

Original Article

Effect of music tempo on exercise performance and heart rate among young adults

Avinash E Thakare¹, Ranjeeta Mehrotra², Ayushi Singh³

¹Department of Physiology, GMC Rajnandgaon, CG, India; ²Demonstrator Department of Physiology, North Bengal Medical College, Darjeeling 734101, West Bengal; ³MBBS LN Medical College, Bhopal (MP) 462042, India

Received August 31, 2016; Accepted January 12, 2017; Epub April 15, 2017; Published April 30, 2017

Abstract: Background & objectives: Music captures attention, triggers a range of emotions, alters or regulates mood, increases work output, heightens arousal, induces states of higher functioning, reduces inhibitions and encourages rhythmic movement. Music has ergo-genic effect as well, it increases exercise performance, delays fatigue and increases performance and endurance, power and strength. Our study tried to evaluate the effect of music on exercise performance in young untrained subjects. Methods: In this study, we tested the effect of music on sub maximal exercise performance time duration in young adults. 25 Male and 25 females were subjected to standard submaximal exercise with and without music. Resting HR and Max. HR during exercise and the exercise time duration was recorded. Results: Total exercise duration in whole group with music ($37.12 \pm 16.26^{**}$ min) was significantly greater than exercise duration without music (22.48 ± 10.26 min). Males ($42.4 \pm 15.6^{**}$ min) outperformed significantly better than females (31.84 ± 15.48 min). Also, we observed statistically significant higher values of Maximal heart rate with music than without music. But there was no significant correlation between duration of exercise, music and change in Heart rate. Interpretation & conclusion: We can conclude that Music increases duration of exercise in both sexes and hence endurance.

Keywords: Music tempo, exercise performance, heart rate

Introduction

We live in a time when technology has brought us closer to music than ever before, enshrining its role in our emotional and social lives. According to the available evidence, music captures attention, triggers a range of emotions, alters or regulates mood, increases work output, heightens arousal, induces states of higher functioning, reduces inhibitions and encourages rhythmic movement [1, 2]. Ergogenic effect of music is evident as it improves exercise performance by either delaying fatigue or increasing work capacity. This effect results in higher than expected levels of endurance, power, productivity or strength [1]. Listening to music while exercising improves work performance and decreases the perceived exertion and fatigue caused by ongoing exercise [3-5].

Present study tried to explore the effect of music on exercise performance and heart rate among young untrained adults using sub-maximal exercise. We tried to assess the endurance

enhancing effect of music in young adults of both sexes. The study tried to explore that whether music increases the performance time in young boys and girls. Does it produce a significant increase in Heart rate while listening to music during exercise and not listening to music while exercising? In addition, the study assessed the role of self-selected music on an endurance level at a sub-maximal intensity of exercise.

This study has far-reaching implications in ways to motivate young adults and students to increase the duration of exercise, consequently endurance and emphasize the role of music, which can encourage them to instill healthy lifestyle.

Aims and objectives

The objectives of the study were:

- a). Effect of music tempo on exercise performance in young adult subjects.
- b). Effect of

Music increases exercise performance and endurance

Table 1. Basic profile of study subjects

	Total (50)	Boys (25)	Girls (25)
Age (Mean ± SD in years)	21.92 ± 1.97	21.92 ± 1.99	21.92 ± 1.99
Age Range (in years)	19-25	19-25	19-25
Height (cms)	160.12 ± 10.30	164.48 ± 9.55	155.76 ± 8.63
Weight (kgs)	64.42 ± 7.29	68.80 ± 6.22	60.04 ± 5.47
Resting Heart rate (beats/min)	81.64 ± 7.21	79.96 ± 6.41	83.32 ± 7.68
Max. Heart rate without Music (beats/min)	131.92 ± 10.51	132.20 ± 7.12	131.64 ± 13.22
Mean Exercise duration without Music (mins)	22.48 ± 10.26	26.80 ± 10.40	18.16 ± 8.26
Max. Heart rate with Music (beats/min)	138.02 ± 10.89	136.72 ± 5.86	139.32 ± 14.29
Mean Exercise duration with Music (mins)	37.12 ± 16.26	42.40 ± 15.60	31.84 ± 15.48

All values of the data set are expressed as mean ± STD. Deviation.

Table 2. Mean duration of exercise performed without and with music

Mean Exercise duration (Minutes)	Total (50)	Boys (25)	Girls (25)
Without music	22.48 ± 10.26	26.80 ± 10.4	18.16 ± 8.26
With music	37.12 ± 16.26**	42.40 ± 15.6**	31.84 ± 15.48**

Using Paired t Test **P≤0.01 -Highly significant Mean exercise duration in Minutes.

Table 3. Mean duration of exercise performed without and with music in boys and girls sexwise

Mean Exercise duration (Minutes)	Boys (25)	Girls (25)
Without music	26.80 ± 10.4**	18.16 ± 8.26
With music	42.40 ± 15.6**	31.84 ± 15.48

Using Independent t Test **P≤0.01 -Highly significant.

music tempo on heart rate during exercise in young adult subjects.

Material and methods

25 males & 25 females untrained young adult subjects of 19 to 25 years of age were recruited in the study. The study subjects were untrained Medical students chosen randomly with willingness to participate in the study. Participants signed a declaration of informed consent.

This study was conducted in, Physiology Research Laboratory, Department of Physiology, LN Medical College and Research Centre, Bhopal (MP). The study was approved by the Institutional Ethics Committee (IEC).

Inclusion criteria for the subjects:

- 1) No history of medical illness like hypertension, diabetes mellitus, asthma, obesity. 2)

Past or present musculoskeletal illness, Traumatic injury. 3) Any illness that limits the subjects to perform exercise.

All the subjects were informed regarding the study and tested for exercise in the morning hours over a period

of 10 days. Three subjects were called per day and were informed about the procedure. Initially they were made to sit down and relax for 5 min and their resting heart rate was recorded by the pulse Oxy-meter. (Med-first). Then they were asked to run on treadmill at self-selected speeds and initial time was noted. They were instructed to stop the exercise whenever they felt tired, fatigued or breathless. The pulse Oxy-meter was placed on their index finger during exercise and their pulse was noted when it reached to its maximum and steady level. When they stopped the exercise, again time was noted. Total duration of the exercise was calculated by subtracting final and the initial timing. The following day, same subjects repeated the exercise. During the exercise, self-selected music was played, which was fast and loud for all. They were made to listen to the music on cell phones with speakers. Recording of heart rate and duration of exercise was noted as previously.

For recording the heart rate during exercise and the duration of the exercise, the same procedure was followed for all 50 candidates.

Data about various parameters was noted & statistical analysis of data was performed using SPSS [6]. For comparing Means of Exercise duration and Heart Rate in whole group,

Music increases exercise performance and endurance

Table 4. Max. Heart rate achieved during exercise performed without and with music

Max. Heart rate (beats/min)	Total (50)	Boys (25)	Girls (25)
Without Music	131.92 ± 10.51	132.20 ± 7.12	131.64 ± 13.22
With Music	138.02 ± 10.89**	136.72 ± 5.86*	139.32 ± 14.29*

**P≤0.01 -Highly significant *P≤0.05 significant. Max. Heart rate in beats/min.

Table 5. Comparison of Max. HR achieved during exercise performed with music in boys and girls

Max. Heart rate (beats/min)	Boys (25)	Girls (25)
With Music	136.72 ± 5.86	139.32 ± 14.29^

Using Independent t Test ^ P≥0.05 Non Significant.

paired T test was used. For comparing means of males and females independent' T test was used.

Result

Table 1 shows the basic profile of study subjects. All data was expressed, as Mean ± SD. Mean exercise duration in whole group was significantly higher with music than without music (**Table 2**).

Similarly, mean exercise duration among males (**Table 3**) significantly higher than females in both conditions, i.e. with music and without music. Males performed significantly better than females in either condition.

Maximum heart rate achieved during exercise was significantly higher in whole group than the heart rate during exercise without music condition. Also in both sexes, Max heart rate during exercise with music was significantly higher than the heart rate during exercise without music (**Table 4**). However, we observed (non-significantly) higher values for Maximum heart rate in females with music than in males with music (**Table 5**).

Table 6 shows Change in heart rate from resting to Maximum in whole group, males, and females separately.

We observed non-significant change in heart rate in boys when exercising with music than exercising without music. In addition, change in heart among exercising females from resting to

maximum was higher (but non-significant) than males when compared sex wise (**Table 6**).

Total duration of exercise increased significantly when music was being played (p value <0.01). Analysis for boys and girls separately using independent t test, also gave significant results for mean exercise duration.

Significant increase in heart rate was seen when boys and girls were analyzed separately.

Multiple regression analysis was done to evaluate the effect of music and duration of exercise on heart rate. No correlation was seen between change in heart rate with duration of exercise and music.

Discussion

The aim of the present study was to analyze the effect of music on duration of submaximal exercise and heart rate.

Discussion

In our study, duration of exercise increased significantly when music was played. Potteiger et al reported a strong effect of music at moderate exercise intensities-Fast jazz, slow classical and self-selected music reduced perceptions of exertion relative to a control condition [7-9]. However, Pujol et al reported that fast music had no effect on performance or fatigue in a maximum intensity cycling test lasting 30 Sec [10]. Elliott et al also permitted self-selection of exercise intensity and reported similar results [11].

A number of studies have tested the effects of stimulative music on self-paced aerobic exercise performance and found that music enhanced work output [12, 13]. It is reported that the intensity of exercise determines the extent to which music can inhibit the processing of other sensory cues [14]. At high intensity levels, physiological cues appear to dominate processing capacity due to their relative strength while at the more moderate intensity levels of exercise both internal (e.g. Kinesthetic) and external (e.g. Music) cues can be processed in parallel. While the positive effects of music on how one feels may not have the power

Music increases exercise performance and endurance

Table 6. Change in heart rate (Δ HR) from resting to maximum during exercise

Change in Heart Rate - Δ HR (beats/min)	Total (50)	Boys (25)	Girls (25)
Without Music	50.48 \pm 11.38	52.16 \pm 5.54	48.8 \pm 15.1
With Music	54.32 \pm 12.08 [^]	53.6 \pm 8.07 [^]	55.04 \pm 15.22 [^]

[^]P \geq 0.05 Non-Significant.

to alter the perceptions of fatigue when exercising at very high intensities, music may change how one interprets or responds to sensation of high exertion [15].

In our study, heart rate also increased significantly when music was played. However, no correlation of increase in heart rate was seen neither with the duration of the exercise nor with the presence of music. Birnbaum et al used fast music, slow music and a no music protocol during steady state exercise and indicated that fast music increased several indices related to heart and lung function [16].

However, Atan T [17] concluded that listening to music and its rhythm cannot enhance anaerobic performance and cannot change the physiological response to supramaximal exercise.

In our study, the variability of sub maximal exercise due to self-selection might have interfered in determining the effect of music on heart rate.

Conclusion

Our study was performed on 50 young adult subjects who were asked to exercise with and without music being played. There was an increase in Total duration of exercise and heart rate when music was played which was fast and loud for all. However, because of lack of uniformity in exercise protocol, no correlation could be seen between increase in heart rate and the presence or absence of music.

Music may exert an ergogenic and distractive effect during exercise under conditions of self-paced moderate exercise and self-selected music. Motivation by music can lead to increase in exercise duration, which is a stress alleviator in young medical students. Nevertheless, importance and beneficial effect of music on health cannot be underestimated.

1) Music increased the duration of exercise significantly both in boys and girls of 19-25 years

of age. 2) No-correlation was seen between increase in heart rate with duration of exercise and music.

Acknowledgements

We acknowledge the effort and support provided by all study subjects, and staff of Physiology research lab, LNMC, Bhopal for this study.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Avinash E Thakare, Department of Physiology, GMC Rajnandgaon, CG, India. E-mail: dravinash1979@gmail.com

References

- [1] Karageorghis CI. The scientific application of music in sport and exercise. *European Physical Education Review* October 2008; 14: 347-366.
- [2] Terry PC, Karageorghis CI. Music in sport and exercise. In: Morris T, Terry PC, editors. *The new sport and exercise psychology companion*. 2011; 359-380.
- [3] Beisman GL. Effect of rhythmic accompaniment upon learning of fundamental motor skills. *Res Q* 1967; 38: 172-176.
- [4] Crust L. Carry-over effects of music in an isometric muscular endurance task. *Percept Mot Skills* 2004; 98: 985-991.
- [5] Edworthy J, Waring H. The effects of music tempo and loudness level on treadmill exercise. *Ergonomics* 2006; 49: 1597-1610.
- [6] IBM SPSS Biostatistic software for data analysis www.ibm.com/software/analytics/spss.
- [7] Potteiger JA, Schroeder JM, Goff KL. Influence of music on ratings of perceived exertion during 20 minutes of moderate intensity exercise. *Percept Mot Skills* 2000; 91: 848-854.
- [8] Nethery VM. Competition between internal and external sources of information during exercise: influence on RPE and the impact of the exercise load. *J Sports Med Phys Fitness* 2002; 42: 172-178.
- [9] Bernandi L, Porta C, Sleight P. Cardiovascular, cerebrovascular and respiratory changes induced by different types of music in musicians and non-musicians. *Heart* 2006; 92: 445-452.
- [10] Pujol TJ and Langenfield ME. Influence of music on Wingate anaerobic test performance. *Percept Mot Skills* 1999; 88: 292-296.
- [11] Elliott D, Carr S, Orne D. The effect of motivational music on submaximal exercise. *European Journal of Sport Science* 2005; 5: 97-106.

Music increases exercise performance and endurance

- [12] Cohen SL, Paradis C, Le mura LM. The effects of contingent monetary reinforcement and music on exercise in college students. *Journal of Sport Behavior* 2007; 30: 146-160.
- [13] Elliott D. Music during exercise: Does tempo influence psychophysical responses? *Philica.com*. Article no. 110.
- [14] Rajeski WJ. Perceived exertion: an active or passive process. *Journal of Sport Physiology* 1985; 75: 371-378.
- [15] Hardy CJ and Rajeski WJ. Not what, but how one feels: the measurement of affect during exercise. *Journal of Sport and Exercise Psychology* 1989; 11: 304-317.
- [16] Birnbaum L, Bornas T, Huschle B. Cardiovascular responses to music tempo during steady state exercise. *Journal of Exercise Physiology Online* 2009; 12: 50-57.
- [17] Atan T. Effect of music on anaerobic exercise performance. *Biol Sport* 2013; 30: 35-39.