The changes in lactate levels and body weight during a regional and single Triathlon competition in Sergipe, Brazil

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The main tissue that produces and releases lactate during exercise is the skeletal muscle. Triathlon competitions can result in dehydration and lactate variation. The aim of this study was to evaluate the changes in lactate levels and the body weight during a single Triathlon competition in Sergipe, Brazil. Fifteen regional male triathletes age 31,33 ± 9,22 years and body weight 72,9 ± 8,8 Kg voluntarily participated of this study. Blood samples were collected 30 minutes before the beginning of the competition, and between 7 and 9 minutes after the last stage of the Triathlon competition. Shapiro-Wilk test, Student's t test two-tailed, and the absolute delta were used to do the statistical analysis. It was adopted $p<0.05$. When compared the pre and post lactate levels (Pre 4.91 ± 1.0 vs Post 6.95 ± 2.7 mmol.L-¹; $p<0.01$) and the body weight (Pre 72.9 ± 8.8 vs Post 71.4 ± 9.1 Kg; $p<0.0001$) of the participants was found a significant difference. A single Triathlon competition increased the blood lactate concentrations and promoted reduction of the body weight from regional male triathletes.

Key-words: Lactate, Triathlon, exercise.

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As mudanças nos níveis de lactato e no peso corporal durante uma competição regional de Triathlon em Sergipe, Brasil.

O principal tecido que produz e libera lactato durante o exercício é o muscular esquelético. Competições de Triathlon podem resultar em desidratação e variação de lactato. O objetivo deste estudo foi avaliar as mudanças nos níveis de lactato e peso corporal durante uma única competição de Triathlon em Sergipe, Brasil. Quinze triatletas regionais do sexo masculino com idade 31,33 ± 9,22 anos e peso corporal 72,9 ± 8,8 Kg participaram voluntariamente deste estudo. Amostras de sangue foram coletadas 30 minutos antes do início da competição e entre 7 a 9 minutos após o término do último estágio do Triathlon. Shapiro-Wilk, teste T de Student bi-caudal e o delta absoluto foram utilizados para a análise estatística. Foi adotado $p<0.05$. Quando comparado o pré e o pós dos níveis de lactato (Pré 4.91 ± 1.0 vs Pós 6.95 ± 2.7 mmol.L-¹; $p<0.01$) e do peso corporal (Pré 72.9 ± 8.8 vs Pós 71.4 ± 9.1Kg; $p<0.0001$) dos participantes sendo encontrada diferença significante. Apenas uma competição de Triathlon elevou os níveis de lactato e promoveu diminuição da peso corporal nos triatletas regionais do sexo masculino.

Palavras-chaves: Lactato, Triathlon, exercício.

1. INTRODUCTION

Skeletal muscles convert chemical energy of adenosine triphosphate (ATP) into mechanical energy producing movement [1], and during this process some metabolites are created, including lactate [1,2]. Skeletal muscle is the main tissue that produces and releases lactate during exercise [2,3]. The lactate during exercise can be used by skeletal muscles or by heart or it may return to the liver by kori cycle, where it would be converted into glucose [2].

Lactate is formed when the rate of pyruvate produced is higher than the rate of pyruvate which enters the mitochondria. This pyruvate is converted into lactate. The lactate is not associated just with the lack of oxygen [4]. Maintaining a low level of lactate also saves glycogen, which allows an extending duration of an effort into high intensity. The length of time that the body can resist to an effort in an intense exercise will depend on the type of muscle fiber recruited which depends on the exercise type performed [5].

There is more recruitment of type I fibers or oxidative muscle fibers in aerobic physical activity [5,6]. In anaerobic activities there is a higher recruitment of type II fibers or glycolytic

and oxidative-glycolytic [5,6]. The muscle fiber type recruited during physical activity and the intensity of this activity are important factors to be considered in determining the increase of lactate levels [5]. At long distances there will be more recruitment of type I fibers and in sprints, where the exercise intensity is higher, there will be a greater recruitment of type II fibers [6]. When lactate production is more than the normal it can lead the body to produce higher levels of acid through a greater production of hydrogens ions [6,7].

The release of lactate is lower in exercises below moderate intensity and the acid production occurs more slowly than in exercises of high intensity [8]. One of the functions of lactate blood concentration is to control the exercise intensity with the intention of avoiding fatigue. The physiological mechanism to avoid fatigue consists in pyruvate receiving hydrogens to form lactate in order to become the cell less acid. One sport that can use lactate levels to help in its performance is the Triathlon which recruits both types of muscle fibers in different parts of the body [9].

Triathlon is a competition sport that involves three different continuous and endurance sports: swimming, cycling and running. It can be done at different distances, day or night and has different standards for short or long distance depending also on factors such as age and gender. In a single Triathlon competition participants might have a big reduction of the body weight due to the intense activity [10,11].

The evaluation of the morphological, physiological and biochemical adaptations and responses to the intense performance are important for favoring the construction of new training methods which can lead athletes to higher performance with a metabolic improvement and reduction of the fatigue. This study is presented in a perspective rarely addressed in this health researching area justifying on this way its importance.

In view of the importance of the lactate analysis during sports competitions and considering that the Triathlon specificity can result in dehydration and may occur consequent reduction in performance the aim of this study was to evaluate the changes in lactate levels and the body weight during a single Triathlon competition in Sergipe, Brazil.

2. METHODOLOGY

2.1 Participants

This project was approved by the Ethics Committee of the Federal University of Sergipe. The protocol number was 192.759. All participants signed a form authorizing the participation and the use of all data collected in this study, in agreement to Resolution 466/12 of the National Health Council of Brazil and also followed the Declaration of Helsinki.

Fifteen regional male triathletes voluntarily participated of this study. The characteristics of the sample are expressed by mean and standard deviation: age 31,33 ± 9,22 years and body weight 72,9 ± 8,8 Kg. The collect process happened before and after a Triathlon competition in the state of Sergipe, Brazil in order to investigate the differences in lactate levels.

2.2 Protocol

This Triathlon competition consisted of 1 km of swimming, 30 km of cycling and 8 km of running to adults (starting from 18 years). The distances for participants under 18 years were different. Therefore, the exclusion criteria adopted in this study was to be under 18 years old.

The determination of lactate was done through an Accu-chek Active-Roche lactimeter. Blood samples from the capillaries were collected 30 minutes before the beginning of the competition, and between 7 and 9 minutes after the last stage of the Triathlon, in this case the running. The procedure was done with all athletes being in a seated position for the collection of the blood of the right hand. It was also analyzed the body weight pre and post competition. This procedure was done after the check of the lactate level. At this stage all participants stayed on an orthostatic position over the balance. An electronic balance from the microlife branch was used to check the body weight.

2.3 Statistical analysis

To check the normality of the sample Shapiro-Wilk test was used. Student's t test two-tailed was used for analysis of repeated measures in the pre and post competition. The absolute delta was made to show the variance between pre and post workout. The Prism 5.0 statistical program for analysis of the collected data was used. It was adopted $p<0.05$ of significance.

3. RESULTS AND DISCUSSION

The main findings in this study are showed in figure 1 and 2. When compared the pre and post lactate levels of the participants it was found a significant difference (Pre 4.91 ± 1.0 vs Post 6.95 ± 2.7 mmol.L-¹; *p<0.01). The absolute delta presented an average increase of 2.04 ± 2.32 mmol.L-¹.

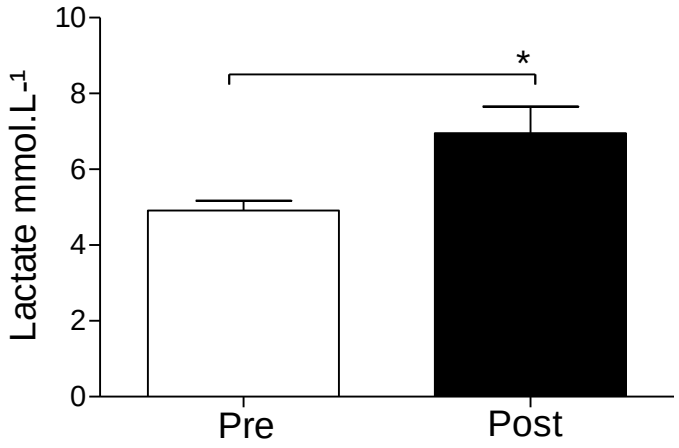

Figure 1. *The increase of lactate level after a Triathlon competition (n=15). Values are expressed using mean and standard error. *p<0.01 in relation to Pre.*

When compared the pre and post body weight of the competitors it was found a significant difference (Pre 72.9 ± 8.8 vs Post 71.4 ± 9.1 Kg;*p<0.0001). The variance presented an regular reduction of -1,5 ± 0,2 Kg.

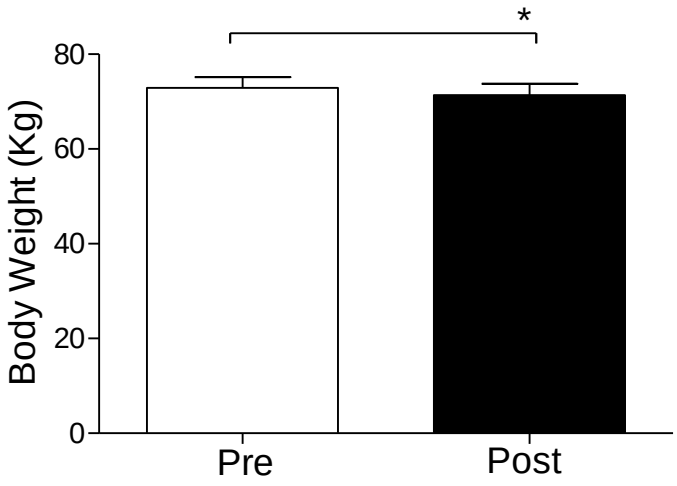

Figure 2. *The reduction of the body weight after a Triathlon competition (n=15). Values are expressed using mean and standard error. * p<0.0001 in relation to Pre.*

All athletes increased the lactate levels (figure 1) showing that even in short Triathlons you may have fatigue. Lactate levels increase because the muscle fibers do not resist to the intensity of the effort performed during a Triathlon competition.

Triathlon involves 3 different modalities. Theories about how to avoid the fatigue or how to improve the performance are constantly made. The athletes can develop manners to avoid the fatigue and the early production of acid intracell. When training to a short and long high-intensity triathlon competition longer intervals between cycling and the beginning of the running session (over five minutes) can improve the cycling and the running performance [12]. A swimming intensity below the average effort helps to improve subsequent cycling and overall triathlon performance [13], and a controlled and reduce pace of 5% in the first kilometer of the running can contribute to a better Triathlon performance [14]. On the other hand, the use of different techniques to warm up, brings no additional benefits to a Triathlon performance [15]. Even that the warm up does not contribute to avoid the fatigue, the lactate level may be controlled during the intense effort in Triathlon.

The increase in lactate levels in high intense physical effort is related to the metabolism control through insulin activity being activated or inhibited. In high intensity exercise insulin is almost totally inhibited. When the organism is being inhibited of insulin there is more glucagon releasing and more oxidizing of fatty acids [16,17]. Glucagon increases according to the physical effort level, promoting higher glycogenolysis and hepatic gluconeogenesis while the suppression of insulin is proportional to the exercise intensity [1,18]. This can partially explain the weight loss caused after the competition (figure 2).

There is also another factor that might have contributed to the weight loss after the competition. We know that our body is composed primarily of water and that in an event of intense physical activity we eliminate a lot of water through sweating. Usually the level of dehydration during a Triathlon competition is high [10,11]. And this can have also contributed to the reduction of the body weight.

Given the characteristics of our sample, we believe that self-report for training volume done before the competition would have helped to determine if the intensity or the volume were more effective in promoting the increasing of the blood lactate. We collected samples from males and females and the data might have been influenced by the gender and the age difference between then.

Our study was successful in determining the increase in lactate level and the reduction of the body weight. This lead us to indicate a better preparation for the Triathlon competitors through an intense training before the competition in order to avoid the fatigue. It is worthy to emphasize the importance of rehydration during the Triathlon competition in order to avoid dehydration and a big reduction of the body weight.

4. CONCLUSION

A single Triathlon competition increased the blood lactate concentrations and promoted reduction of the body weight from regional male triathletes. Other studies could analyze the relationship of these changes in performance during the three Triathlon's modalities and at the final athletes classification.

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