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Effect of music on psycho-physical variables of male cross-country athletes

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■ **ABSTRACT**

The purpose of the study was to determine the effect of motivational music on psycho-physical variables *i.e.* Rating Perceived Exertion (RPE), Maximum Heart Rate (MHR) and Time to Exhaustion (TTE) of male cross country athletes. Twenty four (N=24) male cross country athletes of Lakshmibai National University of Physical Education, Gwalior in the age group of 20-25 years were randomly selected as subjects for the study. Subjects were randomly divided in two groups (A and B), each group had 12 participants. All the participants ran to Volitional exhaustion on two separate occasions. On trial (T_1) both group participants ran without listening music, whereas on trial (T_2) participants of Group B ran without listening music and group A participants ran while listening to preselected motivational music with intensity (115–125 beats per minute). To find out the significant difference between two trials, independent t-test was used at 0.05 level of significance. The results of this study indicated that music had psycho-physical effect on the male cross country athletes, as measured by RPE, MHR and TTE.

■ **Key Words :** Rating perceived exertion, Time to exhaustion, Maximum heart rate

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The interplay of exercise and music has been long discussed, crossing the discipline of bio-mechanics, neurology and exercise physiology and sports psychology. Music alters emotional and physiological arousal and can therefore be used prior to competition or training as a stimulant, or as a sedative to calm "up" or anxious feelings (Bishop *et al.,* 2007). During sub-maximal exercise, music can narrow attention, in turn diverting the mind from sensations of fatigue. This diversionary technique, known to psychologists as dissociation, lowers perceptions of effort. Research shows that the dissociation effect results in a 10 per cent reduction in perceived exertion during treadmill running at moderate intensity (Karageorghis, 1999; Nethery, 2002; Szmedra and Bacharach, 1998). Although music does not reduce the perception of effort during high intensity work, it does improve the experience thereof. It makes hard training seem more like fun, by shaping how the mind interprets symptoms of fatigue. While running on a treadmill at 85 per cent of aerobic capacity (VO_2max), listening to music will not make the task seem easier in terms of information that the muscles and vital organs send the brain. Nevertheless, the runner is likely to find the experience more pleasurable. The bottom line is that during a hard session, music has limited power to influence what the athlete feels, but it does have considerable leverage on how the athlete feels.

People automatically felt the beats of the music they listen to and instinctively adjust their walking pace and heart rate to the tempo of the music. Listening to the music while exercise has been found in multiple studies to create an increased sense of motivation, distracting the mind while increasing heart rate. An athlete searching for music to incorporate in training and competition should start by considering the context in which he or she will operate (Karageorghis *et al.,* 2006). To assess the motivational qualities

of particular music, the Brunel Music Rating Inventory (BMRI) may be used (Karageorghis and Terry, 1999), as may its derivative, the BMRI-2 (Karageorghis *et al.*, 2006).

An athlete or exerciser whose goal during warm-up is elevating the heart rate to 120 beats per minute should select accompanying music that has a tempo in the range of 80–130 beats per minute. Successive tracks should create a gradual rise in music tempo to match the intended gradual increase in heart rate.

Coaches and athletes must choose how selected tracks will be delivered before or during training or competition. When cycling at around 70 per cent of one's aerobic capacity, mid-tempo music (115–125 beats per minute) is more effective than faster music (135–145 beats per minute) (Karageorghis *et al.*, 2006 and Karageorghis *et al.*, 2008). Music has been known to influence mood (Macone *et al.*, 2006), but does it also influence mental toughness in running duration and performance? If it does, this knowledge can be of great help to struggling exercisers. Macone *et al.* (2006) found that when participants were instructed to run to exhaustion, women spent significantly more time exercising with music than without, 29 minutes compared to 21, while men spent nearly the same time on the treadmill during both music and no music conditions, approximately 38 minutes. Macone *et al.* (2006) concluded that music would influence time to exhaustion in treadmill running in only certain types of exercisers.

Ansel and Marisi (1978) found that individuals could exercise longer if listening to music they enjoy, suggesting that their nervous system has the capabilities of attending to limited environmental stimuli at any given moment, while at the same time, eliminates other painful stimuli. Therefore, the purpose of this study was to determine the effect of listening to music on psychophysical variables and running performance of university male cross country athletes during a maximal tread mill test.

■ METHODOLOGY

The subjects were twenty four (N=24) male cross country athletes of Lakshmibai National University of Physical Education, Gwalior. The age 22$\pm$3 years, height 155$\pm$3.4 cm and body weight 52$\pm$3 kg. Selection of the subjects was with their readiness after their informed consent. All the participants who met the inclusion criteria for the study were selected using a random sampling technique. The purpose and procedure of the study was explained to the participants and all participants were randomly divided in two groups (A and B). Each group had 12 participants, although all the participants ran to volitional exhaustion on two separate occasions. On trial (T_1) both group participants ran without listening music, whereas, on trial (T_2) participants of Group B ran without listen to music and group A participants ran while listening to pre-selected motivational music with a intensity (115–125 beats per minute). Karageorghis *et al.* (2006) defined motivational music "at that which stimulate or inspire physical activity. A free motion treadmill was used for testing at LNUPE Fitness Centre. No additional encouragement or any other type of communication was given to participants of the groups while they ran the treadmill test.

Following a general warm-up on the treadmill, participants were given time to perform some warming-up exercise before beginning the treadmill test. For each participant treadmill protocol began 10 km per hour with a 0 per cent incline and it remained same on both the occasions. Participants were instructed to run to exhaustion. All the participants were required to wear a polar chest pulse sensor and heart rate was monitored throughout the test and maximum heart rate was recorded. The 15-point rating of perceived exertion (RPE), Borg scale was explained to each participant prior to testing, a large hand written of the Borg RPE scale on chart paper was placed in front of the participants throughout the duration of the tests and participants were asked to call out the number on the Borg scale at the end of each stage. RPE was recorded at the end of each stage until the participant reached his point of exhaustion and could no longer continue. Time to exhaustion, maximum heart rate and RPE were recorded at the point of exhaustion.

Participants were instructed not to use any stimulated substances prior to testing. The participants were instructed to sleep at least 6-8 hours the night before each test and did not participate in any strenuous activity 24 hours prior to each treadmill test and test was taken in evening between 4.00 to 6.00 p.m.

■ OBSERVATIONS AND DISCUSSION

To find out the significant difference between two trials, independent t-test was used at 0.05 level of significance. The statistical analysis of data related to Rating Perceived Exertion (RPE), maximum heart rate and time to exhaustion are given in Table 1.

It is evident from Table 1 that there was a significant difference in the mean value of rating perceived exertion, maximum heart rate and time to exhaustion for trial T_1 and trial T_2, as the calculated t- value of rating perceived exertion (3.99), maximum heart rate (8.62) and time to exhaustion (6.71) was found higher than tabulated t- value (1.717) at 0.05 level of significance (Fig. 1a).

Table 2 reveals that there was a no significant difference in the mean value of rating perceived exertion, maximum heart rate and time to exhaustion for trial T_1 and trial T_2, as the calculated t- value of rating perceived exertion (0.814), maximum heart rate (1.012) and time to exhaustion (0.985) was found lesser than tabulated t- value (1.717) required to be insignificant at 0.05 level of significance (Fig. 1b).

This study was conducted to determine the effect of

Table 1: Significance of difference between trail (T_1) and trial (T_2) of group A

Variables	Trials	Mean	S.D.	Calculated-t
Rating perceived exertion	T_1	14.34	1.45	3.99*
	T_2	11.61	0.87	
Maximum heart rate	T_1	147.30	9.13	8.62*
	T_2	159.40	6.89	
Time to exhaustion	T_1	23.21	5.15	6.71*
	T_2	30.36	6.98	

* indicates significance of value at P=0.05 is 1.717 T_1- First trial without music T_2- Second trial without music

Table 2: Insignificance of difference between trail (T_1) and trial (T_2) of group B

Variables	Trials	Mean	S.D.	Calculated-t
Rating perceived exertion	T_1	13.58	0.92	0.814
	T_2	13.24	0.81	
Maximum heart rate	T_1	146.91	8.29	1.012
	T_2	146.54	7.48	
Time to exhaustion	T_1	24.13	5.34	0.985
	T_2	24.76	5.96	

* indicates significance of value at P=0.05 is 1.717 T_1- First trial without music T_2- Second trial without music

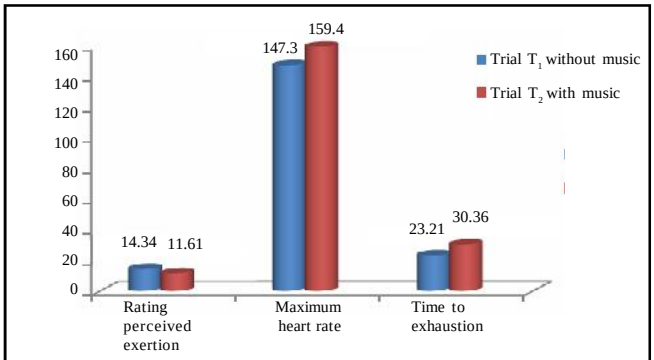

Fig. 1a Group A with music

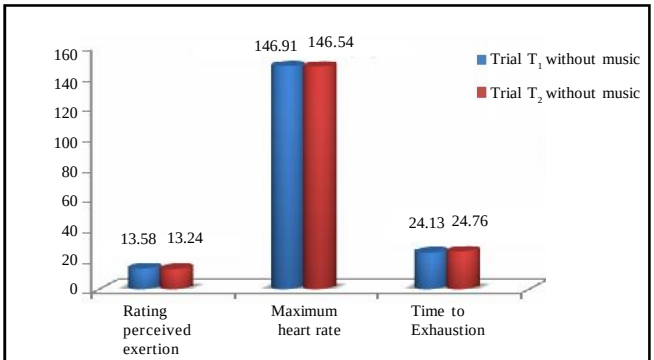

Fig. 1b Group B without music

Fig. 1 (a and b) : Psychophysical variables with and without music

motivational music on psychophysical variables *i.e.* rating Perceived Exertion (RPE), Maximum Heart Rate (MHR) and Time to Exhaustion (TTE) of male cross country athletes. The results of this study indicated that music had psychophysical effect on the male cross country athletes, as measured by RPE, MHR and TTE.

The findings of this study are congruent with previous research which found RPE to be lower during sub maximal exercise when listening to music had effect on physiological responses to exercise in the present study, as measured by time to exhaustion and maximum heart rate (Boutcher and Trenske, 1990; Copeland and Franks, 1991). Evidence from this study suggests that music affects running performance or perception of effort in male cross country athletes. The finding of this study provides sufficient evidence and also suggests that physical education teachers and coaches and athletes may benefit their students by playing motivational music which in many ways shall depict the intensity of the upcoming workout. Music, therefore, seems to be particularly effective in distracting the exerciser away from his or her perceived exertion and associated discomfort (Edworthy and Waring, 2006). This causes a longer duration in exercise time before one is persuaded to stop due to perception of negative bodily sensations (De Bourdeaudhuij *et al.*, 2002). This evidence shows that music may help exerciser push themselves harder and get a better workout (Macone *et al.*, 2006).

For those who are more likely to quit exercising due to

discomfort rather than physical exhaustion, these findings will be helpful in promoting longer physical endurance and higher performance, which will increase exercise adoption and adherence in exercise programmes as well as in obesity treatments (De Bourdeaudhuij *et al.*, 2002). The effects of carefully selected music are both quantifiable and meaningful. As Paula Radcliffe, the world record–holding marathoner, has said, "I put together a playlist and listen to it during the run-in. It helps psych me up and reminds me of times in the build-up when I've worked really hard, or felt good. With the right music, I do a much harder workout."This review of recent literature, from 1995 to 2006, compares the studies conducted in this time frame on the influence of music on treadmill running performance. These studies support the notion that music can serve as a psychological stimulus, enhancing the experience of exercise, and influence exercisers to push themselves harder and get a better workout (Macone, 2006). This causes a longer duration in exercise time before one is persuaded to stop due to perception of negative bodily sensations (De Bourdeaudhuij *et al.*, 2002).

The findings of this study also congruent with the study conducted by Szmedra and Bacharach (1998) who analyzed that participants' RPE was 10 per cent lower when they listened to music, especially after 6 minute of exercise. Women in Macone *et al.*, (2006) study who were instructed to run until exhaustion at a predetermined pace, reported having more fatigue after exercising to music, most likely because in the music condition they continued exercising for a longer time (Macone *et al.*, 2006). These two studies determined that music has a lowering effect on RPE.

It is also important that further research be conducted to determine how different types and intensities of music affect work output and RPE and TTE in male cross country athletes. In this way, music is helpful in increasing the capacity of respiration, heart rate, health related fitness and motivate the athletes for better workout. Now-a-days obesity and poor fitness is one of the major problems and to motivate people in fitness centre for better workout and control obesity, music can be advocated.

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