

A PRELIMINARY REPORT OF PERFORMANCE AND BLOOD LACTATE CONCENTRATION AFTER THE WINGATE TEST AND A SPECIFIC JUDO TEST

by

FRANCHINI EMERSON*, FÁBIO YUTI NAKAMURA, MONICA YURI TAKITO***, MARIA AUGUSTA PEDUTI DAL'MOLIN KISS****, STANISŁAW STERKOWICZ*******

This work was aimed at the presentation of performance and blood lactate concentration in juvenile and adult judo athletes submitted to the upper body Wingate test and a sport specific test (the Special Judo Fitness Test proposed by Sterkowicz, 1995). The sample consisted of six juvenile and six adult judoists submitted to the same training loads, after the athletes' informed consent or a responsible persons. Blood lactate concentrations after both tests were similar to that reported for judo combat or training.

Key words: specific judo test, Wingate test, blood lactate concentration.

Introduction

Judo is an Olympic sport that requires high levels of physical and mental preparation, technique and tactics (Little, 1991). Some studies have considered physiological aspects in judoists (Callister et al., 1991; Ebine, Yoneda & Hase, 1991; Thomas et al., 1989). Anaerobic glycolysis is predominant during judo combat (Little, 1991; Sikorski et al., 1987). The Wingate has been the most

* Doctor Student - School of Physical Education and Sport of the University of São Paulo

** Master Student (UNESP- Rio Claro) - Brazil

*** UNESP- Rio Claro - Brazil

**** Professor of the EEFE-USP - Brazil

***** PhD, Professor of Department of Combat Sports, APE-KP; Department of Combat Sports - Academy of Physical Education of Krakow - Poland (APE-KP) - (Correspondence adress: Al. Jana Pawla II, n.78, 31-571 - Krakow - Poland; e-mail: wtsterko@cyf-kr.edu.pl)

frequently used for the verification of anaerobic capacity, which is inferred from the mean power generated during the test (Bar-Or, 1987; Inbar, Bar-Or & Skinner, 1996; Smith & Hill, 1991).

Athletes of sports using predominantly the upper body and anaerobic metabolism, as judoists, have been evaluated by the upper body Wingate test (Horswill et al., 1989; Horswill et al., 1992; Mourier et al., 1997; Thomas et al., 1989). However, few attempts have been made in order to obtain a specific test to evaluate judo athletes (Nunes, 1997). Combat sports, such as wrestling, possess specific tests for their athletes: (Klinzing & Karpowicz, 1986; Utter et al., 1997). Sterkowicz (1995) proposed a specific test to evaluate judo athlete's physical preparation. The great advantage of this test, of intermittent character, is the utilization of a specific movement of the modality (*Ippon-seoi-nage* technique). However, no previous studies analyzed its relationship with the Wingate anaerobic test, specially analyzing blood lactate concentration. This research compared the blood lactate concentration to both tests.

Methods

Subjects

Twelve athletes (6 juvenile and 6 adults) participated in this study after they or their parents signed a term of informed consent. The athletes were between 16 and 25 years, trained at least three times a week and participated in official competitions promoted by the São Paulo Judo Federation. The judoists of the two groups were being submitted to the same training.

Anthropometric measures

To characterize the sample, measures of body weight, and height as well as of 6 skinfolds (triceps, subscapular, suprailiac, abdominal, thigh and leg) were taken.

Tests

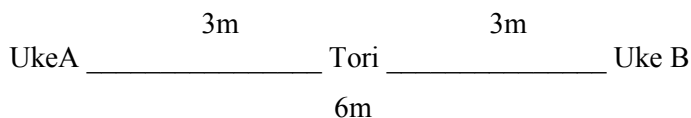
Evaluations included the Wingate test and the specific judo test proposed by Sterkowicz.

- 1) **Wingate** - test was performed on a Monark bicycle ergometer adapted for execution with the upper body (arms). After a warm up of three minutes on the bicycle ergometer the athlete began the test from a stationary position with a previously set load. This procedure aimed to decrease the effect of the kinetic energy of the pedal, which according to Basset (1989) causes an overestimation of 3% in the mean power when the athlete begins the test without a load. The test was filmed by a Panasonic S-VHS Movie NV - 9000 PN (60 pictures a second) camera placed perpendicular to the cycle ergometer so that the rotations of the pedal could be counted every 5 seconds.
- 2) **The test proposed by Sterkowicz (1995)** - this test is performed according to the following protocol: two judoists (*Uke*) of similar stature and body mass of the performer (same category) are positioned at 6 m of distance, while the performer of the test (*Tori*) is three meters of distance from the judoists that will be thrown.¹ The test is divided into three periods of 15 sec (A), 30 sec (B) and 30 sec (C) with intervals of 10 sec. During each period the performer throws the partners using the *Ippon-seoi-nage* technique as many times as possible. Immediately after and 1 minute after the end of the test the athlete's heart rate is recorded. The total accomplished throws in each period is added and an index is calculated according to equation 1:

$$\text{Index} = \frac{\text{final HR (bpm)} + \text{HR 1min after the end of the test (bpm)}}{\text{total number of throws}}$$

(Equation 1)

Outline of the test:



Therefore the smaller the value of the index, the better is the performance in the test. The heart rate was obtained through the use of the POLAR monitor NV (Finland). The test proposed by Sterkowicz (1995) was applied twice in 11

¹ The standarization of the *Uke* (judo players that are thrown) is the key for different height's problem: they must be of similar height and stature of the executant (same judo weight category).

judoists (6 juvenile and 5 adults) to verify its reliability. The reliability of the index was moderate ($r = 0,733$, $n = 11$).

After the Wingate tests and the one proposed by Sterkowicz (1995), the athletes were asked about the similarity of fatigue during these tests in comparison to what they experienced after a 4 minute-fight in competition and after 1 hour and 30 min of judo training. A record with a Likert scale was presented to the athlete for their effort evaluation:

1	2	3	4	5
very low	low	moderate	high	very high
similarity	similarity	similarity	similarity	similarity

Arterialized blood samples were obtained from the ear lobe, on which a vasodilator ointment (*Finalgon*) had been placed, for measuring blood lactate with the *Accusport*, electrochemical equipment.

Results and discussion

a) Characteristics of the subjects

The basic characteristics of the groups are presented in Table 1.

b) Wingate test performance and blood lactate concentration

Table 2 presents the result of the performance and the blood lactate concentration in the Wingate test.

The performance of this group was similar to other studies, except when compared with athletes of the 1987 Canadian Judo Team (Thomas et al., 1989) and athletes of the USA Wrestling Team (Horswill et al., 1992). The blood lactate concentrations after the Wingate test for the two groups analyzed in this study were inferior to those obtained with athletes of the Canadian Judo Team ($14,5 \pm 1,7$ mmol) (Thomas et al., 1989). The difference between the results in this study and those of athletes of high level is due to the fact that the Wingate test has been regarded as a test capable to appropriately discriminate athletes of different levels (Horswill et al., 1989).

c) Performance and blood lactate concentration after the Specific Judo Fitness Test proposed by Sterkowicz (1995)

Table 1. Characteristics of juvenile and adult judoists: age, body mass, body height, sum of skinfolds (mean \pm standard deviation).

	juvenile (n = 6)	adults (n = 6)
Age (years)	17,11 \pm 0,58	22,31 \pm 2,97
Body mass (kg)	64,4 \pm 7,46	77,1 \pm 5,29
Body height (cm)	176,5 \pm 5,32	175,8 \pm 3,72
Sum of 6 skinfolds (mm)	57,0 \pm 18,34	76,8 \pm 27,19

Table 2. Performance and blood lactate concentration in the Wingate test in juvenile and adult judo athletes (mean \pm standard deviation).

	Juvenile (n = 6)	Adults (n = 6)
Absolute Mean Power (W)	300 \pm 66	416 \pm 33
Relative Mean Power (W/kg)	4,64 \pm 0,82	5,43 \pm 0,76
Absolute Peak Power (W)	357 \pm 90	533 \pm 70
Relative Peak Power (W/kg)	5,53 \pm 1,24	6,98 \pm 1,30
Fatigue index (%)	33,3 \pm 10,5	43,2 \pm 10,2
Blood Lactate (mmol) at rest	1,8 \pm 0,75	1,5 \pm 0,19
1 minute after	5,9 \pm 0,97	7,0 \pm 1,91
3 minutes after	6,5 \pm 1,14	8,3 \pm 1,88
Peak	6,6 \pm 1,09	8,3 \pm 1,88

Table 3 presents the result of the performance and blood lactate concentration after the specific test for judo proposed by Sterkowicz (1995).

The performances of the judoists in this study were inferior to those obtained with Polish judoists of high level (Sterkowicz, 1995 and 1996).

Table 3. Performance and blood lactate concentration after the specific test proposed by Sterkowicz (1995) in juvenile and adult judo athletes.

	Juvenile (n = 6)	Adults (n = 6)
15s (A) - number of throws	5,3 ± 0,8	4,8 ± 0,4
30s (B) - number of throws	10,3 ± 0,8	10,2 ± 0,4
30s (C) - number of throws	9,7 ± 1,0	9,2 ± 0,4
Total amount of throws	25,3 ± 2,6	24,2 ± 1,2
HR after (bpm)	193 ± 5,5	179 ± 11,4
HR 1 minute after (bpm)	167 ± 7,8	157 ± 15,4
Index	14,26 ± 1,85	13,92 ± 1,06
Blood Lactate (mmol) at rest	1,7 ± 0,9	1,5 ± 0,5
1 minute after	7,1 ± 2,8	10,0 ± 2,7
3 minutes after	8,1 ± 3,7	9,8 ± 2,2
Peak	8,2 ± 3,5	10,7 ± 2,3

Once Sterkowicz (1996) obtained significant difference in the performance of the Specific Judo Fitness Test (B, C, Total, HR 1min after and Index) among athletes with better and poorer achievements in competition, the difference found between the judoists of this study and the Polish athletes is probably due to this fact, because the judoists of this study were of municipal level and the judoists of Sterkowicz's study (1995 and 1996) were of national level.

There are no reports of previous studies proposing to verify the blood lactate concentration of the test proposed by Sterkowicz (1995). Despite this it is interesting to notice that the blood lactate concentration obtained for this group was similar to the values found in several judo activities (according to Table 4), indicating that the similarities of the metabolic demand between the test, judo fight and training situation.

d) Comparison of results between the two tests

The subjective perception of the similarity of fatigue after each test and the fatigue felt after fight or training is displayed in Table 5.

Table 4. Blood lactate concentration (mmol) in several judo activities (mean \pm standard deviation).

Author	Activity	Group	(n)	Lactate (mmol)
Amorim et al. (1994)	uchi-komi (6x1'1')	-	9	11,6 \pm 2,6
Bracht et al. (1982)	3 fights (4min)	senior	5	
	1			7,49 \pm 2,51
	2			8,31 \pm 2,46
	3			7,68 \pm 2,56
Callister et al. (1990)	randori (1 hour)	senior	15	8,9 \pm 0,5
Callister et al. (1991)	randori (1 hour)	senior	18	9,1 \pm 1,1
Cavazani (1991)	senior competition	6 *		
	won			10,02 \pm 2,80
	won			12,94 \pm 2,98
Franchini et al. (1996)	3 fights (4min)	junior	5	
	1			10,68 \pm 1,19
	2			10,48 \pm 1,32
	3			9,80 \pm 2,62
Sikorski et al. (1987)	competition			
	Cup senior Matsumae 1986 (* *)			
	1 st fight			10,3 \pm 4,7
	2 nd fight			13,3 \pm 2,0
	3 rd fight			15,9 \pm 1,4
	4 th fight			17,2 \pm 1,9
	International and Polish tournaments			
	1 st fight (51 combats)			13,6 \pm 2,3
	2 nd fight (15 combats)			13,9 \pm 2,9
	3 rd fight (22 combats)			13,2 \pm 2,5
	4 th fight (05 combats)			13,3 \pm 1,0
5 th the fight (15 combats)	13,2 \pm 1,6			
Tumilty et al. (1986)	senior	4		
	fight 1			7,1 \pm 1,96
	fight 2			7,9 \pm 2,53

* total of 29 fights; * * number of athletes not cited

Table 5. Frequency of responses (distribution in %) of the perception of similarity of fatigue after the tests and the fatigue after a 4 minute-fight in competition and a session of judo training of 1 hour and 30 minutes (n = 12).

Scale of similarity	W and T	W and F	SJFT and T	SJFT and F
1	-	-	-	-
2	-	-	-	-
3	9 (75)	3 (25)	5 (42)	2 (17)
4	3 (25)	6 (50)	6 (50)	4 (33)
5	-	3 (25)	1(08)	6 (50)

W = Wingate; F = Fight; T = Training; SJFT = Special Judo Fitness Test

Six athletes (50%) considered fatigue after the Specific Judo Fitness Test very high similar (5) to fatigue after a 4 minute-fight and very similar (4) to fatigue after a 1 hour and 30 minutes training session. These data demonstrate that also in the athletes' point of view the test closely resembles real fight and training fatigue, as shown by blood lactate concentrations. The smaller similarity in relation to training than to fight is understandable considering that training occurs at a slightly smaller intensity than that of fight, allowing that training session to last more than one hour.

After the Wingate test, 9 (75%) athletes considered the similarity (3) of fatigue between moderate after the test and a training session, while 6 (50%) considered the fatigue after fight and the Wingate test very similar (4). It could be noticed that athletes considered the Wingate test less similar to training situations and of fight when compared to the Specific Judo Fitness Test. This fact is probably due to smaller muscular mass and smaller duration of the Wingate test in relation to the Specific Judo Fitness Test, besides obviously, the specificity of the movements. Sugiyama (1999) observed that the performance of *Seoi-nage* (the technique similar to that used in the Specific Judo Fitness Test) resulted in the highest exercise intensity of 85% of the VO_2 max of the subjects, indicating the high aerobic solicitation of this technique among others judo throws. The value of energy expenditure was 1,94 kcal/one throw *Seoi-*

nage and was higher than other judo throws investigated by Sugiyama (1999). The relation between results of the Wingate-test and SJFT needs verification on a broader material in further research.

Summing up of this pilot study, the Special Judo Fitness Test of Sterkowicz (1995) comes as an important alternative for judo athletes' evaluation, because this test has the following attributes: (1) requires simpler apparatus (a monitor of heart rate and a chronometer) than demanded by the Wingate test (a bicycle ergometer adapted for the upper body, chronometer, video or computerized counting system of the revolutions), (2) SJFT to be accomplished in the same training place of the athletes; (3) utilization of specific judo technique and (4) to present blood lactate concentration similar to the other typical judo activities.

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