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APLIKÁCIA INHALÁCIE KONCENTROVANÉHO KYSLÍKA POČAS REGENERÁCIE PRI INTERVALOVOM ANAERÓBNOM ZAŤAŽENÍ V JUDO

APLICATION OF INHALATION OF CONCENTRATED OXYGEN DURING REGENERATION IN SHORT TERM ANAEROBIC PERFORMANCE IN JUDO

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ABSTRACT

The research deals with the use of inhalation of concentrated oxygen in the regeneration interval during anaerobic load in Judo. To implement the research was to diagnose the impact of inhaling concentrated oxygen (hyperoxia) on the course of recovery and the water level in capillary blood lactate during intense medium loads modeled for 7 matches (randori) in judo. The experiment was conducted on one proband (MR- member of nation team SR) during one training session. During the execution of the experiment was to our proband continuously monitored and recorded heart rate, and at the end of each interval, and then load after 3-minute recovery, we applied measuring lactate levels in capillary blood. Experimental factor was anonymous inhalation of concentrated oxygen respectively air (as placebo) during controlled rest. After each load our proband 3.minútovej regenerated by either inhalation of concentrated oxygen or placebo and were his capillary blood sampled to determine current levels of lactate. For continuous monitoring of heart rate during the seven simulated load intervals and diluted regeneration, we found a significant difference in mean decrease in heart rate during 3.min. regeneration with concentrated oxygen inhalation by 9 pulses (n.min-1) compared to placebo inhalation of regeneration. The average decrease in lactate levels during inhalation of oxygen was greater by 3.19 mmol l-1 compared to placebo inhalation and recovery.

Keywords: oxygen; lactate; recovery; immediate regeneration; heart rate

SÚHRN

Výskum sa zaoberá problematikou aplikácie využitia inhalácie koncentrovaného kyslíka pri regenerácii počas intervalového anaeróbneho zaťaženia v Judo. Cieľom realizácie výskumu bolo diagnostikovať vplyv inhalácie koncentrovaného kyslíka (hyperoxie) na priebeh regenerácie a úroveň hladiny laktátu v kapilárnej krvi pri intenzívnom strednodobom zaťažení počas 7 modelovaných zápasov (randori) v judo. Experiment bol realizovaný na jednom probandovi (MR-reprezentant SR) počas jednej tréningovej jednotky. V priebehu realizácie experimentu bola nášmu probandovi nepretržite monitorovaná a zaznamenávaná pulzová frekvencia, pričom po ukončení každého intervalu zaťaženia a následne aj po 3 minútovej regenerácii sme aplikovali meranie hladiny Laktátu v kapilárnej krvi. Experimentálnym činiteľom bola anonymná inhalácia koncentrovaného kyslíka respektíve vzduchu (vo forme placeba) počas riadeného odpočinku. Po každom zaťažení náš proband regeneroval formou 3.minútovej inhalácie buď koncentrovaného kyslíka alebo placeba a boli mu odobrané vzorky kapilárnej krvi pre zistenie aktuálnej hladiny laktátu. Pri permanentnom sledovaní pulzovej frekvencie počas všetkých siedmich modelovaných intervaloch zaťaženia a riedenej regenerácie sme zistili významný rozdiel v priemerných hodnotách poklesu pulzovej frekvencie počas 3.min. regenerácie s inhaláciou koncentrovaného kyslíka o 9 pulzov ($n.min^{-1}$) oproti regenerácií s inhaláciou placeba. Priemerný pokles hladiny laktátu počas inhalácie kyslíka bol väčší o 3,19 $mmol.l^{-1}$ oproti regenerácii s inhaláciou placeba.

Kľúčové slová: kyslík; laktát; zotavenie; okamžitá regenerácia; srdcová frekvencia

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Introduction

Judo is an individual power-speed sport, The structure of which has a character of rotation intensity interval exercise (Michalov, 1996). The intensity of the load is central to a maximum duration of load in a duel in men and in women within 5 to 4 minutes. In this form of load carried in judo coverage metabolic energy in the form of ATP-CP, anaerobic glycolysis and oxidative phosphorylation. The range of maximum heart rate for men under load in judo is by Harrison (2007) 174-191 pulses, the concentration of lactate after exercise is 12.3 mml.l-1 (Degoutte, 2003), and the concentration of lactate after exercise in the girls category was average 7,7 mml.l-1 (Štefanovský, 2010). The speed-power combat sports, which is an essential part of judo is one of the critical factors affecting the performance of the athlete adaptation to alternating aerobic and anaerobic load that is determined by speed of recovery between loads.

Problem

The research claims the positive affect of inhalation of concentrated oxygen to the sport performance. It has been published by many authors such as Bannister - Cunningham (1954), Welch (1982, 1987) Snell et al. (1986), Takafumi a Yasukouchi (1997), Morris et al. (2000), Wilber (2004, 2003), Suchý et al. (2008, 2010), Pupiš et al. (2009, 2010), Korčok - Pupiš (2006), Pupiš - Čillík et al. (2013), Vanderka - Kampmiller (2005). On the other hand there are researches which did not consider the inhalation of oxygen positively. Murphy did not notice and positive effect of this phenomenon on human mainly in middle and long term loads the same Robbins and Yamyji /Shephard in sequenced shorttherm submaximum or maximum loads. The summary of these researches shows that the inhalation of hyperoxic mixture positively affects the performance lasting approximately two or tri minutes immediately after inhalation. The reason is probably higher blood and fiber saturation by the oxygen and lower anaerobiosis of working muscles which speeds up the recovery and return to the starting values. (Haseler et al., 1999, Nummela et al., 2002). The single or repeated short term oxygen application has its affect on higher blood saturation which can be used for speeding up the regeneration of interrupted loads. (Nummela et al., 2002, Suchý a kol., 2008). Hyperventilation symptoms and related respiration, tachycardia, smasm, sweating or short reflex period when application higher concentration of oxygen were not noticed. (Matthys, 1993). Meta-analysis of Todd and Robert 2003 stated several studies of the oxygen affect on the sport performance, but non of them is about the affect of hyperoxic on the speeding of regeneration processes between repeated anaerobic loads. The specialized literature we could find only one study with similar topic, which shows the improvement of maximum anaerobic capacity after oxygen concentrate inhalation of 3% to 6% (Gabrys a Smatljan-Gabrys, 1999, Smatljan-Gabrys - Gabrys, 2000). The oxygen manipulation is a very difficult topic in a word of sport. The WADA concerns it the doping which can have and affect with rising the oxygen transmittion in following procedures/ blood doping, using the autologous, homologous or heterologous blood or red blood cell products of any origin, artificially enhancing the uptake, transport or delivery of oxygen, including modified hemoglobin products perfluorochemicals, efaproxiral (RSR13), but not limited to it, (www.antidoping.sk). The list of prohibited products therefore is not included supplementation with concentrated oxygen.

The Aim

The aim of this research is to prove the use of inhalation of the concentrated oxygen while interval anaerobic loads while randori practise in Judo for speeding the immediate regeneration and metabolic recovery of organism.

Methodology

Thanks to the active cooperation with the army sport club Dukla Banska Bystrica we could prove the affect of concentrated oxygen affect to the process of organism regeneration after maximum interval loads of the Slovak representant Milan Randl. Mr Randl is a top competitor of ASK Dukla Banská Bystrica who is in present the best Slovak representant. He is 24, 188 cm a 90kg. His heart frequency we record with telemetric equipment Polar team 2. For simpler evaluation we record all beginnings and endings of all contests and regenerations. The program then figured the average and maximum values of the hear frequency. The blood lactate levels were analyzed by the Lactate Pro LT – 1710 which according to it producer is accurate to 3% (www.arkay.co.jp). The experiment was realized in a ASK Dukla Banska Bystrica gym while one of the practice intervals during international meeting in autumn 2011. While realization of experiment was our person's pulse frequency monitored in all times After the end of each load interval (in form of 7 matches of 5 minutes randori always with a different opponent) and also after 3 minutes regeneration we applied the measuring of lactate level in capillary blood.

The experimental factor was an anonym inhalation of concentrated oxygen – air in a form of placebo while resting. After each load our proband relaxed by tree minutes inhalation of concentrated oxygen or placebo and examples of capillary blood were taken for finding out the actual lactate level. The research principles are according to Helsinki declaration. This study was realized during the project task VEGA 1/1175/12 "Influence of hyperoxia to sport performance and regenration in the sport".

Table 1. Monitoring of the pulse frequency and diagnostic of lactate level in capillary blood during the experiment.

	Begin of experim.	1.fight O2	2.fight placebo	3.fight placebo	4.fight O2	5.fight O2	6.fight placebo	7.fight O2
	(inhalation) 3 min.O2	(randori) 5 min.	(randori) 5 min.	(randori) 5 min.	(randori) 5 min.	(randori) 5 min.	(randori) 5 min.	(randori) 5 min.
PF max. during endurance	x	183	183	175	176	178	173	180
Average PF during endurance	x	176	173	166	161	170	163	165
Average PF during regenerat.	98	132	144	126	121	112	124	130
Difference AV. PF	x	44	29	40	40	58	39	35
LA - after endurance	x	13,8	9,5	10,4	7,3	6,6	4,9	8,6
LA - after regenerat.	4,6	6	9,4	7,1	4	3,9	5,1	5,4
Difference LA	x	7,8	0,1	3,3	3,3	2,7	-0,2	3,2
	Inhalation O2	Rege.-inhalation O2	Rege.-inhalation placebo	Rege.-inhalation placebo	Rege.-inhalation O2	Rege.-inhalation O2	Rege.-inhalation placebo	Rege.-inhalation O2
Supporting narrative:	PF - pulse frequency (n.min-1)							
	LA - lactate level in blood (mmol.l-1)							

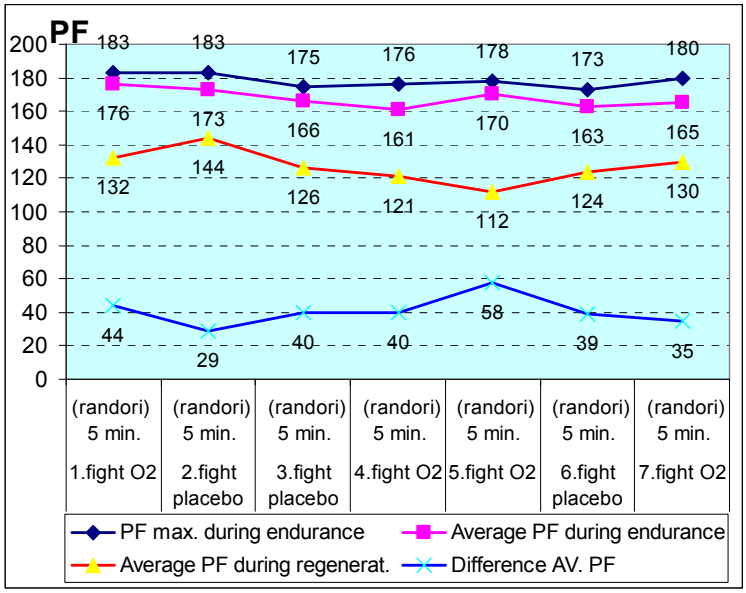

Figure1. Monitoring of the pulse frequency during the experiment.

The results and discussion

The permanent telemetric monitor of lead plus frequency and also during the regeneration as well as the diagnostic of the lactate level in capillary blood immediately after the load and therefore after planned relax have given us following values.

In each individual levels of the Table 1 are listed found maximum and average numbers of pulse frequency chronological in order during individual loads intervals. There are also average levels of pulse frequency found during regeneration.

There are also listed the levels of lactate level (mmol.l^{-1}) in the capillary blood which were measured immediately after the load and also after the planned regeneration. The colored columns are for rates of interval loads with following regeneration with inhalation of concentrated oxygen. The important part of Table 1 are calculated rates of difference between the average pulse frequency during the load and during the regeneration after appropriate load interval as well as the contrast of rates measured immediately after the load and with following regeneration.

In watched intervals in first to the seventh match after which the proband inhaled during the regeneration O2 we can see the great differences (between the rates of the average pulse frequency in a match and the average pulse frequency during regeneration) in a fall of the cardio-pulmoral activity during three minutes regeneration in average of 45 degrees compare to the second to the sixth match after whose we could record the fall of the pulse frequency in average for all matches 36 pulses in minutes more. Therefore while regeneration with the O2 was after the first, the fourth and the fifth match recorded three greatest differences in a fall of pulse frequency during the rest.

In the next Picture we present the rates of lactate level in capillary blood, measured immediately after the load and also after three minutes of regeneration. While doing the complex difference evaluation actually real fall of blood lactate level in the same length of regeneration we can state that in all matches after which the proband regenerated with inhalation of concentrated oxygen the concentrated blood level lactate had fallen more than 50% compare to the total average difference of lactate level fall after matches after whose when was placebo inhaled. (the lowest lactate level while O2 inhalation was 2,7 mmol.l in the fifth match and the average fall after the all matches with the air (placebo) inhalation after the regeneration was 1.06 mmol.) After the sixth match, one before the last one while regeneration without the hyperoxigen was the lactate level rise recorded in more than 0,2 mmol.l. The average

lactate level fall while regeneration with O2 inhalation was 4,25 mmol.l For the final evaluation of the results we can state that the affect of hyperoxic to the process of regeneration has no proved effects but can in special conditions speed up the length of regeneration. We have considered the fact that the positive effect of hyperoxic falls by the length of load intensity because the organism is not able to store oxygen. The reason is limited blood cell capacity to bind the risen amount of oxygen (Robbins wt al., 1992) Yamaji – Shephard (1985) list for affect of concentrated oxyge inhalation several seconds to maximum a minute.

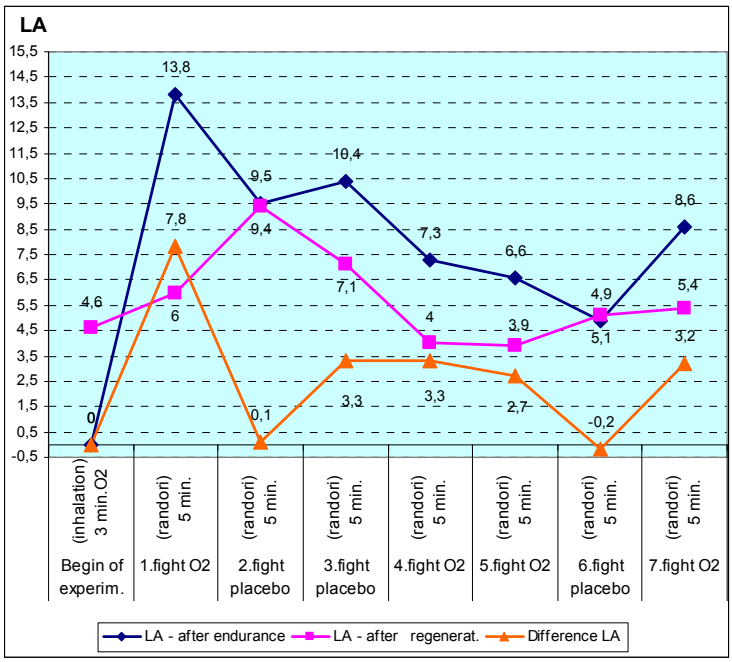

Figure 2. The rate of lactate level while the experiment realization.

Summary

Our performed study confirms accordingly to the similar studies (Smatljan-Gabrys, 2000, Wilber, 2003, 2004, Suchý a kol., 2008, 2010, Pupiš et al., 2010) a positive effect of hyperoxic on speeding the regeneration in specific cases of loads. That is the reason while we consider a good idea to widely use this kind of legal improvement of sport performance between short term anaerobic loads. Our experiment showed a positive effect of concentrated oxygen inhalation on a lactate level fall. We recorded more than 50% fall of the average lactate level fall in capillary blood while regeneration with hyperoxic compare to placebo. The average fall of level lactate during the oxygen inhalation was more than 3,19 mmol.l compare to placebo inhalation regeneration. While permanent pulse frequency control during all seven model lead intervals and planned regeneration we found out the difference between the average rates of pulse frequency fall during three minutes regeneration with oxygen inhalation in 9 pulses compare to placebo inhalation regeneration. The question is how much the oxygen inhalation can affect the sport performance itself not only regeneration.

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