music result in better anaerobic performance than a no-music control, but there were no significant difference between synchronous music and oudeterous condition. Also, this finding is in accordance to previous studies (Atkinson *et al.*, 2004; Copeland & Franks, 1991) but is contrast to finding of Pujol & Langenfeld, 1999 and Schwarts *et al.,* 1990.

The conceptual framework underlying the use of asynchronous motivational music in exercise and sport devised by Karageorghis *et al.,* (1999) indicated three main hypotheses, all of which bear some relevance to the present study of synchronous music. First, music can be used to alter psychomotor arousal and thus can act either as a stimulant or sedative. Second, music narrows a performer's attention and consequently diverts attention from sensations of fatigue (Hernandez-Peon, 1961). Third, music enhances the positive dimensions of mood (e.g. happiness, vigor) and tempers the negative dimensions (e.g. anger, depression, tension).

The second finding of the present study showed that rating of perceived exertion during listening of relaxation music treatment was significantly lower than motivational music or no music treatment. This finding confirmed results of Jing & Xudong, 2008 and Potteiger *et al.,* 2000, but is contrast to finding of Atkinson *et al.,* 2004 and Tenenbaum *et al.,* 2004.

Rejeski (1985) proposed that sensory and affective information is processed preconsciously in parallel. Preconscious processing is seen as an active process that filters information through to focal awareness. Thus, sensory information such as a sense of effort, or affective information, such as apprehension resulting from a heavy work load, can form the object of attention and determine affective responses and RPE during exercise. Rejeski (1985) has suggested that during high intensity exercise, physiological cause predominate as the most salient influence on psychophysical responses. At lower intensities, external cues such as music may become more influential. Boutche and Trenske (1990) also reported significant decrease in rating of perceived exertion during submaximal exercise accompanied by listening of music and concluded that music effect on rating of perceived exertion is depend on work load. This author believe that listening of music during exercise may block unpleasant feedbacks from environmental and central factor to central nerves system and let to person that feeling relaxation.

Based on the findings, music would result in better aerobic performance and decreased RPE than no-music condition, but aerobic performance in motivational music was better than relaxation music. Furthermore, although in both groups of motivational and relaxation music, aerobic performance was better, it is noted that operation of every type of music has special characteristic. Authors found that muscles stress change with music types so they motivational music increase and relaxation music decrease muscles stress (Mark *et al.,* 2005).

Relaxation music may decrease muscular activity during exercise, but motivational music cause increase running time and delay in fatigue. This kind of music through change of mental and kinetic exciting stimulate central nervous system (Kayoko & Kazuhito, 2005; Makoto *et* *al.,* 2005; Yamamoto, 2003) and decrease activation of parasympatic nervous system (Makoto *et al.,* 2005).

Based on findings salivary cortisol (SC) concentrations were significantly lower at 5 min after exercise in relaxation music compared to motivational- and no- music condition. Also, SC concentrations were significantly higher at 30 min post exercise in no music condition compared to both music conditions, but no difference were found between motivational- and relaxation- music conditions. This finding confirms results of McMurry *et al.*, 1996 and Fukui and Yamashita, 2003; but it is in opposite to findings of Brownley *et al.*, 1995.

Cortisol is one of important stress hormones that secrete in response of physical and psychological stress (Green, 1991). Exercise is one of important stimulant of cortisol secretion (Kuoppasalmi & Adlercreutz, 1984). Cortisol response to exercise is dependent to intensity (Fry *et al.,* 1998) and time of exercise (Elias *et al.,* 1991). Stimulation of hypothalamus-hypophesis-adrenal axis and increase secretion of ACTH from hypophesis is most important factor of cortisol secretion (Singh *et al.,* 1999).

During physical exercise, hypothalamus-hypophesis-adrenal axis become activated and increase cortisol secretion (Buono *et al.,* 1986). Products originated anaerobic metabolism like lactate accumulation, PH drop and hypoxia are stimulant of hypothalamus-hypophesis-adrenal axis. Previous study showed that running on treadmill during eight to 20 minutes, increase ACTH concentration by to 10% and cortisol increase parallel to ACTH (Buono *et al.*, 1986). Increase of central temperature and decrease PH is other mechanism that induces increase cortisol concentration, particularly free cortisol (Deligiannis *et al.,* 1993).

It should be mentioned that despite the aerobic performance in the motivational music condition was higher than relaxation music and no-music control condition but SC concentration at post-exercise in both music groups was lesser than no-music condition. Because of exercise intensity is constant (80-85% of maximal heart rate) this is probable that listening music lead to decrease mental stress of subjects during running. Giving that one of stimulant of cortisol secretion is mental stress and only differences between present groups was hearing music, lower cortisol concentration can attribute to listening of music. Cortisol concentration and other facilitating hormones increase metabolism during exercise, and after exercise drop increase procedure of it. Increase cortisol concentration is general response to physical stress, so during exercise activity in mean intensity similar to intensity used in this investigation, considerable change didn't observe in cortisol concentration (Lesle, 1967). Physical fitness level of subjects, intensity and kind of exercise and music type that used all affect cortisol concentration change.

There are few limitations of this study that warrant discussion. First, Iakovides *et al.*, 2004 describes music as the means to express emotion and that it influences mood. The central nervous system is involved through processes of integration and interpretation when one listens to music, thus making it a subjective experience which depends on how the person perceives music (Iakovides *et al.*, 2004). Evidence in favor of variability changes according to subjective perception is documented in a study whereby heart and respiratory rate were monitored whilst listening to firstly a synthesizer, secondly bird twitters, and thirdly mechanical sounds. The study showed inhibition of the parasympathetic nervous system during listening to mechanical sounds as well as promoting an unpleasant and alert feeling (Iakovides *et al.*, 2004). The influence of subjective perception whilst listening to relaxation and/or motivational music on subjects' physical performance is unexplored. Therefore, it is recommended that future studies consider subjective perception as an effective factor on parasympathetic nervous system and subsequent physical performance. Second, in our study the influence of music on heart rate (HR) which has been considered to be an indication of stress and anxiety didn't measure, changes in heart rate should be observed if music reduces stress (Hanser, 1985). Previous investigation reported that music may elicit differentiated responses that make sample changes in HR trivial as the effects of music cannot be revealed via HR (Iwanaga, 2005). Not even measuring average changes in HR from baseline is a good indication of the effect of music since stress influence not only changes in response levels but also variability in responses (Fiske & Rice, 1955). It would be much interesting that future studies measure HR response throughout performing physical exercise whilst listening to relaxation and/or motivational music.

The main practical implication of the present study is that the use of motivational music can have a considerable effect on the aerobic performance. Furthermore, rating of perceived exertion and salivary cortisol concentration was significantly lower five minutes after exercise during listening of relaxation music than motivational and control music groups. In summary, listening of music improve aerobic performance and lead to lower increase of salivary cortisol at five minutes post-exercise to exhaustion. A clear trend is emerging in the literature, which suggests that music is a genuine ergogenic aid, at least among non-elite sportspeople. Practitioners seldom tap the ergogenic properties of music. The application of music could be extended to elite sportspeople, in particular track athletes who can use music to regulate effort exertion (Atkinson *et al.*, 2004). Moreover, the effects of music on female's performance should be given greater attention by researchers.

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