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ORIGINAL ARTICLE

Venous blood gases and cardiorespiratory parameters during aerobic exercise with different pre-exercise diet and hydration

Évaluation des gaz du sang veineux et des paramètres cardiorespiratoires à l'exercice dans des conditions diététiques différentes

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Summary

Objective. – To monitor and evaluate venous blood gases before and during cycle ergometer activity for one hour after three breakfast nutritional procedures offered 30 minutes before in the attempt to establish correlations between possible changes in cardiorespiratory parameters of volunteers.

Methods. – Twelve healthy male practitioners of regular physical activity performance four sessions of continuous exercise on an cycle ergometer (60 to 70% of VO_{2MaxEx}) for one hour after breakfast offered or not 30 minutes before the exercise. The sessions differed by pre-exercise meal and hydration, as follows: high glycemic index/water, low glycemic index/water, in fasting state/water and in fasting state/carbohydrate beverage (60 g/L). Statistical analysis used Analysis of Variance, Pearson correlation test, and significance level 5%.

Results. – No significant difference was observed in the cardiorespiratory parameters of participants among the four experimental procedures, since the venous blood gases parameters showed significant differences for pH and pO_2 . The moment that showed the most significant

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MOTS CLÉS

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Exercice

correlations between venous blood gases and cardiorespiratory parameters was at 40 minutes of exercise. Significant negative correlation between lactate levels and base excess (BE) was observed at 20 minutes of exercise ($r = -0.31$, $P = 0.04$).

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Résumé

Objectif. – Évaluer et suivre les gaz du sang veineux avant et pendant un exercice sur cycloergomètre d'une heure, débuté 30 min après trois types de petits déjeuners. Dans cette étude, il s'agit aussi d'établir des corrélations entre les variations de l'équilibre acide-base et les réponses adaptatives de caractéristiques cardiorespiratoires.

Méthodes. – Douze jeunes hommes en bonne santé, pratiquants réguliers de l'activité physique, ont réalisé quatre séances d'un exercice continu sur bicyclette ergométrique à une intensité de 60 à 70 % de VO_{2MaxEx} pendant une heure. Cet exercice est réalisé 30 min après un petit déjeuner dont la composition est contrôlée. Les séances différaient par la composition du repas qui précède l'exercice test et le niveau d'hydratation. Les situations expérimentales testées sont les suivantes, (1) glucides à indice glycémique élevé/eau, (2) glucides à index glycémique faible/eau, (3) en état de jeun de la veille/eau et (4) à jeun/glucides boisson (60 g/L). L'analyse statistique a reposé sur une analyse de la variance, associée à des analyses de corrélation de Pearson. Le niveau de signification de 5 %.

Résultats. – Aucune différence significative n'a été observée pour les paramètres cardiorespiratoires mesurés au cours des quatre procédures expérimentales. Les repas pré-exercices et le niveau d'hydratation influent sur les paramètres des gaz du sang veineux, notamment du pH et de pO_2 . Les corrélations les plus significatives entre les gaz du sang veineux et les paramètres cardiorespiratoires étaient observées à 40 minutes d'exercice. On observe à la 20^e minute d'exercice une corrélation négative significative entre les niveaux de lactatémie et l'excès de base (BE) ($r = -0,31$, $p = 0,04$).

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1. Introduction

The ingestion of food 2 to 3 hours before the beginning of exercise for adequate gastric emptying is recommended [1], which in turn affects the intestinal absorption of liquids and nutrients, and this result has already been shown in studies offering meals 2 hours before exercise [2–4]. However, the extension of this period, as well as the intake of large amounts of carbohydrates near physical activity can lead to hypoglycemia and other organic changes that may be influenced by the glycemic index of the diet [4].

However, for athletes and active individuals who perform physical exercise in the early morning, between 5 and 8 a.m., this recommendation becomes impossible or difficult to implement given that both have limited time for breakfast, 30 to 45 min before exercise, according to most respondents in studies carried out by Brasil et al. [5]. Furthermore, the physical activities of competitive character, depending on the sport, can vary from a few seconds to several hours. Thus, in sports with duration upwards of an hour, only the consumption of water is not recommended, since it can cause hypoglycemia, fatigue and decreased performance [6], particularly when the exercise is performed in the fasting state.

While changes in carbohydrate metabolism during exercise associated to different types of breakfast have been widely studied with glucose [7,8] and serum insulin [4,8], the behavior of blood gases in similar situation is not yet fully consolidated in literature. It is known that exercise

promotes several simultaneous changes in plasma concentrations of ions and CO_2 [9], and that each of these changes can directly affect the physicochemical interactions between hydronium ion (H^+) and hydroxyl (OH^-), thus changing blood pH and other dependent variables.

Thus, the objective of this study was to monitor and evaluate blood gases 30 minutes before and during 1-hour cycle ergometer activity after three breakfast nutritional procedures: (a) high glycemic index, (b) low glycemic index, (c) in the fasting state, administering two different forms of hydration: water and carbohydrate beverage with concentration of 60 g/L, seeking to establish correlations between possible changes with the cardiorespiratory parameters of volunteers.

2. Methods

The study included 12 healthy male practitioners of regular physical activities (22.9 ± 1.9 years of age, 74 ± 5.5 kg, 1.77 ± 0.06 m of height). The project was approved by the Research Ethics Committee (REC) of the Federal University of Viçosa, under number 140/2011 and all volunteers signed an informed consent form (ICF) previously approved. The following inclusion criteria were considered: be practitioner of regular physical activities, do not have cardiovascular risk factors and do not have any kind of chronic degenerative disease. Each subject underwent five tests.

Test 1: filling of the informed consent form, PAR-Q questionnaire [10], interview (available in the Avaesporte®

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