Original Research

Effect of Music Tempo on Attentional Focus and Perceived Exertion during Self-selected Paced Walking

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ABSTRACT

International Journal of Exercise Science 9(4): 536-544, 2016. This study investigated the influence of music on the rating of perceived exertion (RPE) and attentional focus during walking at a self-selected pace. Fifteen overweight and obese women volunteered to participate in the study. They underwent four sessions: the first for incremental maximal test and anthropometric measurement followed by three experimental sessions. After the first session, they were exposed to three 30-minute walking sessions at a self-selected pace in a counterbalanced order: fast-tempo music (FT), medium-tempo music (MT) and no-music control (NM). Borg's RPE Scale and an Attentional Focus Questionnaire were used to measure the perceptual response and attentional focus, respectively. Results showed that the RPE was higher in the no-music control than in the medium-tempo music (12.05 ± 0.6 vs. 10.5 ± 0.5). Furthermore, dissociative attentional focus was greater for both conditions with music in comparison with the no-music control (NM= 39.0 ± 4.1; MT= 48.4 ± 4.1 and FT= 47.9 ± 4.5). The results indicated that the use of music during walking can modulate attentional focus, increasing dissociative thought, and medium-tempo music can reduce the RPE.

KEY WORDS: music, cognitive, overweight and obese women.

INTRODUCTION

Regular physical activity is an important for the prevention and treatment of overweight and obesity. Although physical activity is not the main means for reducing body fat, it improves cardio-respiratory fitness and lowers the risk of heart disease, among others, if performed regularly and safely (9, 16). Despite the knowledge of the benefits of exercise, overweight and obese individuals tend to be sedentary (1, 3). Regarding their low level of physical activity, it has been observed that the way the individual perceives physical exercise tends to influence their participation (36). In this sense, the development of strategies that encourage exercise to be perceived more positively may be interesting for this population.

Music is an important way to reduce monotony during exercise (17, 21, 30). Its use can produce psychological and physiological effects, influencing the rating of perceived exertion (RPE) and the attentional focus during exercise (21). The RPE can be defined as the subjective intensity of effort, strain, discomfort, and/or fatigue that is experienced during physical exercise (32). In the context of endurance exercise, attentional focus has been operationally in associative and dissociative attentional. These terms are dichotomous, while associative attentional focus has been defined as attention in physical sensations or other task-related process, dissociative attentional focus has been defined as attention in sensations or task-not related with the physical work (7, 9).

Despite knowledge of the effect of music on psychological and psychophysical responses, few studies have explored its effect on cognitive orientation during exercise (19). The use of music seems to influence the RPE when compared to no-music conditions. In a study conducted by Potteiger, Schroeder, and Goff (29), the use of music produced a reduction in all conditions when compared with the no-music condition. Moreover, Almeida et al. (3) found that the RPE is higher with fast tempo music compared with the no-music and medium-tempo music conditions. This influence of music can be explained by attentional processing. When the exercise is performed at low or moderate intensity, external factors, like music, can be process in parallel with physiological cues, attenuating this response on the information process. However, at higher intensities, physiological cues seem to dominate the processing of information; while at moderate intensity, external routes, such as the use of music, can be processed in parallel (31, 33). Accordingly, a motivational factor of music—tempo — appears to influence RPE.

Regarding attentional focus, previous studies have observed that elite runners use an associative attentional focus during a race whereas recreational runners have dissociative focus during the effort (27). The associative attentional focus seems to be more productive in highly conditioned individuals because they are able to meet the physiological demands objectively (8, 11). However, sedentary subjects with lower fitness levels can benefit from a dissociative attentional focus, reducing bodily sensations and positively interpreting the effort. In this manner, strategies to modulate the RPE and make the attentional focus more dissociative could benefit lower-conditioned people.

This study observed the effect of music on the RPE and the attentional focus in self-selected paced walking performed by overweight and obese women.

METHODS

Participants

A sample of 15 women aged 35 to 50 participated in the study (mean ± SD, age 42.9 ± 4.9 years, height 1.56 ± 0.07 m, body mass 79.7 ± 11.9 kg, body mass index 32.7 ± 5.1 kg/m^2, peak oxygen uptake 24.7 ± 4.7 ml.kg.min.$^{-1}$). Inclusion criteria were as follows: (a) engages in less than 30 minutes of exercise on most days of the week (1); (b) has a body mass index (BMI) of between 25 and 39 kg/m^2; (c) does not make use of pharmacological resources that could change the outcome of the study; (d) does not have cardiovascular disease; (e) answers negative to all questions in the Physical Activity Readiness Questionnaire (PAR-Q). This study was approved by the Research Ethics Committee of the Federal University of Paraná, and all participants signed an informed-consent form before starting the research.

Protocol

The medium tempo was between 115 and 120 beats per minute (bpm) while the fast tempo was between 140 and 145 bpm (21). The participants were asked to prepare a list of their three favorite artists, in hierarchical order, to exercise context. Upon completion of the list, the three most-mentioned artists were used to compile the playlist. Three medium-tempo and three fast-tempo songs from each artist were used for the experimental sessions (22).

Body weight (kg stadiometer Sanny, São Paulo, Brazil) and height (cm, Toledo, Sao Paulo, Brazil) were measured according to the technique described by Lohman, Roche, and Martorell (26). To calculate the body mass index (BMI) the following formula was used: kg/m^2.

The RPE was measured using the 6–20 Borg scale (6). This instrument essentially comprises a category rating scale of 15 points, with scores ranging from 6 ("minimal effort") to 20 ("maximum effort").

The RPE has been analyzed and related to several physiological variables such as heart rate, oxygen uptake, blood lactate, metabolic acidosis, among others markers (5, 24).

The attentional focus was measured by the Attentional Focus Questionnaire - AFQ (8). This questionnaire evaluates the focus of attention asses how much exercisers think about some activities along three domains (association, dissociation and distress), comprising 30 questions, with answers ranging from 1 ("not ever") to 7 ("all the time"), divided into dissociative attention, associative attention, and distress. For the study, we considered only the associative and dissociative attentional domains. Some studies has been discussed the psychometric proprieties and utilized AFQ to evaluate the attentional focus from exercise (25, 35).

The participants performed an incremental maximal test (T_{max}) using the Bruce Protocol (10). The test started at a speed of 2.7 kilometer per hours (km/hr^{-1}) and a 10% slope. Every three minutes there was a load increment on both the inclination and the speed to increase participants' volitional fatigue. The T_{max} was performed on a Reebok Fitness® treadmill (X Fit-7 model, London, UK). The heart rate (HR, beats per min^{-1}) was measured by a Polar monitoring system (Polar Electro Oy, Kempele, Finland). During the test, oxygen uptake (VO_2) was measured using the K-4 system (Cosmed, K4b2, Rome, Italy) in the process "breath by breath." Peak oxygen uptake (VO_{2peak}) was considered the greatest VO_2 achieved during the last 30 seconds of the test. Maximum heart rate (HR_{max}) was defined as the highest value obtained for the HR during the T_{max}.

This study comprised four meetings: (a) familiarization, anthropometric measures and maximal exercise test (laboratory environment); (b) three walking sessions in the external environment, with medium-tempo music, fast-tempo music, and no-music conditions. Participants were requested not to perform physical exercises 24 hours before each workout and not to have energy drinks, coffee, or caffeinated products in a period of three hours before each session (2).

At first meeting, the participants were asked to fill all information and assign the consentient to participate on the research. Following, were recorded height and weight, to calculate BMI. RPE Scale and AFQ were shown to participants and they were instructed how to use them. After that, participants performed the T_{max}. A period of 72 hours after performing the incremental maximal test was set for the participants to performed the first of the three experimental sessions. Each session had one of three conditions: walking with use of fast-tempo music (FT); walking with medium-tempo music (MT); and no-music control (NM). There was a minimum of 48 hours between each experimental session.

The experimental sessions were performed on external environment, on a standard outdoor 400-m track. Each session comprised a three-minute of warm-up, 30 minutes of walking at a self-selected intensity and five minutes of "cool down". At warm-up, the participants were instructed to walking at an intensity that would prepare them to exercise. At begin of each experimental session, were given the following instruction: ''you will be allowed to select an intensity you prefer to perform on overground. This should be an intensity that you would choose for a 30-min workout if you were participating in a fitness program. The intensity should be high enough that you would get a good workout, but not so high that you would not prefer to exercise at that intensity daily or at least every other day. It should be an intensity that is appropriate for you'' (18). After the first 5 min, they were allowed to adjust their walking speed only every 5 min of the 20-min trial (i.e., minutes 5:00, 10:00, 15:00, 20:00 and 25:00). For cool-down, the participants were instructed to walking at a lower intensity that they performed during the 30 minute of exercise, at a self-selected pace that made them decelerate. Experimental sessions were conducted individually to avoid effect of group dynamics or social interaction on the psychophysiological responses to exercise (13).

All sessions were held at the same time of day. The temperature (degree Celsius, C°) was 22.53 ± 3.24; 22.20 ± 3.32 and 23.06 ± 2.52, for NM, MT and FT, respectively. The percent relative humidity of air (%) was 51.26 ± 0.96; 51.53 ± 0.83 and 51.26 ± 0.96 for NM, MT and FT, respectively. This date was provided from K4b2. There were not differences between sessions for temperature or humidity. The order of the sessions was randomized, and participants were not provided with information about the music tempo in sessions spent with the use of music. In the sessions with music, the participants used the headphone Apple. When the participants walking without music, they received the headphone, with this not playing sound.

During the experimental sessions, the physiological responses were determined "breath by breath" and converted to percentages of VO_{2peak} (%VO_{2peak}) and HR_{max} (%HR_{max}). The RPE was measured at 5, 10, 15, 20, 25, and 30 minutes of exercise. The attentional focus was measured after the exercise session.

Statistical Analysis

To physiological analysis, six points were considered: five-minute averages were used for comparison between conditions (01:00-05:00, 06:00-10:00, 11:00-15:00, 16:00-20:00, 21:00-25:00 and 26:00-30:00). To RPE analysis, were utilized the six time points that they were collected and calculated average of session. To AFQ analysis, the sum of each variable (dissociation and association) it was utilized to compare the conditions. Data are presented as mean ± standard error (SE). For all analysis (physiological, perceptual and attentional focus), the repeated measures ANOVA compared the three conditions: medium-tempo music; fast-tempo music; no-music control. In the presence of violations in the sphericity assumptions, Greenhouse-Geisser corrections were employed. The magnitude of effect was calculated by the partial eta squared ($\square^2$p). When significance was found, Bonferroni's post-hoc was utilized to find where was difference. The level of significance for the analyses was set at $p < 0.05$. Data were statistically analyzed using the computer program SPSS (version 17.0).

RESULTS

With regarding physiological responses, there were no differences between conditions for $\%VO_{2peak}$ ($F_{2:30}$= 0.329; *p*= 0.723; η^2p= 0.29) or $\%HR_{max}$ ($F_{2:30}$= 0.904; *p*= 0.382; η^2p= 0.076). NM, MT and FT were performed under 77.45 ± 2.89; 75.14 ± 2.91 and 75.98 ± 2.86 $\%HR_{max}$, respectively. With regarding $\%VO_{2peak}$, NM, MT and FT performed at 59.04 ± 3.48, 56.81 ± 3.81 and 58.00 ± 3.90, respectively.

The pattern of perceptual responses is presented in Figure 1. ANOVA found condition effect in perceptual responses ($F_{2:28}$= 4.380; *p*= 0.02; $\square^2$p= 0.238). The post-hoc Bonferroni found that RPE it was lower at MT than at NM (10.5 ± 0.5 vs. 12.05 ± 0.6, respectively). There were no differences between FT and MT (10.9 ± 0.4 vs. 10.5 ± 0.5, respectively) or between FT and NM (10.9 ± 0.4 vs. 12.05 ± 0.6, respectively).

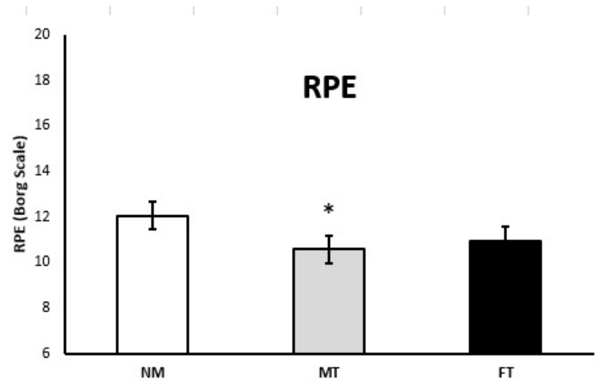

Figure 1. Responses of RPE during walking at a self-selected paced. NM= no-music, MT= medium tempo music and FT= fast-tempo music. Data are presented as mean ± SE. * Note significant difference between NM and MT ($p < 0.05$).

Attentional focus is present in Figure 2. Regarding the dissociative focus, there was effect of condition ($F_{2:30}$= 5.975; *p*= 0.008; η^2p= 0.352). The post-hoc Bonferroni found that NM was lower than MT and FT (39.0 ± 4.1; 48.4 ± 4.1 and 47.9 ± 4.5, respectively). No difference was found between MT and FT. The ANOVA found no effect of the condition on associative focus ($F_{2:30}$= 0.013; p= 0.987; η^2p= 0.001).

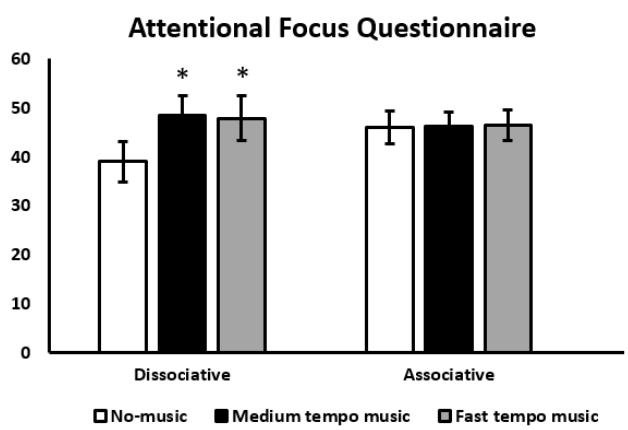

Figure 2. Attentional focus during outdoor walking at a self-selected pace by overweight and obese women. * Note significant difference from no-music condition ($p < 0.05$).

DISCUSSION

This study observed the effect of music on the RPE and attentional focus at a self-selected paced exercise sessions performed by overweight and obese women. The results of this study were as follows: RPE was greater in the no-music control compared with that in medium-tempo music; the dissociative attentional focus was higher in conditions with medium and fast tempo music compared with the no-music control; no differences were observed among the three conditions in associative attentional focus.

Reducing the RPE through the use of music has been found in previous studies (29; 34). Music seems to be able to mitigate the physiological feedback derived from the exercise. However, this effect depends on the intensity at which the exercise is performed. At high intensities, the physiological feedback from exercise seems to dominate the processing of information for the modulation of the RPE. On the other hand, at low and moderate intensities, external factors such as the use of music can be processed in parallel in the process of the RPE (8, 11). The intensity of walking sessions were self-selected paced, that were performed at moderate intensity (1). In this sense, using music in low- or moderate-intensity exercise, such as walking, can be interesting for the participants to experience exercise in a more positive way.

The fact that the RPE shows no differences between FT and NM may be due to the stimulus exposure time. In fact, the literature shows that the tempo of music can influence the RPE of the subject during physical exercise (3). Karageorghis et al. (21) suggest that continuous exposure to fast tempo music may result in reduced motivation, leading to loss of interest in the activity. These changes in physiological responses could change how the exercise is perceived.

Regarding attentional focus, the music affected dissociative attentional focus. The relevance of the stimulus is the causative factor in changing the attentional focus, that can be explained by Social-Cognitive Perspective of Perceived Exertion and Exertion Tolerance (33). With low or moderate intensity, the focus on stimuli unrelated to the exercise predominates in the formation of cognitive response because the exercise has been undertaken lightly. On the other hand, at higher intensities the brain shifts attention to internal cues information due to changes caused by the increased exercise intensity. Our results can confirm this theory, where the session's intensity were at moderate intensity (1).

Dissociative attentional focus has been received attention because your association with factor linked at adherence to exercise (like affective response, enjoyment, and others). Is well established that if the exercise is not perceived as enjoyable, tolerable or comfortable, probably individuals will not repeat the activity and will drop out the training (15). The dissociative strategies can be a solution to how the exercise stimulus is experienced (25). Dissociative techniques have been suggested to diverting attention away from uncomfortable or displeasure stimulus during exercise. Moreover, dissociative focus has been positively associated with revitalization, positive engagement, and reductions in physical exhaustion during exercise (23). For example Pennebaker and Lightner (28) found that external focus was better enjoyment and satisfaction compared to internal focus during aerobic exercise. Another question, is that manipulating attentional focus during exercise, like music use, for example, can influence feeling of pleasure and enjoyment during exercise session, even when at intensities slightly above from ventilatory threshold (20).

Dissociative attentional focus has been suggested improve both immediate and long-term exercise program adherence (14). However, few studies has been investigated the relationship between dissociative attentional focus and adherence or maintenance. Annesi (4) found that dissociative attentional focus during exercise had significantly lower drop out, as well as trend toward to higher attendance than control condition. Nonetheless, the causal effects between dissociative attentional focus and adherence need of experimental designs to be explained.

The present sample was comprised of overweight and obese women adults and thus the findings cannot be readily generalized to the other population without replicate the same design. The benefit of exercising outdoors versus indoors has been established in the literature (12). Our design has an external validity that has not been utilized until now. The present participants walking at an external environment in relative isolation, and it is noteworthy that inmost real life exercise environments.

The present findings show that at moderate exercise intensity, external factors can modulate psychological responses. The use of music while walking at a self-selected paced intensity can improve dissociative attentional focus during exercise. Moreover, medium tempo music can lower perceived exertion in overweight and obese individuals. Our results have practical implication for people that could benefit from strategies that cause a lower interpretation from internal cues during exercise, as overweight and obese women. For future studies, we suggest designs that use dissociative strategies on specific people, as obese man, elderly and sedentary.

ACKNOWLEDGEMENTS

The authors would like to thank CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) to fund this research.

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