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Original Article

Psycho-affective responses of physically active older adults during exercise in different environments

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Abstract:

There is evidence showing that exercise in natural environments (green or blue) promotes positive changes in psycho-affective aspects in comparison to the indoors or urban environments. However, the effects of this practice in older adults is still unknown. This study analysed the acute effect of physical exercise in different environments on the psycho-affective responses of physically active older adults. For this, we measured 15 physically active older adults (Age: 65.4±5.1 yrs.; BMI: 29.5±0.1 kg.m²). The entire sample performed five exercise sessions in three different environments: a multi-sport gym (closed environment), an open running track (green environment) and at the beach (blue environment). The exercise sessions were composed of 30 minutes: 5-min warm-up, 20-min walking and 5-min recovery. We evaluated mood state, feeling, speed and perceived exertion. The main results indicated significant differences between environment results in mood states: vigour (χ^2_5=3.16; p=0.67); fatigue (χ^2_5= 10.23; p=0.06) with higher post-values in the blue environment scenario than pre-values (p=0.031); tension (χ^2_5=3.12; p=0.68); depression (χ^2_5=0.46; p=0.99); confusion (χ^2_5=2.28; p=0.8) and anger (χ^2_5=9.66; p =0.08), with lower post-values than pre-values in the blue environment (p=0.026). The effort and speeds as well as the affective responses were equivalent in these environments (p<0.05). In conclusion, the blue environment was able to reduce anger levels as well as increase fatigue state of physically active older adults.

Keywords: Affective response, perceived exertion, green exercise, mood, older adults.

Introduction

The performance of exercises in natural environments is called "green exercise" (Gladwell, Brown, Wood, Sandercock, & Barton, 2013; Rogerson, Brown, Sandercock, Wooller, & Barton, 2016), and can be an alternative for adherence to physical exercise programs against sedentary behaviour, since natural environments promote health benefits (McSweeney, Rainham, Johnson, Sherry, & Singleton, 2014), improvements in mood, reduced anxiety and mental fatigue (Keniger, Gaston, Irvine, & Fuller, 2013). In this context, there is a dose-response effect due to the presence of natural sources of water such as rivers, ocean and lakes which results in superior positive emotional changes to other environments, including natural ones (Gladwell et al., 2013; Keniger et al., 2013; McSweeney et al., 2014; Rogerson et al., 2016). Due to these differences in the magnitudes of response, White et al. (2010) began to use the term "blue exercise" to refer to exercise performed in environments that contain water.

There is a direct association between adherence to the exercise program and the positive affective experiences (Lacharité-Lemieux, Brunelle, & Dionne, 2015; White, Pahl, Ashbullby, Burton, & Depledge, 2015). In addition, positive mood changes are associated with a fun level of exercise (Raedeke, 2007). On the other hand, the level of sedentary behaviour in people > 60 years (Molina, García-Gonzalez, Pardo, Casterad, & Solana, 2018) and the health problems associated with aging are worrying (Carver, Beamish, & Phillips, 2018). In this way, it is essential to create conditions that motivate the inclusion of older adults in a physically active lifestyle. However, despite this evidence, studies still direct their aims toward healthy adult populations, with exposure to nature in a virtual way (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Thompson Coon et al., 2011) and almost exclusively developed under the same climate conditions, with there being no studies in warmer climate regions such as South America and Africa (Keniger et al., 2013). To the best of our knowledge, there are no studies which have investigated this theme in older adults, so the present study aimed to analyze the acute effect of exercise performed in different environments on the psycho-affective responses of physically active older adults. We hypothesize that the subjects will present higher changes in affective mood states after the exercise carried out in contact with natural scenarios (green and blue) than those seen in the closed environment.

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Material and methods

Experimental approach

This is characterized as a randomized crossover study, with the environment of performed activity as an independent variable and the affective states (affective response and mood state) associated to physical exercise as the dependent variables. The sample calculation was performed in order to obtain the minimum sample size necessary to find reliable results before the study was carried out. For this purpose, the study by Focht (2013) was taken as reference for having a design and similar measures to this study. The effect size found in the revised study was 0.43 and the values of 5 and 10% represent the alpha and beta error, respectively. The calculation was performed in G-Power® software which returned a sample size equal to 10 subjects.

Sample

The following inclusion criteria were adopted: a) to be able to practice physical exercises at moderate intensity, as proven by a cardiological report; b) > 60 years of age; c) > three months of exercise practice; and as exclusion criteria: a) if the subject presented musculoskeletal changes or symptoms which affected the proposed activities. The sample was initially composed of 22 older adults people (of a group with 45) who participated in the project "My Best Age". Seven from the total did not participate in all stages: two due to cataract surgery, two suffering from diseases and three gave-up. Thus, the final sample consisted of 15 (11 female) subjects (65.4±5.1 yrs., 73.6±8.2 kg, 1.6±0.1 m, 29.5±3.5 kg/m^2); four were hypertensive; two were diabetics; and two were diabetic and hypertensive. All subjects signed the Informed Consent Form and the applied procedures. This protocol was approved by the Ethics Committee of the University in which the study was performed (protocol #1,536,771).

Procedures

The study was divided into three stages carried out in different weeks. In the first stage, the subjects received information about the procedures they would be submitted to, as well as on the instruments used in the study: The profile of mood states (POMS) (Viana, Almeida, & Santos, 2001); rating of perceived exertion (OMNI) for walking (Utter et al., 2004); and the feeling scale (Hardy & Rejeski, 1989). In the two remaining stages, the sample was randomized into five sessions lasting 30 minutes (5-min warm-up, 20-min walk with self-selected intensity and 5-min recovery), which were performed in 3 different environments: a) Gym (closed exercise); b) Olympic track-field (green exercise); and c) Beach (blue exercise). For all participants, the first two sessions were performed in the green and blue environment for familiarization with environments and instruments. Only the data collected in the last three sessions were used for analysis. All sessions occurred between 7 and 8 o'clock in the morning with a minimum interval of 48-h between sessions. Figure 1 shows the chart of procedures:

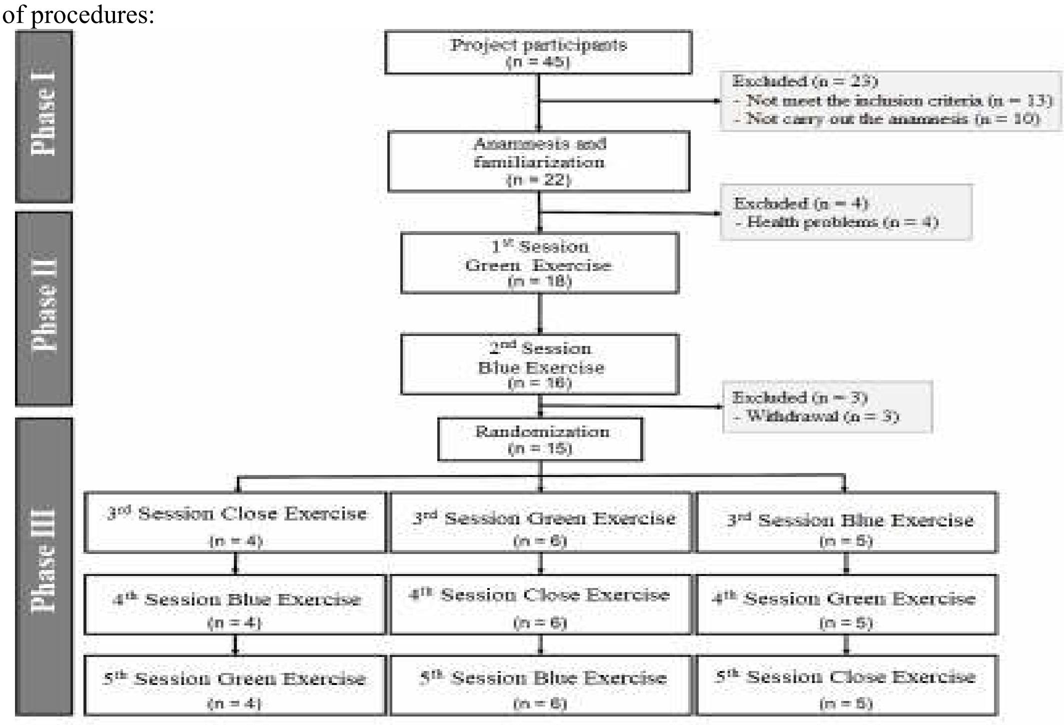

Fig. 1. Chart of procedures and data collection.

All subjects were instructed to not drink alcoholic beverages and to not perform exercises for24 hours prior to the sessions, which occurred on days with similar average climatic conditions (26ºC), relative air humidity (68%) and thermal sensation (28°C). All answered the questionnaire of risk factors for cardiovascular diseases (Medicine, 2007) and physical activity readiness questionnaire (PAR-Q) (Thomas, Reading, & Shephard, 1992).

Anthropometric measures

Anthropometric measures were performed a day before data collection with calibrated material by a trained ISAK level I anthropometrist, who recorded body weight and height. Body mass was measured on a scale with maximum capacity of 200 kg and accuracy of 100 g (WELMI®, Sao Paulo, Brazil). Height was measured using a stadiometer (Harpender®, British Ind., London, England). Weight and height were applied to estimate Body Mass Index.

Statistical analysis

The Shapiro-Wilk test was used to verify the data normality and the Friedman test was used (followed by Wilcoxon test) to search the differences between the groups. Only the measures referring to affective mood states reject the normality. Two-way ANOVA was used for repeated measures (Bonferroni post-hoc) for the other variables: the environment (closed, open and green) X the measurement moment (5, 10, 15 and 20-min). One-way ANOVA was applied (Bonferroni post-hoc) for distance. Sphericity was tested (Mauchly's test) and the Greenhouse-Geisser correction was applied when necessary. For analysis of variance, Eta squared (η^2) values were calculated to evaluate effect size and interpreted using the criteria: strong effect size ($\eta^2 > 0.14$), moderate effect size ($0.06 < \eta^2 < 0.14$) and weak effect size ($\eta^2 < 0.06$). The 95% confidence intervals were calculated and a significance level of $p \leq 0.05$ was used for all analyses.

Results

There was no significant difference in mean speed (Close = 1.4 ± 0.2 m/s; Green = 1.4 ± 0.2 m/s; Blue = 1.4 ± 0.2 m/s; $F_{2;28} = 1.69$; $p = 0.2$; $\eta^2 = 0.01$).

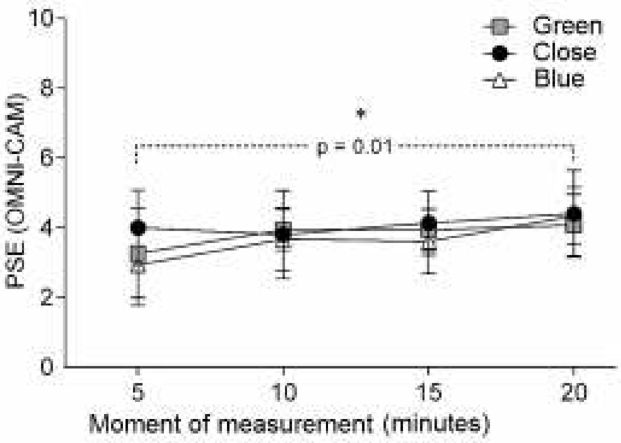

Fig. 2. Rating of Perceived Exertion * p = 0.01 between the 5 and 20-min. (data showed in mean ± standard deviation).

For RPE (Figure 2), there was an isolated effect of time ($F_{2,1;29,5} = 6.58$; $p < 0.001$; $\eta^2 = 0.89$), where the 20-min time was higher when compared to the 5-min time (4.2 ± 0.2 vs 3.4 ± 0.2; p = 0.01; $\eta^2 = 0.56$). There was no significant effect of the environment ($F_{1,4;20,0} = 0.87$; p = 0.39; $\eta^2 = 0.02$), moment of measurement ($F_{1,9;26} = 0.31$; p = 0.71; $\eta^2 = 0.01$), or interaction ($F_{3,5;49,6} = 1.43$; p = 0.24; $\eta^2 = 0.03$) for affective response (Figure 3).

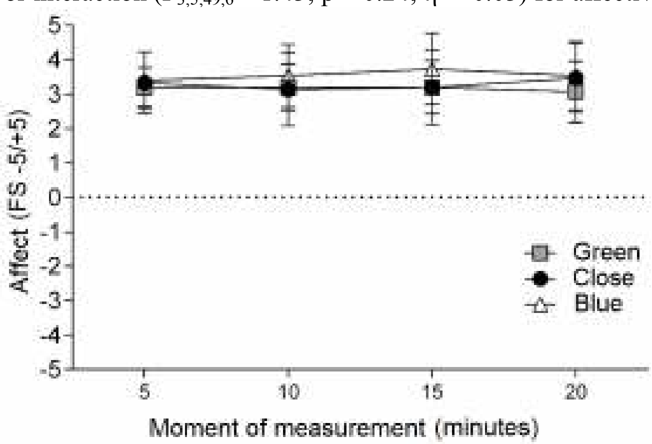

Fig. 3. Affective responses in conditions: closed environment, green and blue (data showed in mean ± standard deviation).

There was a significant difference for mood state domains (Figure 4): (A) Vigor ($\chi^2_5 = 3.16$; $p = 0.67$); (B) Fatigue ($\chi^2_5 = 10.23$; $p = 0.06$) with higher post-values in the blue environment situation than pre-values ($p = 0.031$); (C) Tension ($\chi^2_5 = 3.12$; $p = 0.68$); (D) Depression ($\chi^2_5 = 0.46$; $p = 0.99$); (E) Confusion ($\chi^2_5 = 2.28$; $p = 0.8$); and (F) Anger ($\chi^2_5=9.66$; $p = 0.08$), with lower post-values than pre-values in the blue environment ($p = 0.026$).

Discussion

Studies with healthy adult populations have shown that green exercise can bring about favourable changes in mood states, increasing vigour (Bowler et al., 2010; Rogerson et al., 2016) and reducing tension, confusion (Pretty, Peacock, Sellens, & Griffin, 2005), depression, anger (Bowler et al., 2010; Pretty et al., 2005; Rogerson et al., 2016) and fatigue (Bowler et al., 2010). Moreover, a preceding report indicated that exercise performed in a natural environment with water demonstrated significant improvements in mood states (Barton & Pretty, 2010). The present study aimed to analyse the acute effect of physical exercise in different environments on psycho-affective responses of physically active older adults. The main results indicated that physical exercise resulted in positive affective responses; however, in an affirmative reply to our hypotheses, only blue exercise was able to modify the mood states, with higher fatigue and lower anger post-values than pre-values. No other effects were observed in mood states between groups. In contrast to our results, McSweeney et al. (2014) identified in a systematic review that the visualization of natural environments, whether through windows or images, is sufficient to produce a sensation of comfort and reduce physiological indicators of stress.

Two systematic reviews indicated superior benefits of green exercise on emotional aspects in relation to indoor or urban environments (Bowler et al., 2010; Thompson Coon et al., 2011). Specifically regarding mood, there are different magnitudes of these benefits depending on aspects such as age and type of environment, with the largest effect sizes being verified in natural environments with water and people aged between 30 and 70 years (Barton & Pretty, 2010). There are other distinct types of environments with observed positive effects such as gyms (Lacharité-Lemieux et al., 2015) and laboratories (Focht, 2013; White et al., 2015), but different interventions were implemented. Our practical analysis suggests there are distinct types of engagement in green or blue environments, with a blue environment reported to have a positive effect on older adult mood states. However, the extent to which each type of green or blue physical activity benefits health and well-being is supposed to differ, demanding confirmation in future research. This elucidation of understanding is needed because previous literature has tended to focus on recording empirical evidence rather than developing a sound theoretical framework to understand green or blue environments. Herein we propose an ecological dynamics rationale to explain how and why a blue environment might influence mental health and well-being of physically active older adults. This framework suggests a number of unexplored, interacting limitations connected to types of environment and other population groups which shape different levels of benefit related to each situation. Further analysis is needed to elucidate the categorical relationship among a blue environment with well-being and health, including levels of engagement, levels of physical activity, types of environmental constraints, motor skill effects and sampling of diverse populations. To our knowledge, only one study used self-selection intensity for exercise prescription (White et al., 2015), where positive indexes of affective response occurred in a closed or natural environment, as also occurred in our study. However, Focht (2013) verified statistically superior affective responses in the green environment versus the closed environment.

Self-selection of intensity is an effective method to produce positive affective responses, regardless of the chosen intensity (Oliveira, Deslandes, & Santos, 2015); however, our results do not corroborate this hypothesis. The incompatibility of our results may be related to specific differences in exercise applied in the closed environment, since Focht (2013) used a treadmill in the closed environment, so the subjects need to devote more attention to monitoring the rhythm of the activity, even if it is self-selected. There is evidence that maintaining attention on aspects related to exercise performance reduces affective responses (Rose & Parfitt, 2007). In contrast to our results, Harte and Eifert (1995) showed that indoor exercise with some kind of exercise-related cognitive task makes the activity psychologically more unpleasant by raising feelings of tension, hostility and fatigue, and increasing the level of perceived exertion. Regarding intensity, our study shows that exercises in natural environments (green or blue) do not interfere in the chosen intensity, since it was similar in all three environments. The Dual-mode Theory of Ekkekakis (2003) showed that affective responses in the intensities selected by the participants of our study are predominantly positive. Thus, the choice of mild or moderate intensities and the effects already attributed to self-selection of intensity may have minimized the possible beneficial effects of exposure to natural environments.

Positive changes in affective mood states linked to exposure to nature is often the most visual feature within the exercise theme (Barton & Pretty, 2010; Bowler et al., 2010; Rogerson et al., 2016). It is theorized that these benefits are linked to properties intrinsic to the environment as well as the reduced psychophysiological aspects of stress (Ulrich et al., 1991) and cognitive relaxation (Kaplan, 1995) by virtue of the unconscious attraction of various sensory stimuli (Kaplan, 1995; Ulrich et al., 1991). Nevertheless, this phenomenon is still poorly investigated in older adults. Our results did not find the occurrence of such benefits. However, we do not believe that they were absent, but that they may have been concealed, as the investigated sample seemed to have good mental health due to reports of high vigour and reduced levels of tension, depression, fatigue, confusion and hostility. However, there were no nominal values of references to reinforce this. In view of the foregoing and the fact that our study is the first to investigate such propositions in an exclusively older adult population, it is advisable to perform further studies to confirm our findings given their direct and indirect importance in the health of this population.

Conclusion

Our study suggests there are different types of arrangement in natural, green or blue environments, highlighting the blue environment as having positive effects on older adult mood states. In physically active older adults, an exercise session in a blue environment provided positively higher fatigue and lower anger post-values than pre-values. The behaviours of affective responses were positive and similar in the natural, green and blue environments, with no change in mood states between them. The present study demonstrates that the presence of water in the environment was able to reduce anger levels as well as increase fatigue during a physical fitness session.

Conflict of interest

The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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