THE EFFECTS OF FAST- AND SLOW-TEMPO MUSIC ON RECREATIONAL BASKETBALL TRAINING

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Abstract

A field experiment was conducted to examine whether music could benefit the training experience in recreational basketball. Employing a within-participant repeated measures design, 11 women and 17 men were tested under three training conditions: 1) control (no music), 2) slow-music, and 3) fast-music. Affect was measured before, during and after each training session. Heart rate and perceived effort were assessed during training, and subjective appraisal of the training was recorded following each session accompanied by music. Music did not alter the participants’ heart rate, perceived training effort, or affect during training. The fast-tempo music led to decreased tranquillity after the training. Women experienced more positive affect following training sessions - regardless of music - than men. One third of the participants thought that it was better to train with music, one third believed that is was the same as without music, and one third perceived it as worse than training without music. Although music is known to benefit some individual or rhythmic group exercises, the current findings do not support the use of music in team-sports or at least in basketball training. Finally, the current results show that the psychological benefits of recreational basketball are more positive for women than for men.

Key words: Gender, Mood, Performance, Sport, Training

Introduction

Research interest in the effects of music and rhythm on motor behaviour dates back to the beginning of the past century. MacDougal (1902) suggested that music is a stimulus that promotes "natural movement" or synchrony between rhythm and motion. A century later, research into the impact of music on movement has grown noticeably. The current status of knowledge purports that music could enhance “the exercise experience” in four different, but not exclusive ways: 1) distracting from fatigue, 2) increasing the levels of arousal, 3) stimulating motor coordination by pacing the movement, and 4) facilitating neuromuscular relaxation and flow (Bishop, Karageorghis, & Loizou, 2007; Copeland & Franks, 1991; Karageorghis & Deeth, 2002; Karageorghis, Jones, & Stuart, 2008; Karageorghis & Priest, 2008; Karageorghis & Terry, 1997; Pates, Karageorghis, Fryer, &Maynard, 2003; Rendi, Szabo, & Szabó, 2008, Szabo & Hoban, 2004; Szabo, Small & Leigh, 1999).

Distraction from perception of fatigue during exercise in presence of attention-capturing background music is connected to the concept of association and dissociation as well as to the selective attention resulting from limited information processing ability (Rejeski, 1985). Accordingly, attention-capturing music could act as a distracter because while attending to it the exerciser is prevented from concomitantly attending to feelings of fatigue resulting from exercise (Potteiger, Schroeder, & Goff, 2000). This explanation is based on limited human attentional
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capacity (Nethery, 2002) and it is referred to as the parallel processing model (Rejeski, 1985). Therefore, the explanation could be plausible at low or moderate exercise intensities during which the music stimulus could compete for attention with the stimulus of fatigue while triggering dissociation. Past research has shown that dissociation could result in about 10% decrease in perceived exertion during running on a treadmill at moderate effort (Karageorghis & Terry, 1999). However, when the internal signal of fatigue becomes stronger, the mounting discomfort deters attention from music to pain resulting in an internal focus of attention or association (Szabo et al., 1999). Therefore, the strength of the attention-capturing stimulus determines the switch between dissociation and association. Consequently, dissociation has limited or no value in prolonged and/or high-intensity exercises (Karageorghis et al., 2008), as well as is open-skilled sports where dissociation is inappropriate.

Increased arousal, facilitating simple gross motor tasks, was also suggested to be a mechanism by which music could influence exercise behaviour (Brown, 1980; Hohler, 1989; Copeland & Franks, 1991; Vogel, 1986). While this explanation is plausible, the impact of heightened arousal may be beneficial in some forms of movement but less so in others. For example, optimal performance in golf or bowling requires lower levels of arousal than in canoeing or weightlifting. Therefore, music could have a “psyching-up” effect but that may depend not only on the type of the movement but also on the type of music (Lucaccini & Kreit, 1972). Thus, another critical factor is the tempo of the music (Anshel & Marisi, 1978; Becker, Chambliss, Marsh & Montemayor, 1995; Copeland & Franks, 1991; Pearce, 1981; Szabo et al., 1999) that needs to be synchronised with the movement’s tempo to maximise benefits (Anshel & Marisi, 1978; Fu & Zhang, 2001; Gfeller, 1988; Uppal & Datta, 1990). However, early research has often paid little or no attention at all to the synchrony between the characteristics of the movement and music tempi (Karageorghis & Terry, 1997), which could explain why “mixed” findings have emerged from this area of research (Coutts, 1961; Loucks, 2000; Nelson & Finch, 1961; Schwartz, Fernhall & Plowman, 1990).

In light of the current empirical evidence, music facilitates synchronization of the movement to its rhythm that could be beneficial if the latter is matching the speed of the required movement (Karageorghis, 1999). Empirical evidence for this proposal emerges from inquiries that have used both fast and slow tempo music to test performance during aerobic (and thus relatively fast rhythm) exercise. Copeland and Franks (1991) in a time-to-exhaustion protocol found longer treadmill exercise times (more work), higher heart rates (increased exercise intensity) and higher rated perceived exertion (greater reported effort) when the study-participants ran to fast-tempo music than when they ran to slow-tempo music. Using a similar protocol, Szabo et al. (1999) have found that time to self-exhaustion during ergometer cycling was longest when the slow music was switched to fast music at 70% maximal heart rate reserve of the participants. Further, Simpson and Karageorghis (2006) have demonstrated that synchronous music has improved running speed of 20 male runners by approximately 0.5 seconds in a 400-meter sprint in contrast to a no-music control condition. Complementing the above findings, Becker et al. (1994) reported that both fast- and slow-tempo music played in the background have resulted in higher mileage during a 2-minute ergometer cycling than white noise in the background. Becker et al. (1995) later found that slow or mellow music had a shortening effect on walking distance. It appears, then, that music could influence movement via its tempo to which most exercisers may ‘respond naturally’.

Listening to music is also a mood-regulating strategy used by many athletes (Stevens & Lane, 2001). However, only a few studies have examined the momentary mood or affect during exercise accompanied by various forms of music. A study by Brownley, McMurray and Hackney (1995) revealed that untrained runners reported more positive affect in response to fast music. These results were corroborated by the findings in another research in which fast aerobic dance-music yielded higher scores of vigour and lower scores of confusion as compared to a no-music control bench-stepping exercise condition (Hayakawa, Miki, Takada & Tanaka, 2000). Further,
positive feelings states in relation to fast “pop” music during aerobic exercise were also reported by Seath and Thow (1995). Two other studies examining cardiac rehabilitation patients also found that therapeutic exercise was associated with elevated states of positive affect (MacNay, 1995; Murrock, 2002). In the latter investigation, positive affect has decreased in those patients who exercised without music. Murrock (2002) suggested that positive affect is essential in compliance with a regular exercise regimen.

The bulk of research examining the relationship between music and movement has focused on rhythmical, mainly aerobic, forms of exercises. As a consequence, there is a shortage of research on the effects of music in team sports. While, it could be hard to synchronize all movements with music in open skill events - because of the very fast and very frequent changes in movement rhythm,- music could still benefit training in team sports by distracting attention from fatigue, moderating levels of arousal, and improving players’ mood / affect, which is essential in personal commitment and adherence to the team (Murrock, 2002). In spite of these potential benefits, only one published work, examining the connection between music and training in team sports, could be located on the SPORTDiscus® electronic resource data base in sports and exercise. Szabo and Hoban (2004) found that perceived effort was lower during both fast- and slow-tempo music conditions, in comparison to a no-music control session, in training of a national team of female volleyball players. At the same time, music did not improve affect and slow music led to decreases in positive engagement and revitalization by the end of the training. Demanding training at national level could have partially accounted for such findings.

The idea of incorporating music in basketball training, with skill acquisition and improvement purposes, has been recently introduced by Progetto Azzurina the Women’s Youth National Programme of the Italian Basketball Federation (Bressan, 2004). While it is claimed to be successful, the affective and effort perception-modifying benefits of music in basketball training were not studied neither within the context of the Progetto Azzurina nor scientifically. The current research adopted a similar methodology to that used by Szabo and Hoban (2004) to study the effects of slow- and fast-tempo music in recreational basketball training. In concordance with the results obtained by Szabo and Hoban, it was proposed that both types of music would yield lower perception of fatigue in comparison to a no-music control session. Further, because Szabo and Hoban studied competing national level athletes in a demanding training environment, that could have masked changes in affect, it was postulated that fast-tempo music played in recreational basketball would improve participants’ affect and yield a more motivational climate for brisk game actions and drills in contrast to the no-music control session.

**Methods**

**Participants**

In response to a university-wide call and personal solicitation of the PE teachers, three recreational basketball teams, who trained on a regular weekly schedule at a large urban university’s sports centre, have volunteered for the research. From a total of 36 participants forming the three teams, 28 completed three sessions of the study. Seven out of eight participants who did not complete, did not withdraw from the research, but were unable to attend one of the three training sessions that were part of this study. Therefore, their partial data obtained in one or two sessions were not included in the analysis. One male basketball player refused to sign the informed consent form that was required from all participants. Therefore, no data were collected from him. The final sample included 17 men and 11 women. Participants’ mean age was 20.6 years ($SD = 1.8$), mean height was 177 cm ($SD = 9.5$), mean weight was 68.6 kg ($SD = 13.4$), and their mean exercise experience was 46.9 months ($SD = 50.2$, ranging from 1 to 168 months). Four of the 28 volunteers were smokers. None of the participants...
reported medical reasons for which they could be at risk during exercise. The British Psychological Society’s (2008) ethical guidelines for conducting research with human participants were followed and enforced by the project leader in the course of this study.

Materials

To measure changes in affect from pre- to post-training the Exercise-Induced Feeling Inventory (EFI - Gauvin and Rejeski, 1993) was used. The EFI is a 12-item tool that requires participants to rate on a five-point scale, ranging from zero (do not feel at all) to four (feel very strongly), the degree to which they experience four affective states: positive engagement (enthusiastic, upbeat, happy), revitalization (energetic, refreshed, revived), tranquillity (calm, peaceful, relaxed), and physical exhaustion (fatigued, tired, worn out). These states are proposed to be conceptually (and psychometrically) distinct (Gauvin & Rejeski, 1993). For example, positive engagement exemplifies the degree of enjoyment of exercise, revitalization mirrors how refreshed or alive the individual feels after exercising, tranquillity reflects the calmness arising from the exercise experience, and physical exhaustion symbolizes the subjective appraisal of physical fatigue resulting from exercise (Gauvin & Rejeski, 1993). The maximum score on each of the four subscales of the EFI is 12 and the minimum score is 0. It is suggested that the EFI was presented with good psychometric properties (Bozoian, Rejeski & McAuley, 1994). The internal consistencies of the four subscales ranges from α=.72 to .91 (Gauvin & Rejeski, 1993). Before the research, the 12 items were semantically and conceptually translated from English to Hungarian and then translated back from Hungarian to English by other researchers until a final consensus emerged. The internal consistency of this Hungarian version of the EFI was on the average above α=.70 as calculated 6 times (3 conditions x 2 pre- and post-measures). Since the 12 items represent single-word feeling states, and since only changes from pre to post-training were of interest, it was deemed unnecessary to further study the psychometric properties of the translated scale (Appendix I).

Affect at the midpoint of the training (minute 40) was measured with the well-being questionnaire (WBQ - Gauvin & Szabo, 1992) that assessed positive affect (PA) with six adjectives like “happy” and negative affect (NA) with eight adjectives like “nervous”. The semantic validation of the adjectives on the WBQ has been performed in the same way as for the EFI. The internal consistency of the WBQ’s Hungarian version in the current study was, on the average, above α=.80 (Appendix II). The use of EFI for measuring affect during training was considered inappropriate, because the EFI was designed to tap changes resulting from the completed exercise experience.

Perceived exercise during the midpoint (minute 40) of the training was assessed using the Rated Perceived Exercise Scale (RPE - Borg, 1998). The scale ranges from 6-20, corresponding to no exertion at all to maximal exertion.

The music was an edited extract prepared from Beethoven’s Symphony no. 7 in A major op.92 identical to the music used by Szabo, Small and Leigh (1999). This work is an exploration of the rhythm, therefore, making it suitable for such an experiment. Its second advantage is the existence of a universally-praised recording made by the Vienna Philharmonic under Carlos Kleiber in 1976 (record reference: DG 447-400-2).

The slow music begins from the third bar of the second movement. The tempo marking is allegretto and the metronome mark is crotchet (equals 76 beats per minute). Kleiber’s recording is slightly slower than this mark (e.g. 72 beats per minute). The fast music is the exposition (repeated) of the last movement (Allegro con brio). The Kleiber recording brings out the intensity and exhilaration of this music, keeping it close to the metronome mark of minim (equals 72). The fast music is, consequently, twice as fast as the slow music (1 minim = 2 crotches). This music was selected for several reasons: 1) the tempo could be well defined, 2) contains no lyrics, and
At the conclusion of both slow- and fast-music training sessions, participants were asked to indicate whether training with the given music in the background was better, same, or worse than training without music.

**Procedure**

After signing an informed consent- and medical disclosure-form of no known reason for which exercise would not be suitable for them, athletes were tested during three scheduled training sessions, once in a no-music control session (representing their usual training), once in a slow-tempo music training session, and once in a fast-tempo music training session. The order of the test conditions was counterbalanced for the three teams.

Apart from the presence or absence of music, all sessions were identical. The participants completed the EFI within 5 minutes prior to the beginning of the training session as well as within the first 5 minutes immediately after the training session. They gave a quick rating of their perceived effort at minute 40 into their training while also taking their own pulse rate. To ensure accuracy, the participants were trained in manual pulse-rate measurement before the study. Start and stop signals for taking the pulse were given by the experimenters of whom at least two were present for the full duration of the tests. Subsequently, before resuming training, participants completed the 14-item WBQ, which took less that one minute in each case. The total break in training - at minute 40 - was aimed to last less than three minutes.

At the end of each training session with music, the participants also indicated in writing whether they liked or disliked the training session in addition to completing the EFI. It is important to note, that players did not know in advance which of the sessions would follow to prevent possible expectation effects in the pre-training assessment of affect that served as baseline for the post-training measures with the EFI.

**Results**

Psychological data obtained with the EFI were analysed with a three (condition: slow-music, fast-music, no-music) by two (period: before training and after training) by two (gender: male and female) mixed model multivariate repeated measures analysis of variance (MRMANOVA). This analysis revealed a statistically significant multivariate main effect for period and also a period by gender interaction (Wilks’ Lambda = .563; \( F(4, 23) = 4.5, p < .008 \); and Wilks’ Lambda = .509; \( F(4, 23) = 5.5, p < .003 \)). In accord with the statistical principles, only the interaction was examined further. Univariate tests revealed that the interaction was statistically significant for all the four measures of the EFI: exhaustion (\( F(1, 26) = 20.1, p < .001 \)), positive engagement (\( F(1, 26) = 4.1, p < .05 \)), tranquillity (\( F(1, 26) = 8.9, p < .006 \)), and revitalization (\( F(1, 26) = 5.2, p < .03 \)). These interactions are illustrated in Figs. 1-4.
Figure 1. Training period by gender (1 = male; 2 = female) interaction for positive engagement

Figure 2. Training period by gender (1 = male; 2 = female) interaction for physical exhaustion
Although it did not reach the conservative level of statistical significance, the MRMANOVA also yielded a condition by period interaction Wilks’ Lambda = .757; $F(8, 98) = 1.8, p < .08$). Following up on this multivariate result, by using Greenhouse-Geisser correction for the degrees
of freedom and also adjusting the probability level of the univariate tests with the Bonferroni method (i.e., $\alpha = 0.05 / 4$ tests = 0.125) to avoid Type I error, it was established that the interaction was due to a statistically significant condition by period interaction in tranquillity ($F(1.74, 45.45) = 6.4, p < .005$). This interaction is illustrated in Fig. 5.

![Figure 5](image.png)

**Figure 5.** Training period by condition (1 = fast-tempo music, 2 = slow-tempo music, and 3 = no-music control) interaction, illustrating a decrease in tranquillity after the fast-tempo music session.

There were no statistically significant differences in positive affect, negative affect, pulse rate, and rated perceived effort - all obtained at minute 40 in the training - between the three conditions. Training with fast music was appraised as better by nine participants, another nine thought that it was the same as without music, and the rest of them (10) thought that it was worse than without music. Similarly, for the slow-music training sessions these preferences were eleven, nine, and eight in the same order. As expected from the visual examination of these figures, using chi square ($\chi^2$) tests, it was assured that these distributions did not differ statistically significantly from each other.

**Discussion**

The reported field experiment was an attempt to further investigate the use of music in team sports. Although carried out in a recreational setting, the findings echo those of Szabo and Hoban (2004) and show that unlike in aerobic exercises (Bishop et al., 2007) positive psychological changes do not emerge in team sports as a result of music played in the background. These negative findings also agree with the results of past research measuring changes in affect from pre- to post-training without a musical intervention in interactive sports (Abele & Brehm, 1993; Szabo & Bak, 1999; Szabo, Worringham, & Whetton, 1999). It was presumed that in team sports, in general, focus may be directed *outwards* to performance rather than *inwards* to psychological feeling states (Berger, Grove, Prapavessis, & Butki, 1997). However, the earlier results were largely based on the examination of competing and male participants. The current results demonstrate that women in recreational team sports, like basketball, may accrue positive changes in affect as a result of a training session.
Indeed, independent of music, and not a planned part of the current research, the most robust findings could be connected to gender differences in changes in affect from pre- to post-training. Women responded more favourably to the training sessions than men. Similar findings have been reported in literature (Rocheleau, Webster, Bryan, & Frazier, 2004; Hansen, Moses, & Gardner, 1997) and it is not uncommon that women experience more intense improvement in affect than men. Such findings were attributed to higher negative affect before exercise in women than in men (Merns, 1995). In this inquiry too, as visible on Figs. 1-4, women participants reported lower levels of positive affect, tranquillity and revitalization than men and higher levels of exhaustion. However, these findings could not be attributed to floor or ceiling effects because the changes for men were in opposite direction rather than remaining stable, except for tranquillity. It is conceptually difficult to interpret the fact that physical exhaustion decreased in women after the training. However, this is not an isolated case. Similar findings were disclosed in the literature and were connected to the simultaneously occurring positive changes in measures of affect (Rocheleau et al., 2004). Such a connection between positive affect and exhaustion is consistent with the results obtained in this field experiment, because positive engagement, revitalization, and tranquillity were increasing while perception of exhaustion has decreased in the women participants.

The lack of effects of music on perceived effort is inconsistent with the results reported by Szabo and Hoban (2004). In the current study neither slow- nor fast-music altered the perception of effort. There could be three explanations for these differences. The first explanation could be related to the different movements in basketball versus those in volleyball. In basketball there is more running around, sprints, stops, dribbling with the opponent, whereas volleyball is more stationary. The second explanation may be connected to the different type of music adopted in this study and that of Szabo and Hoban. In the latter, contemporary pop music with lyrics was selected by observing the tempo. Those lyrics could have had direct or subliminal effects on the appreciation and reporting of the perceived effort. The third explanation may be related to the training intensity in competitive and recreational team sports. In the former, the required effort could be greater than in recreational sports played for fun, and rating of effort may be different too. A “hard” rating in recreational team sports may be perceived as “light” in training for competition. In the current research all ratings corresponded to “somewhat hard”, whereas in Szabo’s and Hoban’s inquiry the ratings were “hard” in the control session, “somewhat hard” in the fast-, and “light” in the slow-music session.

In spite of the different types of music adopted, music during training triggered negative affect in the current experiment and also in Szabo’s and Hoban’s (2004) work. The negative changes in affect reported in the two experiments could be attributed to an external distraction – caused by music - in the flow of the training. In the current inquiry tranquillity decreased after the fast music condition, suggesting an interference with the feeling of calmness or inner peace. In other words, in the current inquiry, the fast music, dictating a fast tempo, may have interfered with training-driven movements resulting in agitation or restlessness, in the participants. In Szabo’s and Hoban’s (2004) experiment the slow music resulted in decreased positive engagement and revitalization following training, which may also suggest interference with the planned or desired movement by slowing down the rhythm of a dynamic training that is expected to occur at the national level. Alternately, the lyrics of the slow music in Szabo’s and Hoban’s study may have been “less than exciting” or even sad enough to adversely affect the training spirit.

There are several common denominators between the current experiment and that reported by Szabo and Hoban, such as the music’s tempo, the nature of the work (in-situ field experiment), and the social form of sports (teams). However, there were substantial differences between the two studies that limit comparability, like the forms of movement (basketball versus volleyball), the type of music (classical without any lyrics versus pop with lyrics), and the nature of the sport (recreational versus competitive). Furthermore, cultural responses to music have
been reported in the literature (Good et al., 2008) that should not be overlooked. It is important to note that systematic and scholastic effort in identifying optimal forms of music for real-life training environments in sport settings is theoretically desirable to promote in-training well-being, motivation, adherence, effort, and even cohesion in the team (Merns, 1995). However, the current results also suggest that a “universal taste” for a specific type of music in the training environment would be hard to select. Indeed, participants’ appreciations of both slow- and fast-tempo music training conditions was divided in three almost equal thirds. In other words, about one third of the participants thought that training with music was better than without music, one third thought that it was the same, and one third appraised it as worse. Considering these findings, it could be predicted that music which suits the taste of all members of a team would be hard to find. Consequently, in accord with the bulk of music and exercise research, training in team sports could be enhanced with music that is synchronized with movement during independently performed rhythmic drills, while the presentation of the music is restricted to the practice period of those drills.

The current field experiment reveals that addition of tempo-dictating music, slow or fast, makes no difference on perceived effort, pulse rate, and positive and negative affect during training. The results also reveal that affective benefits are not gained with the addition of music to the training session. On the contrary, in recreational basketball, fast-tempo music results in decreased tranquillity after training. Regardless of music or the training session, women participants showed improvements in affect with reports of physical exhaustion in the opposite than the expected direction. The reversed trend was observed for men. Appraisal of the session as better, same, or worse than without music was divided in almost equal thirds among the participants, indicating large variability in preferences for the training environment and prognosticating difficult choices for music selection. It is concluded, that the adoption of music in interactive team sports may have limited value and that the benefits of music on exercise are likely restricted to rhythmic forms of movement in endurance sports. It is also concluded that women’s psychological response to recreational basketball training is more positive than that of men, or alternately, women’s attentional focus was unaffected by the characteristics of the music played during training.

References


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