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Effect of different music tempos on aerobic performance and recovery

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Summary. The aim of this study was to determine effect of different music tempos on aerobic performance and recovery period. Thirty-five healthy male students (age=22.63±2.94, body mass=71.40±10.71, height=178.24±9.95) who were studying at Faculty of Sport Sciences voluntarily participated in this study. Participants carried out Bruce treadmill test with 72 hour intervals under three conditions: slow tempo music (100 bpm), fast tempo music (140 bpm) and no music. Anova was applied for statistical analysis. Fast tempo music (18.28±3.01 minute) was determined to improve running time by 4.63% and 3.10% compared to no music (17.47±2.83 min) and slow tempo music (17.73±3.09 min), respectively ($p<0.01$). Slow and fast tempo music did not have any effect on heart rate (HR) and rate of perceived exertion (RPE) during and after exercise ($p>0.05$). Lactate accumulation during 15 min recovery was found lower with slow tempo music compared to fast tempo and no music conditions ($p<0.05$). As a result, it can be concluded that fast tempo music improved running time and performance by creating ergogenic effect while slow tempo music led to fast decreasein heart rate and lactate accumulation during 15 min recovery.

Keywords: Fast music, Heart rate, Lactate, Running time, Slow music

Introduction

Music, an important part of human life, is known to be important for physical and psychological healing (1,2), accelerate and decelerate brain wave, coordinate movements with muscle tension and create anxiolytic effect (3). In addition, the effect of music on movement is defined as miscellaneous as psycho-emotional supporting coordination of repeated cognitive, affective, motor movement patterns during exercise (4). Music has been used to relax people for a long time. Music is a reliable, effective and non-pharmacological painkiller and tranquilizer. It has been reported that music decreases the need for ataractic drug (5), therapy with music decreases anxiety, increase life quality and is effective to decrease pain (6-8). Many ideas have been suggested to explain the strength which makes athletes to participate long duration physical activities and continue this for a long time (9). The latest one is music which is thought to be effective in athletic performance. Accordingly, the number of studies investigating ergogenic effects of combination of music and physical activity has increased (10). Because music has been used in different areas and successful results have been obtained, its effects on sport practitioners have been investigated and some studies highlighted its positive effects on athletes in terms of physiological and psychological aspects (11,12). While many studies have investigated effects of music pre and during exercise (13, 14) there is not enough number of studies investigating effect of music on recovery following a strenuous exercise. Some of these studies suggested sedative music at least 15 min following an exercise session to stimulate recovery (15, 16). Thus, the aim of this study was to determine effect of different tempos music on aerobic performance and recovery.

Materials and Methods

Participants

Thirty-five healthy male students (age=22.63±2.94, body mass=71.40±10.71, height=178.24±9.95) who were studying at Faculty of Sport Sciences voluntarily participated in this study. Participants who has a chronic disease or regularly uses medicine were excluded from the study.

Measurements

Fifty fast and slow English songs were determined by the researcher before the measurements. Then, the loudness of the music was set at 82 decibels (17) and beats were set at 100 bpm (beat per minute) for slow music tempo and 140 bpm for fast music tempo (18). Songs were sent to participants via e-mail and they were requested to choose 5 songs for both fast and slow tempos they liked most and send back them to researcher. Each participant involved in measurements 3 times with 72-hour intervals under three condition: fast tempo music, slow tempo music and no music. Blood pressure and heart rate were monitored pre and post-test and during recovery with Omron 10 and Polar Team, respectively. Blood lactate measurement was performed with Lactate Scout + lactate analyzer. When participants arrived at the laboratory, they were requested to sit for 15 min to determine resting values of heart rate and blood pressure. Participants listened to the music they chose during the test and recovery for 15 min with earphone. Heart rate (HR) was recorded before, after and at 5th, 10th and 15th min during the test. Borg Scale was used to determine rate of perceived exertion (RPE) at 5th, 10th and 15th min during the test and following the test. Participants state their RPE using a chart (between 6-20) (19). Running performance was tested using a treadmill (RAM 770-M, CAMIN, Italy) with Bruce protocol. Bruce treadmill protocol is a test starting with 2,7 km/h speed and 10% grade and continue with increasing speed and grade every 3 min (20). When participants finished the test, they were seated on a chair for recovery with listening to selected music for 15 min. Meanwhile, peak HR, blood pressure and lactate accumulation were measured. HR, systolic and diastolic blood pressures were recorded 5th, 10th and 15th min of recovery. Blood lactate was measured at the end of the recovery (15th min). When tests were implemented under the third condition they did not listen to or were exposed to any music during the test and were seated for 15 min during recovery in a quiet environment.

Statistical Analysis

Data were analyzed with SPSS-23. Normality of the data was determined using Shapiro Wilk Test. As data was normally distributed, Repeated Measures Anova was used. When any difference was found, Bonferroni Test was applied to see which group caused the difference. The significant level was set at 0.05 and 0.01.

Results

This study aimed to determine the effect of music with different tempos on aerobic performance and recovery duration in healthy active males. Performance variables under no music condition were compared with those during fast tempo music and slow tempo music in terms of aerobic running performance, HR and RPE during the test and HR, blood pressure and blood lactate accumulation during the recovery.

Effect of different music tempos on running performance is presented in Figure 1. It was observed that fast music tempo (18.28±3.01min) improved running duration compared to slow music tempo (17.73±3.09 min) and no music (17.47±2.83min) at percentages of 3.10% and 4.63%, respectively ($p<0.01$). No significant difference was found between slow tempo music and no music ($p>0.05$).

Figure 2 presents effects of different music tempos on HR and RPE during the test. It was observed that HR and RPE at 5, 10 and 15th min of test and

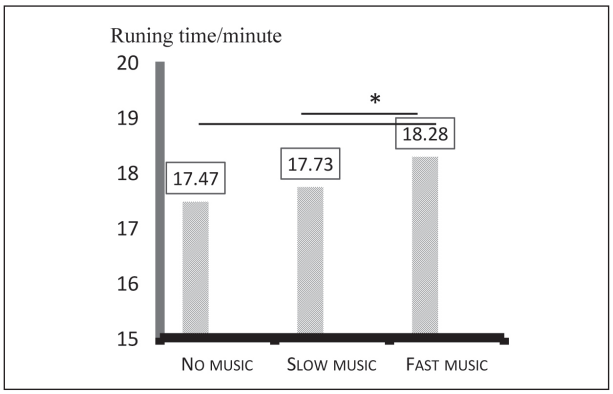

Figure 1. Running performance values under three conditions. Significant differences shown with asterisk (*$p<0.01$).

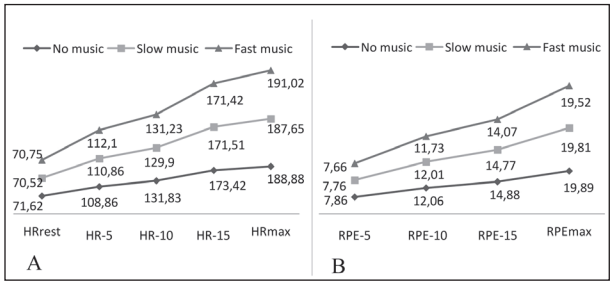

Figure 2. Heart rate (HR) (A) and rate of perceived exersion (RPE) (B) values pre, post and 5th, 10th and 15th min of exercise under 3 different conditions.

post-exercise were not affected by different music tempos (p>0.05).

Resting values of HR, blood pressure, post-test maximal HR, blood pressure, lactate accumulation and HR, blood pressure and lactate accumulation under three condition can be found in Table 1.

Table 2 presents HR, blood pressure and percentage of decrease in lactate accumulation of the participants during 15 min recovery.

Discussion

This study was implemented to determine effect of different music tempos on aerobic performance and recovery time. Fast tempo music increased running performance 3.10% and 4.63% compared to no music and slow tempo music, respectively. However, HR and RPE during and at the end of the test were not affected by different music tempos. In a similar study with Bruce protocol by Karageorghis et al. (2009), while running time was 17.84 min with motivational music, running times were 16.84 and 15.56 for non-motivational music and no music, respectively. They also

Table 1. Physiological variables of the participants pre and post-test and during recovery.

	No music (1)	Slow music(2)	Fast music (3)	Sig. Diff.
	Mean±Sd	Mean±Sd	Mean±Sd	
RestHR	71.62±11.48	70.52±9.95	70.75±8.88	0.143
RestSBP	118.15±9.23	123.89±8.5	120.45±8.23	0.346
RestDBP	71.33±6.32	70.66±7.41	72.45± 6.83	0.928
PeakDBP	79.63±6.65	81.10±6,83	81.02±5.77	0.364
PeakSBP	160.16±15.18	158.30±12.23	161.24±11.89	0.547
PeakHR	188.88±9.19	187.65±9.38	191.02±10.21	0.935
PeakB[LAC]	13.31±2.81	12.64±2.68	12.97±2.45	0.169
RecB[LAC]15min	9.94±2.06	8.82±1.95	9.56±0.98	0.017* 2<1,3
Rec HR-5min	105.94±10.31	105.00±13.25	103.03±11.78	0.626
RecHR-10min	105.00±11.06	100.78±12.80	102.55±10.16	0.093
Rec HR-15min	102.68±9.73	98.42±10.06	101.43±10.11	0.082
RecSBP5min	126.00±10.60	126.78±12.80	125.44±9.56	0.788
RecSBP10min	122.72±8.03	122.66±7.32	121.28±4.56	0.748
RecSBP15min	121.05±10.63	122.15±9.94	120.47±5.43	0.825
RecDBP5min	69.63±4.05	71.10±3.87	69.94±3.04	0.276
RecDBP10min	71.16±7.11	71.55±4.75	70.77±3.63	0.900
RecDBP15min	71.47±5.41	73.21±7.56	69.78±2.76	0.429

*P<0.05.Sd:Standard deviation. RestHR: Heart rate during resting. PeakB[LAC]: Peak blood lactate after maksimal exercise. RecB[LAC]15min: Blood lactate in minute 15 during recovery. RecHR-5min: Heart rate in minute 5 during recovery. RecHR-10min: Heart rate in minute 10 during recovery. RecHR-15min: Heart rate in minute 15 during recovery. RecSBP5min: Systolic blood pressure in minute 5 during recovery. RecSBP10min: Systolic blood pressure in minute 10 during recovery. RecSBP15min: Systolic blood pressure in minute 15 during recovery. RecDBP5min: Diastolic blood pressure in minute 5 during recovery. RecDBP-10min: Diastolic blood pressure in minute 10 during recovery. RecDBP15min: Diastolic blood pressure in minute 15 during recovery. Diff. : Diffrence

reported that motivational music improved running performance by 15% compared to no music condition and music had no effect on RPE. It was concluded by the same researchers that music improved endurance performance during exercise (21). Likewise, Eliakim et al. (2012) also stated that music has positive effect on aerobic components but also highlighted that it did not affect RPE (22). Tenenbaum et al. (2004) implemented treadmill test on participants at 90%of their VO2max under 4 different music condition (no music, rock, sedative and dance) and stated no significant effect on RPE and HR (23). Birnbaum et al. (2009) stated that music (fast, slow and no music) had no effect on systolic-diastolic blood pressure, HR and RPE during 15 min steady state running exercise on a treadmill (24). Most of the studies stated no significant effect of music on HR during exercise (25-27). Likewise, we determined that music did not affect HR responses during the exercise. It was reported that female football players performed a treadmill exercise with increasing speed and grade and running time, HR_{max} and RPE and HR during the exercise were not affected by self-selected fast music (28). Terry et al. (2012) applied a study on 11 elite triathlon athletes where self-selected music improved exhaustion time by 18.1%, 19.7% with motivational music and neutral music, respectively compared to no music. Moreover, emotional state and mood were found more positive with motivational music compared to other two conditions and music decreased oxygen consumption by 1-7% and improved running economy (29). Another study reported that music increased running time and fast tempo music was found more effective than slow tempo music (12). Our findings also indicate that fast tempo music improved running performance compared to slow tempo music. Ghaderi et al. (2009) reported that fast tempo music increased running time by 41% compared to slow tempo music but aforementioned music tempos did not enhance running performance compared to no music condition (30). In contrast to the studies in the literature, some researchers stated that music did not increase running distance and time and concluded that music does not affect sub-maximal performance of individuals (28, 31, 33). Different results suggested by different studies may stem from the type of music, fitness level of the participants, music tempo lacking motivational stimulus.

Table 2. Rate of decrease between peak values after exhaustion exercise and recovery values after 15 min recovery.

	PeakB[LAC]	**RecB[LAC]15min**	**%Δ15**
	Mean±Sd	**Mean±Sd**	
No music	13.31±2.81	9.94±2.06	33.90
Slow music	12.64±2.68	8.82±1.95	43.31
Fast music	12.97±2.45	9.56±0.98	35.66
	PeakHR	**RecHR15min**	**%Δ15**
No music	188.88±9.19	102.68±9.73	83.95
Slow music	187.65±9.38	98.42±10.06	90.66
Fast music	191.02±10.21	101.43±10.11	88.32
	PeakSBP	**RecSBP15min**	**%Δ15**
No music	160.16±15.18	121.05±10.63	32.30
Slow music	158.30±12.23	122.15±9.94	29.59
Fast music	161.24±11.89	120.47±5.43	33.84
	PeakDBP	**PeakDBP15min**	**%Δ15**
No music	79.63±6.65	71.47±5.41	11.41
Slow music	81.10±6.83	73.21±7.56	10.77
Fast music	81.02±5.77	69.78±2.76	16.10

%Δ15: Percentage of decrease 15 min after exercise

There was no significant difference in recovery HR and systolic and diastolic blood pressure at the 5th, 10th and 15th min of recovery between slow, fast tempo music and no music ($p>0.05$). however, slow tempo music enhanced removal of the lactate during recovery compared to fast tempo music and no music ($p<0.05$). While percentage of lactate removal was 43.31% with slow tempo music, it was 33.90% with no music condition and 25.66% with fast tempo music at the 15th min of recovery. HR decreased by 90.66% with slow tempo music while it decreased by 83.95% with no music condition and 88.32% with fast music tempo. Eliakim et al. (2012) stated no effect of music on HR and lactate removal during recovery following an exhaustion exercise but highlighted a faster lactate removal with music (28.1%) compared to no music condition (22.8%). Moreover, lactate removal increases with music for 12-15 min (15). Tan et al. (2014) stated that listening to sedative music for 15 min after an exercise did not enhance recovery in HR compared to no music (34). Karageorghis et al. (2018) suggested that slow tempo and sedative music enhance recovery following an exhaustive exercise in terms of hemodynamic (blood pressure and HR) parameters in spite of a clear explanation (35). Knight and Richard

(2001) indicated that sedative music hampersincrease in subjective anxiety, systolic blood pressure and HR (36). According to literature, music decreases HR by increasing vagal activity and decreasing sympathetic activity (37) while sedative music is thought to lead to fast recovery because it indirectly affects autonomous system by activating hormones that decreases stress by affecting pituitary part of the brain (16). Some studies highlighted that music solely cannot enhance recovery in healthy subjects although it enhance recovery in HR and systolic blood pressure after aerobic exercise (38). In contrast to Gomes et al. (2018), Savitha et al. (2010) stated that slow tempo music during recovery decreased systolic and diastolic blood pressure and HR faster and concluded that sedative music is a very useful tool to enhance recovery after exercise (39). In our study, slow tempo music did not affect recovery in systolic and diastolic blood pressure and HR but it significantly enhanced rate of lactate removal.

Conclusion

Currently many studies have been conducted in sport sciences to increase performance and enhance recovery during/after exercise. The importance of music increases in exercise to create an ergogenic effect on athletes in terms of psychologically, physiologically and physically. In this study, it was observed that fast tempo music increased running time which is a sign of endurance compared to slow tempo music and no music. Slow tempo music was observed to lead blood lactate and HR to turn normal values faster. As a result, it can be concluded that fast music can be used to motivate, activate athletes to increase endurance and provide an ergogenic aid while slow tempo music can be advised to enhance recovery after exercise.

Conflict of interest: No potential conflict of interest relevant to this article was reported by the authors

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