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The effect of motivational music during exercise on the performance of elite female swimmers

Lila Sabaghian Rad and Fariba Hafezi

Physical Education and Sports Science Department, Science and Research Branch, Islamic Azad University, Tehran, Iran

ABSTRACT

Some studies have shown that an exercise session with music can enhance the speed and performance of athletes. The question is whether music is actually effective for athletic performance. The purpose of the present research is to examine the effect of motivational music during exercise on the performance of elite female swimmers. 30 women (18-25 yrs.) with average height of 161 cm and average weight of 60 kg participated in the research. Pressure perception was measured using Borg's Rate of Perceived Exertion Scale, and resting heart rate and heart rate after a 100m swim as well as the time of the 100m swim were measured. The subjects were divided into an experimental group and a control group. Both groups participated in 16 exercise sessions, with the experimental group listening to motivational music, while the control group performed the exercises without any music. Then the participants took the post-test. The data was analyzed using ANOVA in SPSS 19 ($P < 0.05$). The results showed no significant differences between the studied groups in any of the variables. Listening to motivational music during exercise has had no effect on the performance of elite female swimmers.

Keywords: Perceived exertion, elite swimmers, resting heart rate

INTRODUCTION

Music can improve the psychological state of athletes and create positive ideas. It contributes to athletes' motivation and their resistance against psychological fatigue, thus improving their performance and skill learning. Music acts as an effective intervention for improving psychological and performance-related factors.

Research has shown that music improves performance in different ways. In sustained sub-maximal activities such as running, music can draw one's attention away from the feeling of fatigue [1]. Studies have also suggested the significant psychological and physiological benefits of music during exercise. Music has been shown to be effective in increasing aerobic endurance and exercise tolerance. The mechanisms of psychological-physiological effects of music are dissociation, arousal regulation, and synchronization [2]. A review of the research on the effect of music on performance factors reveals contradictions in results, which underline the necessity for further clarification of motivational, psychological, and performance changes in athletes when listening to music during exercise.

Perceived exertion is the subjective intensity of effort, strain discomfort, and/or fatigue experienced during exercise. Early studies on perceived exertion as a result of vigorous physical activity go back to the studies of Borg and Dahlstrom in the late 1950's and Borg in the 1960's. The results of these studies suggested that perceived exertion increases with exercise intensity [3].

Perceived exertion and mood states are important psychological variables in sports which are affected by such factors as body image, social and environmental factors, motivational strategies, and gender. With low levels of perceived exertion, athletes can perform activities for a longer period of time[4]

Eston et al. (1987) evaluated the use of the rating of perceived exertion (RPE) as a means of regulating the intensity of exercise during running. Estimates of effort were recorded using the Borg 6-20 Scale. The results supported the view that RPE could be a useful medium for controlling intensity of effort during vigorous exercise[5].

Coaches and athletes are mostly concerned with perceived exertion and mood states that can seriously affect the performance of athletes. Music is believed to have a significant effect on these factors, and here we review a number of studies that have examined the effect of music on psychological variables.

Macone et al. (2006) examined the effect of music on mood, state anxiety, and time to exhaustion during exercise of moderate intensity (75% resting heart reserve), and investigated the role of gender. The results showed significant mean changes in tension, depression, fatigue, confusion, and state anxiety. However, the findings suggested no significant effect of music, except that women, but not men, reported greater mean fatigue after exercising with music than without music[6].

Boutcher and Trenske (1990) found that participants who listened to music during a moderate workout had a reduced perceived exertion rate. They concluded that the effects of music on affective responses during exercise appear to be load-dependent [4].

Potteiger et al. (2000) reported that music (whether upbeat, classical, or self-selected) reduced peripheral, central, and overall RPE and improved performance on a cycle ergometer with an intensity of 70% VO_2 max [7].

Research has shown that listening to music while performing sub-maximal exercises increases efficiency and postpones fatigue, especially if there is a synchrony between the rhythm of the music and the movements of the athlete [1].

Given the considerable effect of music on the performance of athletes, it seems that further research is required to provide a deeper insight into the psychological benefits of listening to music while performing exercises. Although the effectiveness of music for performance has been supported in previous studies, factors such as biological, age, and gender differences, time, state of mind, mood, tradition, type of music, personal preferences, intensity of exercise, and different training protocols can lead to different effects of music on performance. Therefore, the purpose of the present research is to examine the effect of music on the performance of elite female swimmers.

MATERIALS AND METHODS

The present research was quasi-experimental. The population consisted of all the female swimmers in Iran's universities. The sample included 30 elite swimmers (18-25 yrs.; average height of 161 cm and average weight of 60 kg). The participants had not previously performed the task assigned to them in the present research. They also had no history of epileptic attack, serious injury, hearing impairment, and heart and nervous disorders.

The participants were informed of the purpose and procedure of the research and they all completed a consent form. Since the present research involved no invasive or non-invasive intervention, requiring written consent seemed sufficient. The participants were randomly divided into an experimental group (with music) and a control group (no music).

Using standard instruments, resting heart rate and heart rate after a 100m swim were measured. Then the participants completed Borg's Rate of Perceived Exertion (RPE) Scale and the data was recorded as pretest data. After 16 sessions of exercise with music for the experimental group and without music for the control group, these measurements were repeated as the posttest. Upbeat music was played for the participants in the experimental group using waterproof devices.

Borg's standard Rate of Perceived Exertion (RPE) Scale was used for measuring the participants' perception of exertion. To examine the content validity of the scale, it was distributed among a sample of 10 swimmers, and after examining the results few modifications were made to the ambiguous items in the scale. As for the reliability of the scale, it was again distributed among the sample a week after the posttest and a correlation coefficient of 84% was obtained. To ensure the reliability of the test, 20 participants performed the test one week after the posttest, leading to a 82% correlation.

Kolmogorov-Smirnov test was applied to examine the normal distribution of the data. Moreover, t-test for independent samples was used to compare the groups in heart rate, the time of the 100m swim, and perceived exertion. All the statistical operations were done in SPSS and Excel at the $\alpha = 0.05$ significance level.

RESULTS

As shown in the table below, listening to music has no significant effect on perceived exertion, resting heart rate, heart rate after the 100m swim, and the time of the 100m swim.

Table 1 – The results of t-test for pretest heart rate of the participants

	t-test						
	95% Confidence Interval		SD	Mean	Sig.	df	t
	Upper Limit	Lower Limit					
Resting Heart Rate	1.79694	-1.52627	0.8117	0.13533	0.869	28	0.167

Based on the results of t-test, the significance level is greater than 0.05; thus, the null hypothesis is accepted and listening to motivational music has had no significant effect on the resting heart rate of swimmers.

Table 2 – The results of t-test for the posttest heart rate of the participants

	t-test						
	95% Confidence Interval		SD	Mean	Sig.	df	t
	Upper Limit	Lower Limit					
Heart Rate after the 100m Swim	1.79694	-1.52627	0.8117	0.13533	0.869	28	0.167

The significance level is again greater than 0.05, indicating that motivational music has had no significant effect on the heart rate of swimmers at the end of the 100m swim.

Table 3 – The results of t-test for perceived exertion in the posttest

	t-test						
	95% Confidence Interval		SD	Mean	Sig.	df	t
	Upper Limit	Lower Limit					
Heart Rate after the 100m Swim	0.46400	-0.73067	0.29059	-0.13333	0.650	25.989	-0.459

The significance level is greater than 0.05. Therefore, the null hypothesis is accepted and motivational music has had no significant effect on perceived exertion.

Table 4 – The results of t-test for the time of the 100m swim in the posttest

	t-test						
	95% Confidence Interval		SD	Mean	Sig.	df	t
	Upper Limit	Lower Limit					
Time of the 100m Swim	1.79694	-1.52627	0.81117	0.13533	0.869	28	0.167

According to Table 4, significance level is greater than 0.05. Therefore, the null hypothesis is accepted and motivational music has had no significant effect on the time of the 100m swim.

DISCUSSION

The intensity of exercise mediates the relationship between attention during exercise and the exercise-induced psychological effects. In high-intensity exercise, external stimulants such as music can distract attention from the feeling of fatigue. It has been shown that the choice of the right type of music and paying attention to the musical preferences of the participants can increase its effectiveness. For instance, listening to relaxing music can replace the unpleasant feedback from vigorous physical exercise, thus improving performance. However, the results of the present research indicated otherwise, and the reason for the inconsistency could be related to the choice of music in this study, for musical preferences of the participants is a major problem in such studies. The music could be interesting and effective for some participants and dull and ineffective for other, therefore leading to different responses from the participants.

The results of the present research showed that motivational music has no significant effect on the performance of elite female swimmers. This is inconsistent with the findings of Pujol and Langenfeld (1999). The reason for this

inconsistency can be attributed to differences in exercise intensity, type of music, and type of exercise. Upbeat music was used in the present research, and there is not much research on the effects of this special type of music. Karageorghis (2006) studied the interactive effect of music with fast, medium, and slow tempos and exercise intensity on performance. He argued that at different intensities fast-tempo music is preferable to medium- and slow-tempo music [1, 8].

The results of this study indicated no significant difference between the control and experimental group in perceived exertion. This is consistent with the findings of Copeland and Franks (1991). They studied the effect of fast and slow music on rating of perceived exertion. The results showed insignificant changes in the experimental group compared to the control group. Other studies that have reported similar results include Wales (1972), Boutcher and Trenske (1990), Schwartz et al. (1990), Karageorghis et al. (1997), Thomas and Mark (1999). All these studies have reported no significant effect of music on perceived exertion. Boutcher and Trenske (1990) argued that perceived exertion increased with exercise intensity in both with music and without music conditions. Also Thomas and Mark (1999) suggested that the physiological effects of Wingate test can suppress the effects of music. Nethery (2002) found that perceived exertion increases with exercise intensity. The results of a study about effects of Music on Affect at Progressive Cycling did not showed any effect on affect. The results indicated that preferred music and no music have the same effect on subject's affect and no differences observed between two music conditions. The results of this study did not add any evidence that music had a significant positive effect during exercise. Schwartz (1990) concluded that music had no significant effect on the perceived exertion of the music and the no-music groups, which can be attributed to the high intensity of the exercise [1, 2, 4, 9-14].

The present findings are inconsistent with the results of Anshel and Marisi (1978), Eston et al. (1987), Boutcher and Trenske (1990), Copeland and Franks (1991), Szmedra and Bacharach (1998), Potteiger et al. (2000), Cromarty et al. (2002), Matesic (2002), and Maraki et al. (2006). The reason for the inconsistency of results can be attributed to such factors as gender, exercise intensity, age, type of music, and type of exercise. For instance, Eston et al. (1986) studied 30 young men. On the other hand, perceived exertion is an important complement for physiological measurements. It integrates a great amount of information, with cues from the peripheral muscles and joints, cardiovascular and respiratory functions, and central nervous system (Borg, 1962). However, it was impossible to examine and control the physiological conditions of every participant in the present research. Moreover, there is a difference between women and men in perceived exertion, i.e. women have lower rating on perceived exertion. Macone et al. (2006) examined the effect of music on mood state, anxiety, and fatigue when performing moderate intensity exercise, while accounting for gender differences. They reported no significant effect of music, except that women, but not men, reported greater mean fatigue after exercising with music than without music [2-6, 15].

CONCLUSION

The purpose of the present research was to examine the effect of motivational music on the performance of elite female swimmers. The results showed that listening to music while performing exercises has no significant effect on performance. The literature, however, suggests that listening to music can be effective for improving performance. Nonetheless, the lack of a significant difference between the control and the experimental groups can be attributed to the mediating effect of other factors such as the training protocol, type of exercise, type of music, and individual differences.

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