Relationship between physiological parameters, perceptual and emotional journey into rhythm during self-selected


ABSTRACT: The purpose of this study was to investigate the association between physiological, perceptual and affective responses during walking at a self-selected pace in sedentary women. The sample was composed by forty-five women with a median age of 32.6 ± 8.6 yr. Subjects participated of an incremental test to determine the maximal physiological, perceptual, and affective responses; subjects also participated of an 20 min walking bout on the treadmill at their self-selected pace to determine the physiological (maximal oxygen uptake, VO2max, heart rate, HR), perceptual (rating of perceived exertion, RPE) and affective responses (affective valence, AV). Pearson correlations (r) were used to verify the associations between physiological, perceptual and affective responses during walking, with a level of significance of p<0.05. RPE were associated to percent of maximal oxygen uptake (%VO2max), percent of oxygen uptake at the ventilatory threshold (VT; %VO2VT), heart rate (HR), percent of maximal heart rate (%HRmax) and percent of heart rate at the VT (%HRVT) (p<0.01). Otherwise, affective valence (AV) was only associated to HRVT and VO2max (p<0.05). In conclusion, the psychological responses, more particularly the RPE, were associated to physiological responses during walking at a self-selected pace.

Keywords: walking, physical effort, anaerobic threshold.

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INTRODUCTION

The physical inactivity is considered one of the major modifiable risk factors related to non-transmissible chronic diseases with a high prevalence in the adult population Brazilian. Recently, extensive discussions have been conducted by professionals related to public health on relevant aspects of the low rate initial engagement in physical activity. Meanwhile, another fundamental problem in programs of physical activity, the high abandonment rate, it has unfortunately been neglected. A major risk factor for the abandonment in programs of physical activity is the high intensity of exercise prescribed. Dishman and Buckworth demonstrated that interventions involving the prescription of a low intensity of physical activity (approximately 50% of maximum capacity or less) had a higher rate of compliance than those involving prescriptions of more vigorous intensity. However, despite these considerations relating to the adherence to regular practice of physical activity, it appears that an intensity of exercise minimum is required for the occurrence of organic beneficial adjustments to cardiorespiratory fitness, usually between 55% to 90% of the maximum heart rate (FC) maximum (FC máx) and 50% to 85% of maximum oxygen consumption (VO₂max). Although discussions relevant compliance and the relationship between intensity of exercise ideal (dose-response model) for the maintenance and improvement of cardiorespiratory fitness has been made lately, previous studies have shown that individuals participating in programs of regular physical activity tend to exercise in a self-selected intensity and preferred to the detriment of an intensity previously prescribed.

It was suggested further that this intensity of exercise self-selected could be physiologically appropriate to the minimum values recommended by the American College of Sports Medicine and linked to the emergence of perceptual responses positive, or a mild-moderate subjective perception of effort (SPE) and a state affective denoting comfort. In this context, the present study was to describe the physiological parameters, perceptual and emotional related to the hike in intensity self-selected by adult women, previously sedentary. Furthermore, the association between physiological parameters, perceptual and emotional was also investigated.

METODOLOGY

Subjects
Participation of this study 45 adult females, previously sedentary, residents of the municipality or the metropolitan region of Curitiba. The initial recruitment of potential participants was conducted through personal ads and / or printed. All subjects were informed about the procedures used, possible benefits and risks coupled to the implementation of the study, after their participation conditional on a voluntary basis through the signing of the end of free and informed consent. The research protocol is designed as the guidelines proposed in Resolution 196/96 of the Council National Health on research involving humans. We established the following inclusion criteria: (a) that previously sedentary, obtained the International Physical Activity Questionnaire (IPAQ), Brazilian version and / or participation less than 30 minutes of regular physical activity on three or more days of week, (b) any changes occurred in the patterns of habitual physical activity during the past six months, (c) all of the negative responses to the Physical Activity Readiness Questionnaire (PARQ), (d) no history of cardiovascular disorders, respiratory, and musculoskeletal metabolic and (e) any history of smoking.

Experimental Design
This study is part of the project Preferred Intensity, Research Center in Exercise and Sport, University Federal of Paraná, which deve-
lops its activities since the year 2006. A design of observational research, cross correlational was employed, adopting a process of sampling non-relative for convenience. All participants were subjected to two experimental sessions, held on two days distinct, with a minimum of 48 hours between them. In the first session, a test incrementally until exhaustion in wake was conducted for the determination of physiological parameters, perceptual and emotional maximum. During the second session, held up a test of 20 minutes of walking at a pace in line with self-regulated and preferred, in which physiological parameters, perceptual and affective were again measured. The participants were instructed not to undertake vigorous physical activity on the day before the experimental sessions, but not to eat for a period of two hours before its start.

Procedures

At the start of the first trial session, the subjects participants underwent anthropometric an assessment performed by a single investigator previously trained. Following procedures, standardized instructions on the scale of perceived effort scale14 and affective feeling15 were conducted. A model of valve mask respirator with bidirectional format T (Hans Rudolph brand, model 2726, Inc. Kansas City, Missouri, USA) and a catch nasal were adjusted for each participant, connected to a system of spirometry. Following procedures, five minutes of warming were performed in wake ergométrica (brand Reebok Fitness, fit model X-7, London, United Kingdom) to a default speed of 4.0 km/h inclination of 0%. Later, an incremental test was conducted using a protocol established by Lind et al.11, starting at a speed of 4.0 km/h inclination of 0% for two minutes, and then increased by 0.6 km / h every minute until exhaustion. Throughout the test the determination of physiological parameters, perceptual and emotional was obtained every minute. In the second trial session, a test of 20 minutes of walking in wake was conducted after initial heating to 5 minutes at a speed of 4.0 km/h 0% inclination. During the test, participants were instructed to self-select a preferred speed, as with the procedures proposed by Dishman9, through the use of sensors to control speed coupled to wake. The adjustment of the speed was allowed ad libitum during the first four minutes of walking (minutes 1, 2, 3 and 4), and then, only in minutes 5, 10 and 15. However, the label of speed was hidden subject to the estimated16 through an object placed its front. Again, the determination of physiological parameters, perceptual and emotional was held every minute.

Instruments

The anthropometric variables body mass (MC, in kg.; Balance mark Toledo, model 2096, Sao Paulo, Brazil), height (EST on cm; stadiometer mark Sanny, Standard model, Sao Bernardo do Campo, Brazil) and Index of Mass Corporal (BMI, kg/m²) were obtained as the procedures proposed by Lohman et al.17. The body density was measured by the method of thickness of skinfolds, according to the equation proposed by Durnin and Womersley18. Subsequently, the percentage of body fat (% fat) was obtained by Siri equation19. Seeking avoid variations inter-evaluators, all measurements were obtained by a single evaluator previously trained. Heart rate (HR) was determined by using the frequency meter (Polar brand, model S625X, Kempele, Finland). This method of monitoring the heart rate, often recommended for the prescription and monitoring of physical activity8, consists of an elastic tape adjusted to the chest and a radio transmitter connected to a system of computerized metabolic analysis. The maximum heart rate and heart rate at ventilatory threshold were determined as the highest average heart rate (intervals of 10 seconds) recorded in the last stage of the test incrementally until complete exhaustion in wake and the ventilatory threshold, respectively. The oxygen consumption (VO₂) was determined by a system of computerized spirometry, open circuit (ParvoMedics brand, model TrueMax 2400, Salt Lake City, Utah, USA). This system was calibrated for O₂ and CO₂ concentration using a gas certified for O₂ and CO₂ in the ventilation using a syringe from 3L (Hans Rudolph brand, model 5530, Kansas City, Missouri, USA). The maximum oxygen consumption (VO₂max) and the consumption of oxygen in the ventilatory threshold (VO₂vent) were determined as the highest VO₂ average (range 1 minute) occurred in the last stage of the test incrementally until complete exhaustion in wake in the ventilatory threshold, respectively. The ventilatory threshold (VT) was calculated individually as the procedures established by Caiazzo et al.20 and visually identified as the point at which the plot of reason minute ventilation by consumption of oxygen (VE/VO₂) versus the reason minute ventilation for production CO₂ (VE/VCO₂) deviates from the normal. The emotional state (ES) for the exercise was determined through the range Feeling Affective14, due to the fact that previous evidence to demonstrate their sensitivity as an indicator of aerobic-anaerobic transition21. This instrument consists of a measure bipolar (positive / negative or comfort / discomfort) on a Likert scale of 11 points (-5 to +5), single item, with anchors ranging from “very good” (+5) to “very bad” (-5). According to Hall et al.22, single-item scales, are suitable for repeated measures of achievement during exercise. The subjective perception of effort (SPE), determined by the scale of perceived effort Borg23,24, was used as an indicator of intensity of physical activity and is considered by the American College of Sports Medicine, an important adjunct in the monitoring of the heart rate8,15. This instrument consists of a Likert scale of 15 points, single item, ranging from 6 to 20, starting with anchors on “no effort” and ending on “maximum effort”. The validity of the SPE for completion of physical activity is supported by extensive evidence15.

Statistical Procedures

Measures of central tendency and variability were used for the characterisation of the participants of the study. A test of product moment correlation of Pearson (r) was used to determine the degree of association between physiological parameters, perceptual and emotional obtained during hike in intensity self-selected. The significance level was p <0.05. The statistical procedures of this study were performed using the Statistical Package for the Social Sciences (SPSS version 13.0) for Windows.

RESULTS

Table 1 presents the anthropometric characteristics of the participants of this study. Most participants were classified as normal (BMI ≥ 18.5 and 25.0 kg/m²; 68.4%). However, some subjects were classified as carriers of overweight body (BMI > 25.0 and ≤ 30 kg/m²; 26.8%).
The physiological responses, perceptual and emotional during the test incrementally until exhaustion in wake are presented in Table 2. For physiological parameters in VT, there was a response of the HR average of 78.8 ± 6.8% of HRmax and VO2 average of 65.7 ± 9.8% of VO2max.

Table 3 shows the absolute values of physiological parameters, perceptual and emotional test during 20 minutes of walking in rhythm self-regulated. For physiological parameters VO2 and HR, it was observed that participants tend to work in a relative intensity of 56.9 ± 11.2% (variation 35.6% to 85.7%) and 73.8 ± 9.2% (variation 49.7% to 94.4%) of your maximum (VO2max and HRmax, respectively), and 86.9 ± 19.3% (variation 46.5% to 140.9 %) and 93.4 ± 11.5% (variation 56.9% to 119.0%) of its figures on the VT (VO2vt and HRvt, respectively). For SPE and ES, it was found that the subjects tend to work themselves into an intensity corresponding to 98.8 ± 15.1% (variation 31.5% to 130.0%) and 96.0 ± 2.0% of its values obtained in VT (SPEvt and ESvt, respectively) (Table 3).

Table 4 shows the correlation coefficients product-moment of Pearson (r) between physiological responses, perceptual and emotional test during 20 minutes of walking in intensity self-selected and preferred. A significant association (r = -0.649, p <0.01) between SPE and ES was observed.

**DISCUSSION**

Despite the influence of various components of physical exercise on the rate of abandonment of programs of physical activity, the intensity seems to a key role. Interventions based on a reduced intensity of exercise prescribed appear to be more successful than those involving greater intensity6. This could be due to the completion of exercise at an intensity light, below the point of transition from dominance between aerobic-anaerobic metabolisms, be related to perceptions of nice effort and a state of comfort, thus resulting in greater adherence to physical activity11,12. Unlike the approach reduced intensity / high grip, much has been discussed on the fact that a minimum intensity of physical activity is required to the occurrence of cardiorespiratory significant adjustments, in a dose-response model2-5. According to the American College of Sports Medicine6, it is necessary intensities of exercise usually between 55% to 90% of the HRmax and 50% to 85% of VO2max.

In the present study, it was found that adult women, previously sedentary, can self-select an intensity of physical activity physiologically appropriate (56.9 ± 11.2% of VO2max and 73.8 ± 9.2% of HRmax) (Table 3). These results corroborate the findings of Lind et al.11, where adult women exercitaram in a preferred intensity ranging from 55 ± 10% and 67 ± 14% of VO2max and 67 ± 13% and 83 ± 13% of the HRmax and Murtagh et al.25 in which individuals recreacionalmente active walked in a self-selected intensity average of 59.0 ± 13.4% of VO2max and 67.3 ± 11.6% of HRmax Table 3 also shows that participants preferred exercise in a forthcoming intensity to the values observed in VT, in the point where lactate begins to build up in the blood, subsequently resulting in an increase in respiratory ventilation26. This proximity of average values was observed both in relation to physiological parameters VO2 (86.9 ± 19.3%) and in relation to the heart rate (93.4 ± 11.5%).

The parameters SPE and ES hike in intensity during certain preferred also presented closer to those average values in the VT (98.8 ± 15.1% and 96.0 ± 2.0%, respectively). These results are similar to those observed in previous studies11,12,21 and confirm the hypothesis that individuals tend to exercise in a forthcoming intensity to the point of aerobic-anaerobic transition parameters associated with perceptual positive. Indeed, the association between perceptual and physiological parameters relating to the VT was observed in the present study, as shown in Table 4. In addition to its association with various physiological parameters during the performance of physical exercise, the SPE has also been linked to responses psychological situational, such as ES. According to Baden et al.27, ES seems to be a major psychological factors contributing to the SPE. Unfortunately, this relationship between SPE and ES was only found during tests of physical exercise so incremental. In the present study, involving a test of walking in intensity self-selected and preferred, a significant association between SPE and ES was also evident (p <0.01). According to the model proposed by Rejeski28, the achievement of physical exercise at a lower intensity and / or similar to the VT is influenced by cognitive and traces.

**Table 1. Demographic and anthropometric characteristics of survey participants.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Average</th>
<th>DP</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>32.3</td>
<td>8.7</td>
<td>20.0</td>
<td>45.0</td>
</tr>
<tr>
<td>Body Mass (kg)</td>
<td>63.9</td>
<td>11.2</td>
<td>42.8</td>
<td>97.8</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>163.1</td>
<td>7.4</td>
<td>149.0</td>
<td>178.0</td>
</tr>
<tr>
<td>IMC (kg/m2)</td>
<td>24.0</td>
<td>3.5</td>
<td>15.9</td>
<td>35.0</td>
</tr>
<tr>
<td>% Body Fat</td>
<td>28.5</td>
<td>4.9</td>
<td>14.3</td>
<td>37.2</td>
</tr>
</tbody>
</table>

**Table 2. Physiological parameters, perceptual and emotional of the subjects investigated.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Average</th>
<th>DP</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR&lt;sub&gt;max&lt;/sub&gt; (bpm)</td>
<td>180.1</td>
<td>17.2</td>
<td>126.0</td>
<td>208.0</td>
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<tr>
<td>HR&lt;sub&gt;max&lt;/sub&gt; (bpm)</td>
<td>142.4</td>
<td>15.2</td>
<td>103.0</td>
<td>176.0</td>
</tr>
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<td>VO&lt;sub&gt;2max&lt;/sub&gt; (ml.kg&lt;sup&gt;-1&lt;/sup&gt; min&lt;sup&gt;-1&lt;/sup&gt;)</td>
<td>32.8</td>
<td>6.5</td>
<td>18.1</td>
<td>45.7</td>
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<tr>
<td>VO&lt;sub&gt;2&lt;/sub&gt; (ml.kg&lt;sup&gt;-1&lt;/sup&gt; min&lt;sup&gt;-1&lt;/sup&gt;)</td>
<td>21.7</td>
<td>5.3</td>
<td>12.7</td>
<td>35.5</td>
</tr>
<tr>
<td>SPE&lt;sub&gt;vt&lt;/sub&gt; (escore)</td>
<td>12.2</td>
<td>1.7</td>
<td>7.0</td>
<td>16.0</td>
</tr>
<tr>
<td>ES&lt;sub&gt;vt&lt;/sub&gt; (escore)</td>
<td>2.6</td>
<td>1.6</td>
<td>-2.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Table 3. Physiological parameters, perceptual and emotional subject of the investigation obtained during testing of 20 minutes of walking in wake.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Average</th>
<th>DP</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>132.2</td>
<td>16.6</td>
<td>95.0</td>
<td>117.0</td>
</tr>
<tr>
<td>VO&lt;sub&gt;2&lt;/sub&gt; (ml.kg&lt;sup&gt;-1&lt;/sup&gt; min&lt;sup&gt;-1&lt;/sup&gt;)</td>
<td>18.2</td>
<td>3.6</td>
<td>11.5</td>
<td>30.2</td>
</tr>
<tr>
<td>SPE (escore)</td>
<td>11.9</td>
<td>2.0</td>
<td>7.0</td>
<td>17.0</td>
</tr>
<tr>
<td>ES (escore)</td>
<td>2.6</td>
<td>1.9</td>
<td>-4.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Table 4. Correlation between physiological responses, perceptual and emotional obtained during test of 20 minutes of walking in wake.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>VO2</th>
<th>%VO2&lt;sub&gt;2max&lt;/sub&gt;</th>
<th>%VO2&lt;sub&gt;vt&lt;/sub&gt;</th>
<th>HR</th>
<th>%HR&lt;sub&gt;max&lt;/sub&gt;</th>
<th>% HR&lt;sub&gt;max&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPE</td>
<td>NS</td>
<td>0.341**</td>
<td>0.313**</td>
<td>0.202**</td>
<td>0.276**</td>
<td>0.334**</td>
</tr>
<tr>
<td>ES</td>
<td>NS</td>
<td>-0.157*</td>
<td>NS</td>
<td>NS</td>
<td>-0.176**</td>
<td></td>
</tr>
</tbody>
</table>

NS not significant; * p < 0.05; ** p < 0.01
of personality. This could be the genesis of perceptual responses during execution of this exercise intensity, and thus could influence the relationship between parameters perceptual and physiological. Thus, the determination of cognitive and personality traits, it would be essential, and that one of the limitations of this study. Other limitations are inherent on the inability of generalization for other populations, environmental situations and type of exercise. In conclusion, the results of this study indicate the existence of a significant association between the perceptual parameters, specifically the SPE, and physiological hike in intensity during self-selected and preferred in adult women, previously sedentary. Moreover, it was observed that participants tend to exercise in a proper intensity needs minimum recommended for the occurrence of cardiorespiratory beneficial adjustments. In this context, it is suggested the inclusion of perceptual parameters associated with physiological parameters in future programmes of physical activity involving intensive self-selected.

BIBLIOGRAPHIC REFERENCE


