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STUDY PROTOCOL

The subacute behavior of arterial blood pressure in street runners after a session of high-intensity continuous and interval training: Study protocol

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Abstract

Background: Street running is a form of exercise, often pursued recreationally, that has been growing in popularity in recent years. Among the training methods, both moderate-intensity continuous running and high-intensity interval running have been prescribed. However, while the latter is motivating, it requires further investigation regarding cardiovascular responses. **Objectives:** Evaluate the subacute blood pressure responses in healthy young adults, who are street runners, after a session of high-intensity interval running and a session of moderate-intensity continuous running. **Methods:** This is a cross-sectional study with 10 street-runners, who underwent 3 protocols continuous aerobic (CA); high-intensity interval (HII); and control (C). In CA group, a 3000m continuous running session was performed at 75% of the heart rate reserve. In HII group, a similar volume session was conducted, consisting of 7 cycles of stimulus and recovery, where 300m will be run at maximum speed followed by 100m of passive recovery with walking. And in C group, no exercise was performed. Blood pressure measurements will be taken before, immediately after, and every 10 minutes up to 40 minutes after the end of the protocols. **Considerations:** This study protocol aims to provide additional contributions to the understanding of the subacute hemodynamic responses associated with high-intensity interval running and moderate-intensity running.

Keywords: Blood pressure; street running; continuous training; interval training.

BACKGROUND

Systemic arterial hypertension (SAH) is a continuous and independent risk factor that contributes for various cardiovascular conditions, being associated with a mortality rate of 40% from cerebrovascular accident (CVA) and 25% from coronary artery disease[1]. Epidemiological data reinforce the need for studies that address both the prevention and treatment of SAH, as cardiovascular diseases have been a significant cause of death worldwide, representing one of the leading causes of mortality[2,3]. It is estimated that 17.5 million people died from cardiovascular diseases in 2012, accounting for 31% of all global deaths[4]. In Brazil, studies based on population surveys indicate a prevalence between 22 and 44%, being more common in individuals aging over 60 years[3,5].

Amaral, Brito, and Forjaz[6] report a convergence among the Brazilian (DBHA), American (AHA), International (ISH), and European (ESC) guidelines regarding the influence of insufficient physical activity levels as one of the causes of hypertension. Physical exercise has been used in the prevention and control of cardiovascular diseases. Regarding hypertension, both acute and chronic, aerobic exercises have been shown to reduce blood pressure levels[3,7,8].

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Regular exercise is a well-established intervention for preventing and treating SAH[9]. Individuals may clinically benefit from post-exercise hypotension[10,11], which has a longer duration when exercise is performed from 2 to 3 times per week[12,13]. The hypotensive effects of exercise seem to be primarily induced by improved baroreflex sensitivity[14], suppression of sympathetic activity[11], improved cardiac output[15], and release of vasodilators[16].

Despite its high prevalence, adherence to recommended treatments for SAH is low. In a cohort study of hypertensive patients, 45% discontinued regular monitoring, and only 55% maintained the desired blood pressure levels[17]. Several studies have indicated the therapeutic effect of physical exercise on the pathological condition of SAH[3,7,8]. However, it is not a consensus, as other studies have not found changes in hypertension indices[18,19]. In recent decades, scientific interest has turned to analyzing the cardiovascular effects of anaerobic exercises and, primarily, their effects on blood pressure. However, as this concern is relatively recent, several questions still remain[19]. In the specialized literature, no studies were found on street running that used both continuous aerobic training and high-intensity interval training, neither in hypertensive individuals nor in healthy ones. Therefore, this study aims to examine and evaluate the acute hemodynamic responses of street runners after a session of high-intensity interval running and a session of moderate-intensity continuous running.

METHODS

This is a cross-sectional, controlled, and crossover protocol study. The study was approved by the Research Ethics Committee of the State Hospital of Urgencies of Goiás, under identification: 050/11. Participants will be selected according to the inclusion and exclusion criteria established for the research. The population of this study will consist of 10 individuals, academics from a higher education institution. All participants will undergo 3 protocols: continuous aerobic protocol (CAP); high-intensity interval protocol (HIIP); and control protocol (CP), where the sequence of execution will be randomized through a draw. In CAP, a continuous running session of 3000m will be performed, with an intensity of 75% of the reserve heart rate. In HIIP, a session of similar volume, consisting of interval running, will be performed, comprising 7 cycles of stimulus and recovery, where 300m were performed at the maximum speed achieved by the runner, followed by 100m of passive recovery with walking. And CP where no exercise will be performed. Hemodynamic measurements will be taken before, immediately after, and every 10 minutes up to 40 minutes after the end of the protocols.

Inclusion criteria

All volunteers who sign the Informed Consent Form (ICF), who are between 18 and 32 years old, systolic blood pressure equal to or below 140 mmHg and diastolic blood pressure equal to or below 90 mmHg, and not using continuous medications will be included in the study.

Exclusion Criteria

Volunteers with overweight (BMI $\geqslant$ 25 kg/m2), uncontrolled diabetes mellitus, decompensated heart failure, acute myocardial infarction or stroke, chronic kidney disease,

liver disease, orthopedic limitations, or any physical or mental limitation that would hinder the exercise performance will be excluded from the study.

Procedures

After signing the Informed Consent Form (ICF), established in Resolution 510/2016 of the National Health Council (NHC), and being included in the research, participants will attend the laboratory for clinical and physical assessment to identify the inclusion and exclusion criteria of the study. The adopted registration form includes information regarding age, gender, medication use, and health data.

To evaluate the sample characteristics, measurements of body mass will be taken using a digital scale, the precision of 0,05kg, (Welmy brand - W200A, São Paulo, Brazil). Height will be measured using a stadiometer (Wall-mounted Compact ES2040, SANNY Company, USA) with an accuracy of 0.01 cm[20]. Body Mass Index (BMI) will be calculated. After the pre-participation assessments, individuals will be random in one of the 3 protocols, but will participante of all them The sequence of execution will be randomized through a draw. There will be a 72-hour interval between the protocols.

Study protocol

CP consist of a non exercises session where individuals remained for a similar average time as the experimental protocols, however, without performing any type of physical exercise. They will be allowed to stand, sit, converse. CAP consisted of a continuous 3,000-meter run, with an intensity of 75% of the heart rate reserve, calculated based on the American College of Sports Medicine (ACSM) protocol[21]. HIIP consisted of 8 sets of 300-meter runs performed at the maximum velocity the runner could achieve, followed by 100 meters of active recovery, with slow walking.

Blood pressure measurements

For hemodynamic measurements, the semi-automatic device Omron 705 (OmRon Corporation, Japan) will be used, validated by international organizations, following the techniques adopted by The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[22,23]. All researchers will be trained before to measure blood pressure. The measurement will be taken at 6 moments: before the protocols (Pre) after 10 minutes in rest; immediately after (minute 0); 10 minutes (minute 10); 20 minutes (minute 20); 30 minutes (minute 30); and 40 minutes after (minute 40). Measurements will be taken with participant seated, and repeated after 2 minutes, and the average was calculated for analysis purposes in each moment of the study.

Intervention Protocols

Upon arriving at the location where the study protocols will be conducted, the runners will remain seated resting for 10 minutes for hemodynamic measurements. Afterward, they will be directed to general and specific warm-up (5 minutes), followed by the running sessions. In the control protocol, there was no warm-up or exercise performed, but individuals will be allowed to converse, stand, sit, and drink water if desired. Immediately after the execution of the protocols, the participants will sit for successive recording of blood pressure (BP) and heart rate (HR) with intervals of 10 minutes, up to 40

minutes after the end of the protocols, during all protocols the intake of any type of food will be prohibited. Individuals will be allowed to converse and drink water.

Statistical analysis

The statistical package (SPSS, v 22.0, IBM) will be used for data analysis, with descriptive statistics presented as average and Standard Deviation (±SD). Normality will be tested using the Shapiro-Wilk test with Lilliefors correction.

Variables that do not follow normal distributions will be normalized using the natural logarithm (Ln). For comparisons between time points, the Student's t-test will be used, and effect size (ES) will be applied to measure the size of the effect. A significance level of $p < 0.05$ will be adopted.

Data collection

In this research, the pre and post-intervention assessments will be carried out in the same location along with the physical exercise sessions and their assessments, the weight room of the multisport center and the Exercise Physiology Laboratory, Goiania (GO), Brazil.

Ethical statements

All participants will be informed about the voluntary nature of the research, their right to withdraw from the study at any time without any loss and will be informed about the risks and benefits of participating in the research. These and other elements will be formally presented in the Informed Consent Form, which will be signed in duplicate, with one copy retained by the participant. The researchers ensure the confidentiality of the data, as well as the privacy and anonymity of the participants. All data will be archived for five years and after this period, will be incinerated, following the guidelines of Resolution CNS N 466/2012.

Risks and benefits

This research presents the possibility of discomfort, embarrassment, stress, and annoyance due to invasive questions in the questionnaire, necessary for the progress of the research. There is a risk of dizziness, nausea, hypotension, injuries, and local discomfort. However, these risks will be minimized with support and instructions, ensuring confidentiality of responses, providing necessary explanations, collecting data in a private environment, immediate suspension of the study in case of health risks to participants, professional assistance in case of complications, and offering withdrawal of consent at any time. Additionally, participants will have access to the research results, potential development of new training methodologies and awareness, contribution to health knowledge, and development of more effective control measures. Lastly, the research aims to understand the effects of subacute hemodynamic responses in street running for continuous and high-intensity interval training methods, aiming to establish parameters for indication and contraindication.

RESULTS

Therefore, the present protocol was developed with the aim of ensuring that the described intervention can provide information to assist professionals in indicating or contraindicating effective alternatives for high-intensity interval running and moderate-

intensity running training, through the understanding of the hemodynamic responses of both training modalities.

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