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Blood lactate and rate of perceived exertion in Brazilian jiu-jitsu and Submission combats

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Summary

Introduction. It is common for athletes Brazilian jiu-jitsu compete and be successful in both competitions, with and without the use of gi. However, it is unclear whether there are physiological differences between the two styles. Thus, this study aims to determine whether there differences in blood lactate concentrations [Lac] and rate of perceived exertion (RPE) between Brazilian jiu-jitsu and Submission combats.

Material and methods. Twenty athletes were divided in two groups that performed Brazilian jiu-jitsu or Submission combats. The [Lac] and RPE were obtained before, after the combats and 10 minutes after the combats.

Results. There were variation in the [Lac] according to the moment for Brazilian jiu-jitsu (After *vs* Before, p<0,001; 10' After *vs* Before, p<0,001; 10' After *vs* After, p<0,05) and Submission (After *vs* Before, p<0,001; 10' After *vs* Before, p<0,001) combats, but not between styles. The RPE responses also varied according to the moment in Brazilian jiu-jitsu (After *vs* Before, p<0,001) and Submission (After *vs* Before, p<0,001) combats, but not between styles.

Conclusions. It is concluded that combats activate moderately the glycolytic pathway and the athletes rated the combats as being "hard". However, there were no differences between the values of [Lac] and RPE between Brazilian jiu-jitsu and Submission combats.

Introduction

Nowadays, the combat sports have gained great popularity in society. Among the modalities that have been highlighted given the Brazilian jiu-jitsu, modality which aims to dominate the opponent and takes him to withdraw from the joint use of chokes and joint keys. When not occur submission the combat is decided by points coming from specific techniques (take down, sweep, passing the guard, knee on the belly, mount and back control) [1].

Brazilian jiu-jitsu is originally practiced with the use of gi. However, there are many competitions that are played without the use of gi. Recently the International Federation of Brazilian jiu-jitsu implemented Brazilian jiu-jitsu no-gi competitions [1]. In addition, prior to World Brazilian jiu-jitsu no-gi be created existed competitions of no-gi (known as submission) who kept the rules of Brazilian jiu-jitsu or adopted some changes, like the case of the biggest event of clawed fights of the world, the Abu Dahbi Combat Club, event founded by Arab sheiks.

Thus, it is common for athletes Brazilian jiu-jitsu compete and be successful in both competitions, with and without the use of gi. However, it is unclear whether there are physiological differences between the two styles. In the Brazilian jiu-jitsu can be stated that the combats promote moderate activation of the glycolytic pathway, given the concentrations of blood lactate [Lac] observed in simulated combat and [2-4] and in real competitions [5,6]. Furthermore, Brazilian jiu-jitsu athletes rated the fights as „somewhat hard" on simulations of 10 minutes [3] and as "light or somewhat hard" on real competition [5].

However, as yet there are no informations about the physiological and perceptual responses in Submission combats. The lack of knowledge results in an empirical character of the specific training prescription and planning. Thereby, it is common that data obtained in similar modalities (judo and Olympic wresting) are used by coaches [7].

However, it is necessary that studies be conducted directly with the Brazilian jiu-jitsu and Submission, because there are differences in the dynamics of the fights which can generate peculiarities, as time structure of a Brazilian jiu-jitsu fight (117 s of fighting for 33 s recovery) [5] that is different from Judo and Wrestling, considering that in Judo, the time structure of fights is 30 ± 33 s of fighting for a 12 ± 4 s pause [8] while in Wrestling it is 37 ± 10 s of fighting for a 14 ± 6 s pause [9].

Considering the previous information, this study aimed to determine whether there differences in [Lac] and rate of per-

ceived exertion (RPE) between Brazilian jiu-jitsu and Submission combats.

Material and methods

Sample

The sample consisted of 20 Brazilian jiu-jitsu athletes who trained with and without kimono. The athletes were divided into two groups: Brazilian jiu-jitsu and Submission. The inclusion criteria in this study was that the athletes had brown belt or black belt graduations, and should have been training with a minimum frequency of three times per week.

The informations about age and anthropometric characteristics (weight, height and body fat), are showed in Table 1.

All subjects were informed about the procedures of the study, and all signed informed consent forms. This study was approved by the local ethics committee.

Anthropometry

The athletes had their body mass measured with a Filizola® scale that had a precision of 0.1 kg, and their body height was determined with a Seca® stadiometer that had a precision of 0.1 cm. The determination of the thickness of skinfolds (chest, midaxillary, triceps, subcapular, abdominal, suprailiac and medial thigh) was performed in triplicate, and the average value was used, according to the standardization method of Lohman et al. [10]. For this, we used the Cescorf® plicometer at a constant pressure of 10 g/mm; the plicometer had a precision of 0.2 mm. From the skinfold thickness the body density was determined by using the equation of Jackson and Pollock [11], and body composition was estimated by using the equation of Siri [12]. Measurements were performed by a single evaluator who had experience in conducting measurements.

Experimental design

The data collection was divided into three stages: before the combats (ten minutes seated calmly), immediately after the combat and after 10 minutes of recovery (ten minutes seated calmly). The duration of the combat simulation was fixed at ten minutes. Additionally, there were no referee interruptions during the simulations. This was adopted for all practitioners who were subjected to the same exercise time. The athletes were divided by body mass, so that the athletes fought others with similar weight category.

Blood lactate and rate of perceived exertion scale

Blood samples were taken from the earlobe for blood lactate determination, using Accutrend® portable analyzer. Blood samples were collected in specific strips and immediately analyzed in this portable analyzer. Previous study validated the lactimeter using reference methods [13] and a study from our laboratory reported a high (R = 0.963) intra-class correlation between this device and the Yellow Springs lactimeter [14].

The athletes were questioned about their perception of exertion with the use of the rate of perceived exertion scale (e.g. with 0 representing no fatigue and 10 representing maximal fatigue) [15].

Statistical Analysis

Data were processed using GraphPad 3.0® and are presented as mean (M), standard deviation (SD), and 95% confidence interval (95% CI). Normality was accessed with the use of the *Kolmogorov-Smirnov* test. For independent measures a comparison was performed by conducting the *Student t* test and *Mann-Whitneyt* test, depending on the normality or non-normality of distribution data, respectively. For repeated measures, a comparison across the different time points was performed by conducting a one-way analysis of variance (ANOVA) followed by *Tukey's* or *Friedman* test followed by *Dunn's*, depending on the normality or non-normality of distribution data, respectively. Significance level was set in 5%. To evaluate the magnitude of difference *Cohen´s* effect size (es) was calculated.

Results

Table 2 shows the results of [Lac] and RPE in Brazilian jiu-jitsu e Submission combats.

For [Lac] differences were identified between post-and pre-fight moments to Brazilian jiu-jitsu combats (q = 19.2; p <0.001; es = 5.10) and Submission combats (q = 12,4; p <0.001; es = 4.18), and differences between 10 minutes post-fight and pre-fight moments to Brazilian jiu-jitsu combats (q = 15.1; p <0.001; es = 4.34) and Submission combats (q = 9.1; p <0.001; es = 2.73). The [Lac] 10 minutes post-fight differed from the post-fight moment only the combats of Brazilian jiu-jitsu (q = 4,1; p<0,05; es = -1,00).

For RPE diferences were identified between post-and pre-fight moments to Brazilian jiu-jitsu combats (RS = -19,5; p<0,001; es = 7,07) and Submission combats (RS = -19,5;

Tab. 1. Age and anthropometric characteristics of sample

	Brazilian jiu-jitsu			Submission	
	M ± SD	95% CI		M ± SD	95% CI
Age (years)	27.4 ± 5.1	23.8 – 31.1		28.2 ± 2.3	26.6 – 29.8
Weight (kg)	83.8 ± 12.1	75.1 – 92.5		83.1 ±10.1	75.8 – 90.4
Height (cm)	174.0 ± 5.9	169.8 – 178.2		178.2 ± 5.5	174.3 – 182.1
Body fat (%)	16.1 ± 10.1	8.9 – 23.3		16.6 ± 8.0	10.8 – 22.3

M: mean, SD: standard deviation, 95% CI: 95% confidence interval.

Tab. 2. Blood lactate and rate of perceived exertion in Brazilian jiu-jitsu and Submission combats

	Before			After			After 10 min	
	M ± SD	95% CI		M ± SD	95% CI		M ± SD	95% CI
Lactate (mmol/L)								
Brazilian jiu-jitsu	3,0 ± 1,2	2,1 – 3,9		10,5 ± 1,7*	9,3 – 11,8		8,9 ± 1,5*#	7,8 – 10,0
Submission	3,1 ± 0,7	2,6 – 3,6		10,2 ± 2,3*	8,5 – 11,8		8,3 ± 2,6*	6,4 – 10,2
RPE (0-10)								
Brazilian jiu-jitsu	0 ± 0	0 - 0		5 ± 1*	4 - 6		3 ± 1	2 - 3
Submission	0 ± 0	0 - 0		5 ± 1*	4 - 6		3 ± 1	2 - 3

M: mean, SD: standard deviation, 95% CI: 95% confidence interval. * p<0.001 compared to before fight; # p<0.05 compared to after fight. RPE: rate of perceived exertion.

p<0,001; es = 7,07). Furthermore, no differences were observed in the [Lac] and RPE between Brazilian jiu-jitsu and Submission at different times of collection.

Discussion

The present study found significant increases of the [Lac] as a result of the Brazilian jiu-jitsu and Submission combats, which remained elevated 10 minutes after the end of the fights. The RPE showed increases after the combats to both styles, with the athletes classifying the combats as "hard". Additionally, no differences between styles were observed for measures of blood lactate and RPE in different times of collection.

Given the difficulty of measurement of energy consumption during the real situation of combat, especially in grappling combat sports, has been utilized indirects markers of effort for try to estimate the intensity of the fights. Among the markers has been used the blood lactate and the RPE [5,9], due to the ease of these measures.

Lactate is a byproduct generated, especially, when the resynthesis of adenosine triphosphate (ATP) occurs through anaerobic glycolysis [16]. Therefore, the lactate should be understood as an indicator of the activation of the glycolytic pathway and not as a trigger of the fatigue process [17]. Although, this measure has limitations because the blood lactate may not accurately reflect its production in muscles, considering that the lactate can be consumed by other tissues before being detected in the bloodstream [16]. Nevertheless, in general, the lactate remains a marker little invasive and of easy measurement.

The results of this study, based on the [Lac], shows moderate activation of the glycolytic pathway both Brazilian jiu-jitsu combats as Submission combats. These results are similar to previous studies involving Brazilian jiu-jitsu simulations. In simulations from study of Del Vecchio et al. [2], high-performance athletes (n=7) showed [Lac] of 10.2 ± 1.5 mmol / L two minutes after the fights.In simulations of ten minutes, black belts athletes (n=8) showed [Lac] of 9,5 ± 2,4 mmol/L one minute after the combats [3]. During simulations with less time of duration (7 minutes), Brazilian jiu-jitsu athletes (n=12) showed values of 11,9 ± 5,8 mmol/L after the combats [4].

In real combat situation, similar values were also obtained in regional competition involving white belts to brown belts athletes (n=35; 10.1 mmol/L) [5]. Values less after fights were obtained at regional competition involving only blue belts athletes (n=12; 6,2 ± 2,3 mmol/L) [6].

Considering the previous information, it is inferred that Brazilian jiu-jitsu combats activate moderately the glycolytic pathway. In parts, this fact can be explained from time structure of the combats that is approximately 117 s of fighting for 33 s recovery) [5], being that the recovery period is insufficient to fully restore the phosphagen system [18].

About the RPE, recently, often has been used perceptive scales to infer the intensity of physical activities with different characteristics. This fact is mainly due to the ease of application and low cost involving this measure [19]. In combat sports the RPE has been used to monitor the intensity of fights from real competition [5,6], simulations [4,20-22] and training sessions [23].

In the present study, both in Brazilian jiu-jitsu combats as in Submission combats the athletes rated the combats as "hard" and no differences were observed between stylesIn Brazilian jiu-jitsu, during fights of 10 minutes between black belts (n = 8) the RPE (Borg 6-20) was applied every two minutes of fight. In this study it was shown that the perceived exertion during the final minutes (eight to ten minutes) were superior to the initial minutes (second and fourth minutes) Moreover, the final perception of the athletes classifies the fight as „Somewhat hard„ when deemed the perception obtained after the combat [3].

Classification slightly lower than the present study was also obtained in combat simulations of 7 minutes, in which athletes (n=12) rated the fights as "light or somewhat hard" [4]. During Brazilian jiu-jitsu regional competition blue belts athletes (n=12) rated the fights as "hard" [6] while athletes with graduations from white belt to brown belt (n=35) rated the fights as "hard" [5].

Based on the aforementioned studies,seems not to exist large variation of perceived exertion in competitive situation or simulations. However, uring the simulations the duration of the fights was controled while during the competition the duration is varied because the fight is stopped in case of submission.

Thus, Brazilian jiu-jitsu and Submission generate responses of blood lactate accumulation and perceived exertion similar. However, new studies should investigate other relevant issues as the temporal structure of the fights, to say with certainty that training for these modalities can be conducted similarly.

Conclusions

From the results obtained in this study, it is concluded, based on the concentrations of lactate and perceived exertion that the Brazilian jiu-jitsu and Submission do not differ. Furthermore, based on the concentrations of lactate may be inferred that both styles activate moderately the glycolytic pathway for energy supply, and based on the rate os perceived exertion in both styles of fight, the combats were rated as „hard„.

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