30 - CORRELATION BETWEEN BLOOD LACTATE REMOVAL AND PERFORMANCE IN COMPETITIVE JUDO

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INTRODUCTION

The fight for judo has an intermittent feature, high intensity, so the athletes develop intense efforts of moderate duration, associated with short rest periods, and thus has an activity of high density (ratio of long range effort the time interval of rest). This characteristic has important implications for physiological time, since periods of high activity and short intervals of rest are associated to higher levels of acidity in the body (FRANCHINI, 2001).

With regard to energy metabolism, judo athlete must have an efficient glycolytic energy production and aerobic capacity adequate to support optimal performance during the fight (THOMAS et al., 1989). The great need of energy production from the glycolytic pathway can be demonstrated by high blood lactate concentrations found in judo athletes (AMORIM et al., 1995). It is known that the excessive accumulation of blood lactate is associated with a decrease in athletic performance, since it is correlated to fatigue and consequent disruption of the activity (MONTGOMERY, 1990).

It is found in the literature if there is an inverse relationship between high blood lactate values in the struggle and victory in competition, in other words, athletes who had lower blood lactate value at the beginning of the fight, they were athletes who won the battles despite the understanding that there are several factors that contribute to victory or defeat in the fight judo (CAVAZANI, 1991).

The physiological assessment of athletes in judo, simulating its specificity, presents a series of difficulties due to the intermittent feature of the sport, the unpredictability of the actions and the difficulty of determining the effort of the athletes (NUNES, 1997). Because of these difficulties, it has been suggested that the measurement of physiological or metabolic variables after the sport-specific activities (SILVA, 1988).

The evaluation of a sport through a specific activity of the field, it is important to observe the physiological response in situations closer to the characteristic of the mode (DRIGO et al., 1996). Within this specificity has been proposed to judo, a test of character with the intermittent use of the technique ipon-seoi-nage, called the Special Judo Fitness Test (SJFT) or Sterkowicz's teste (STERKOWICZ, 1995).

This test shows good reproducibility (ICC 0.89, $p < 0.05$) and also provides convenience and objectivity, and is one of the few tests validated for the specific method (FRANCHINI, 2001).

Given the knowledge that high blood lactate concentration, to start a judo fight, a championship, can compromise the outcome of the event (CAVAZANI, 1991), the objective of this study was to assess the correlation between the percentage of removal of blood lactate (analyzed after the execution Sterkowicz's test) with the performance of athletes in a judo tournament.

It can also be identified the degree of correlation with the Sterkowicz's index ranking in judo tournament, the degree of correlation between heart rate and blood lactate concentration, as well as the variation of these two factors as a function of recovery time. Additionally, we evaluated the percentage of removal of lactate per minute after the peak blood lactate concentration has been reached.

The importance of this cross-sectional study is the possibility to raise some hypotheses that can be tested by further studies with longitudinal characteristics with respect to metabolic aspects that influence the performance of judo, and thus able to implement practical changes in the daily training of athletes.

METHODS

Sample

Study participants were seven judo male volunteers. Athletes participating should meet the following criteria: be a participant in official competitions at junior black belt and 1º Dan, being duly registered with the Judo Federation of Rio Grande do Norte (FJERN) and belong to the junior class or senior, or completing at least 18 years in the year of data collection, but also have a minimum body mass 60 kg and a maximum of 66 kg (light-middleweight category).

The exclusion criteria were considered any kind of organic weakness on test day.

The athletes were informed about the risks involved in the study and voluntarily agreed to participate after reading and signing an informed consent and informed.

Procedures

Protocol for analysis of blood lactate removal after Sterkowicz's test and determination of heart rate

The test occurs with the participation of three judo. Two judokas are separated by 6 meters and the other player (which will perform the test), is among them ten feet away. The test is divided into three periods (A) 15s, (B) 30s and (C) 30 s, with intervals of 10 seconds between them. During each period, the athlete throws the performer partners using the technique ipon-seoi-nage, as many times as you can from the command of the evaluator that consisted of "attention", "already". Immediately after and one minute after the end of the test is checked the heart rate (HR) of the athlete. The pitches are added together and made Sterkowicz's index is calculated:

$$\text{Index (i)} = \frac{\text{Final HR (bpm)} + \text{HR 1min. after the end of the test (bpm)}}{\text{Total number of pitches}}$$

At the end of one minute after the test was carried out together with verification of heart rate (measured with the polar heart rate monitor® - RS 100), the first blood sample for evaluation of blood lactate concentration (measured with the aid of lancing accuchek Softclix Pro®). The location was collected (thumb) was cleaned with antiseptic cotton and made with 70% alcohol to avoid any kind of infection. The other samples were collected at 3, 5, 10, and 15 minutes after the end of the test with the athlete at rest passive. The lactate test strips- Accutrend® were used to receive the drop of blood collected to be analyzed in

lactimeter Accutrend Plus®. The measurement of heart rate continued to be held concurrent with the measurements of blood lactate concentrations.

To assess the percentage of removal of blood lactate concentration (% DLA) and the percentage per minute to remove the blood lactate concentration (% DLAmin) at the end of 15 minutes after the test, we used the following equations described below (PELAYO et al., 1996).

(Equation 1)

$$\%DLA = (LA_{peak} - LA_{15min}) / LA_{peak} \times 100$$

Where:
%DLA: Percentage of blood lactate removal;
La_{peak} = peak blood lactate concentration;
LA_{15min} = blood lactate concentration 15 minutes after the test.

The peak lactate concentration was considered the highest concentration observed between the periods measured.

(Equation 2)

$$\%DLAmin = (LA_{peak} - LA_{15min})/(LA_{peak})/(15min - TLA_{peak}) \times 100$$

where:
$\%DLA_{min}$: Percentage removal of blood lactate per minute;
TLA_{peak} = Time, in minutes, which was measured the highest concentration of blood lactate during recovery.

Protocol for performing the tournament

The tournament took place seven days after the test Sterkowicz among the participating athletes.

The duration of the tournament fights were five (5) minutes following the rules of the sport (FIJ, 2008). The model used was a round robin tournament simple, in which all athletes faced all, each one fighting six times. Between each fight there was an interval of less than ten (10) minutes of rest. Prize money was offered first to fourth place for athletes trying their best performance in each of the fights.

Statistical analysis

We used the Spearman correlation coefficient to establish the correlation between the percentage of removal of blood lactate concentration and the rate of Sterkowicz, but also between the percentage of removal and ranking in judo tournament. The Pearson correlation coefficient was used to establish the correlation between heart rate and blood lactate concentration. To this end, we used SPSS 17.0 for Windows®, adopting a significance level of 5% for all correlations.

RESULTS

Athletes of the half-lightweight category had high blood lactate values after Sterkowicz's test, as can be seen in Table 1, demonstrating that the test requires a lot of energy from the anaerobic lactic system, therefore, specific for the requirement of metabolic a judo fight.

Table 1. Means and standard deviations of heart rate and blood lactate concentration versus time post-test.

Parameters assessed	Time after test					
	Immediately after	1 min.	3 min.	5 min.	10 min.	15 min.
HR (bpm)	189,00 ±6,51	167,43 ±8,85	129,14 ±8,65	120,00 ±6,68	108,00 ±11,90	111,14 ±10,37
[La] (mM)	---	14,04 ±1,84	14,73 ±2,55	13, 84 ±1,33	13,54 ±1,99	11,83 ±1,89

HR: Heart Rate.
[La]: blood lactate concentration.

The heart rate can be seen in Table 1, it provides very little control over the components of anaerobic exercise. It was observed that during the recovery period, heart rate was returning to rest and blood lactate levels remained high.

Therefore, heart rate was not commensurate with the level of fatigue of athletes in the recovery period, in other words, it correlated weakly with the removal of blood lactate in the recovery period, as seen in Table 2.

Table 2. Correlations and their statistical significance between variables.

Correlations	r	p
%DLA x ranking in tournament	-0,607*	0,001
(i) x ranking in tournament	0,857*	0,001
Heart Rate x [La]	0,136**	0,001

%DLA: Percentage removal of blood lactate.
(i): Sterkowicz's index.
* Spearman's correlation
** Pearson's correlation.

Table 2 also observed a moderate and negative correlation between the percentage of blood lactate removal and ranking in tournament, as well as a good correlation between the Sterkowicz's index and ranking in judo tournament.

In this study, the athletes took an important time to reach peak blood lactate concentration, as shown in Table 3.

Table 3. Means and standard deviations of the variables collected after the Sterkowicz's test.

Variables	Means ± deviations standard
TLA_{peak}	3,43 ±3,26
$\%DLA_{min}$	1,68 ±1,09
%DLA	23,72 ±11,35
(i)	13,83 ±0,96

TLApeak: Time, in minutes, which was measured the highest concentration of blood lactate during recovery.
%DLAmin: Percentage removal of blood lactate per minute
%DLA: Percentage of blood lactate removal, (i): Sterkowicz's index.

DISCUSSION

The values found in this study were higher than those found in a study conducted with female athletes in high competitive level (FRANCHINI et al., 2001), who presented the third and fifth minutes, an average blood lactate concentration of 11,5 ±1.2mM and 11,0 ±1.2mM, respectively.

This result may reflect the low fitness of the subjects of this study, which did not achieve economy of movement when performing the test, triggering more strongly to the glycolytic pathway and into a higher level of fatigue.

The time to peak lactate concentration in this study was greater than the time found in another study with male athletes, collecting blood lactate post-fight (FRANCHINI et al., 2004), possibly due to higher effort required by the Sterkowicz's test.

As in competitions it is possible to place a short break between fights, it would be important to the peak blood lactate concentration occurs as soon as possible, within the period of rest, that the removal process outweighs the process of production of this metabolite, characterized in this way, a rapid recovery, and enabling a better performance in the next fight (CAVAZANI, 1991).

Table 3 can also be noted that after the time of occurrence of peak blood lactate concentration, the athletes had a low percentage of removal of blood lactate per minute. This may have occurred due to a low level of aerobic fitness of athletes. Corroborating this analysis, Pelayo et al. (1996) observed that removal of blood lactate per minute during passive recovery after four rounds of the 50m swimming with 10s interval, increased during the period of preparation which dominated the aerobic training (2.74 ±0,68% in week 1 to 3.96 ±0,90% in week 10)

It is known that active recovery is superior to passive recovery, when it is being analyzed removal of blood lactate (TOUBEKIS et al., 2010). However, this study adopted the passive recovery, because it aimed to approach the reality of a tournament in which the intervals between the fight sequences are with passive recovery.

Athletes of the final 15 minutes of passive recovery had an average blood lactate concentration of 11.83 ±1.89mM, a value that is much higher than reported in another similar study (FRANCHINI et al., 2004), in which they measured for elite athletes values of 5.79 ±2.19mM, and the non-elite 8.04 ±2.62mM, reflecting the low blood lactate removal was observed in the subjects analyzed in this study.

It is known that in judo is necessary to have a high level technical and tactical, supported by physical endurance, power, anaerobic capacity, strength and flexibility in order to have a good performance in racing (Little, 1991).

In the search for increased athletic performance sought to find a possible correlation between the percentage of blood lactate removal (physical characteristic of each athlete) and performance in a competitive event. Table 2 presents the results of this correlation.

It was observed that although it is a limited number of study subjects, we can see a moderate negative correlation between the percentage of blood lactate removal in judo and sports performance ($r = -0,607$, $p = 0,001$), hypothesizing that the athlete who can remove the greatest amount of lactate after an event that stimulates high production of this metabolite, can take advantage in a judo competition and get a better ranking in the league, and therefore a better reflection of athlete's aerobic capacity. This result is in agreement with Cavazani (1991), which proved important in judo athlete to have a good capacity of blood lactate removal post-fight, because it makes in one day of competition on average five to six fights.

As for the Sterkowicz's index obtained in the test, it can be seen in Table 2 that there was a positive correlation with good athletic performance, thus, this parameter is a good degree of discrimination among athletes better prepared and less prepared athletes.

This index has the characteristic look of the anaerobic capacity of athletes (through the number of throws made), but also to analyze the aerobic capacity of athletes (through the recovery of heart rate) (FRANCHINI, 2001).

By comparing the average score obtained by the athletes in this study with the score obtained by the athletes of the future project in São Paulo (10,99 ±0,85) and the male athletes of the senior national team in 2002 (12,17 ±1,1) (ALMEIDA et al., 2002), and knowing that the lower the rate, the better the athlete's performance (FRANCHINI, 2001), one can see that the athletes of the Judo Federation of Rio Grande do Norte are with a lower yield than expected for participants in official competitions. This may be due to the low level of training that the athletes of the state have been submitted.

CONCLUSION

The main finding of this study was the observation of a moderate and negative correlation between the percentage of removal of blood lactate and performance in sport judo, indicating the possibility of this feature to positively influence physical performance in sports judo because of this ability to reflect a removal better aerobic condition by athletes.

However, considering the limitations of this study, which had an inadequate sample size, and with the characteristic of this cross-sectional research, this aspect can not be said, absolutely conclusive for sports performance in judo championships, and therefore required more studies on this subject for scientific evidence on this point are produced.

The index obtained in the Sterkowicz's test was correlated with athletic performance, is therefore a good parameter to discriminate the level of preparation of athletes, as can be observed by Almeida et al. (2002). This indicates that the judo athletes must have a good lactic anaerobic capacity, but also a good aerobic capacity to sustain high-intensity combat until the end of the fight time.

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CORRELATION BETWEEN BLOOD LACTATE REMOVAL AND PERFORMANCE IN COMPETITIVE JUDO

ABSTRACT

The fight for judo has an intermittent feature, high intensity, so the athletes develop intense efforts during the tournament, firing, therefore, predominantly glycolytic energy pathway production. In this study the main objective was to investigate the correlation between performance in a judo competition with the percentage of blood lactate removal and the Sterkowicz's index. Additionally, we analyzed the correlation between heart rate and lactate concentration, and varying them according to time. The peak lactate concentration was also observed. Seven judokas over 18 year old male, weighing between 60 kg and 66 kg, were submitted on different days, an lactate analysis with the Accutrend Plus®, for the percentage of lactate removal in 15 minutes, with collections 1, 3, 5, 10 and 15 minutes after the Sterkowicz's test, and competition in a simple round-robin fashion simulating a sports tournament. The comparison between the values was performed using Pearson's correlation coefficient and Spearman, in program SPSS 17.0 for Windows®. There was a moderate negative correlation (r=- 0,607, p= 0,001) between the classification of athletes in judo tournament and blood lactate removal after the same Sterkowicz's test. Good correlation (r=0,857, p=0,001) between the Sterkowicz's index and ranking tournament in judo and a weak correlation (r = 0.136, p = 0.001) between heart rate and blood lactate concentration was found. Therefore, the main conclusion of this study was that there is a possibility of removal of blood lactate influence the performance of judo athletes and Sterkowicz's index presented himself as a good parameter to discriminate between athletes. However, additional studies are needed to confirm this finding.

KEY WORDS: Judo. Lactate. Performance.

CORRESPONDANCE ENTRE L'ENLEVEMENT LACTATE DANS LE SANG ET PERFORMANCE DANS JUDO CONCURRENTIEL

SOMMAIRE

La lutte pour le judo a une fonction intermittente, de haute intensité, afin que les athlètes développent des efforts intenses pendant le tournoi, de tir, donc, essentiellement via la production d'énergie glycolytique. Dans cette étude, l'objectif principal était d'étudier la corrélation entre la performance dans une compétition de judo avec le pourcentage d'élimination de lactate sanguin et le taux de Sterkowicz. De plus, nous avons analysé la corrélation entre la fréquence cardiaque et la concentration de lactate, et les variables selon le temps. Le pic de concentration de lactate a également été observée. Sept de judo de plus de 18 ans masculins, pesant entre 60 kg et 66 kg, ont été soumis à des jours différents, une analyse avec le lactadicêmica Accutrend Plus®, pour le pourcentage d'élimination de lactate en 15 minutes, avec des échantillons dans un ,3, 5, 10 et 15 minutes après la Sterkowicz essai, et la concurrence dans un simple round-robin simulant un tournoi sportif. La comparaison entre les valeurs a été réalisée en utilisant le coefficient de corrélation de Pearson et Spearman, SPSS 17.0 pour Windows®. Il y avait une corrélation modérée négative (r =-0,607, p=0,001) entre la classification des athlètes au tournoi de judo et l'élimination de lactate sanguin après le même test Sterkowicz. Une bonne corrélation (r=0,857, p=0,001) entre l'indice et le classement du tournoi de judo Sterkowicz et une faible corrélation (r=0,136, p=0,001) entre la fréquence cardiaque et la concentration sanguine de lactate a été trouvé. Par conséquent, la principale conclusion de cette étude était qu'il ya une possibilité de retrait de l'influence lactate dans le sang de la performance des athlètes de judo et les sports indice Sterkowicz est présenté comme un bon paramètre pour discriminer entre les athlètes. Cependant, des études supplémentaires sont nécessaires pour confirmer cette constatation.

MOTS CLÉS: Judo. Lactate. Performance.

CORRELACIÓN ENTRE LA ELIMINACIÓN DE LACTATO EN SANGRE Y EL RENDIMIENTO EN JUDO DE LA COMPETENCIA

RESUMEN

La lucha por el judo tiene una función intermitente de alta intensidad, por lo que los atletas desarrollar esfuerzos intensos durante el torneo, el despido, por lo tanto, fundamentalmente a través de la producción de energía glucolítica. En este estudio, el principal objetivo fue investigar la correlación entre el rendimiento en una competición de judo con el porcentaje de

remoción de lactato en sangre y la tasa de Sterkowicz. Además, se analizó la correlación entre la frecuencia cardiaca y la concentración de lactato, y variando de acuerdo a tiempo. La concentración de lactato pico se observó también. Siete judo masculino más joven de 18 años, con un peso entre 60 kg y 66 kg, se presentaron en días diferentes, uno lactadicêmica análisis con el Accutrend Plus®, el porcentaje de remoción de lactato en 15 minutos, con las muestras en un, 3, 5, 10 y 15 minutos después de la Sterkowicz prueba, y la competencia en un simple round-robin que simula un torneo deportivo. La comparación entre los valores se realizó mediante el coeficiente de correlación de Pearson y Spearman, SPSS 17.0 para Windows®. Hubo una correlación negativa moderada (r=-0,607, p=0,001) entre la clasificación de los atletas en el torneo de judo y la eliminación de lactato en sangre después de la misma prueba Sterkowicz. Buena correlación (r=0,857, p=0,001) entre el índice y la clasificación del torneo Sterkowicz en judo y una débil correlación (r=0,136, p=0,001) entre la frecuencia cardiaca y la concentración de lactato en sangre fue encontrado. Por lo tanto, la principal conclusión de este estudio es que existe la posibilidad de la eliminación de la influencia de lactato en sangre el rendimiento de los atletas de judo y índice Sterkowicz se presentó como un buen parámetro para discriminar entre los atletas.

PALABRAS CLAVE: Judo. Lactato. Rendimiento.

CORRELAÇÃO ENTRE REMOÇÃO DO LACTATO SANGUÍNEO E O DESEMPENHO COMPETITIVO NO JUDÔ

RESUMO

A luta de judô tem uma característica intermitente e de alta intensidade, sendo assim, os atletas desenvolvem esforços intensos durante o evento esportivo, acionando, portanto, predominantemente, a via glicolítica de produção de energia. Neste estudo o principal objetivo foi verificar a correlação entre o desempenho numa competição de judô com o percentual de remoção do lactato sangüíneo e o índice de Sterkowicz. Adicionalmente, analisou-se a correlação entre freqüência cardíaca e a concentração do lactato, e a variação deles em função do tempo. O pico da concentração do lactato também foi observado. Sete judocas acima de 18 anos do sexo masculino, pesando entre 60 Kg e 66 Kg, foram submetidos em dias diferentes, a uma análise lactadicêmica, com o Accutrend Plus®, referente ao percentual de remoção do lactato em 15 minutos, com coletas em 1, 3, 5, 10 e 15 minutos após o teste de Sterkowicz, e a uma competição em forma de rodízio simples simulando um torneio esportivo. A análise entre os valores foi feita através do coeficiente de correlação de Pearson e Spearman, no programa SPSS 17.0 para Windows®. Foi encontrada uma correlação moderada e negativa (r=-0,607; p=0,001) entre a classificação dos atletas num torneio de judô e a remoção do lactato sangüíneo dos mesmos após o teste de Sterkowicz. Boa correlação (r=0,857; p=0,001) entre o índice de Sterkowicz e a classificação no torneio de judô e uma fraca correlação (r=0,136; p=0,001) entre a freqüência cardíaca e a concentração de lactato sangüíneo foi encontrada. Portanto, a principal conclusão deste estudo foi que existe a possibilidade da remoção do lactato sanguíneo influenciar no desempenho esportivo de judocas e o índice de Sterkowicz apresentou-se como um bom parâmetro de discriminação entre atletas. Entretanto, estudos adicionais são necessários para confirmar esse achado.

PALAVRAS-CHAVES: Judô. Lactato. Desempenho.