

Anaerobic Capacity Changes of the National Freestyle Wrestlers during the Olympic Qualification Competition Period

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Abstract

This study aimed to evaluate the national level wrestlers' anaerobic capacity through the preparation and qualification periods for Rio 2016 summer Olympic Games. For this manner, 10 national level freestyle wrestlers' (age $22,10 \pm 3,21$; weight $64,75 \pm 6,34$; height $164,31 \pm 4,75$) anaerobic outputs measured 3 times in three month intervals with Bosco repeated jump test. Peak Jump(cm), Flight time, average power, average power/weight, first 15sec average jump height, last 15sec average jump height, fatigue index scores analyzed with repeated measures Anova. Mean power/weight output of the wrestlers increased from 20,42 W/kg to 21,28 W/kg(4,21 %) and fatigue index is decreased from 1,185 to 1,142 (3,62 %). However, this increase was not statistically significant ($p < 0,05$). In six months of qualification and preparation period wrestlers' anaerobic capacity did not changed and it is thought to have been caused by some reasons such as having already reached a certain anaerobic peak level or athletes' competition level and frequency which might made it difficult for them to have a proper periodization during the year.

Keywords: anaerobic capacity, power, wrestling, repeated jump, fatigue

1. Introduction

The measurement of an athlete's physical performance through appropriate physiological testing provides the athlete, coach and trainer with information about the relative physical strengths, weaknesses, development, treatment etc. (Richard Hovey, 1989). Wrestling has several essential elements including high levels of dynamic and isometric strength, anaerobic and aerobic conditioning, quickness, flexibility, and power (Gierczuk, Hubner-Woźniak, & Długolecka, 2012). Since wrestling has multiple physiological-physical requirements, lots of scientific measurements are often used to evaluate these demands by coaches and athletes. One of the most important requirement for a wrestler is continuing the game under intense physiologic stress and disrupted homeostasis(Ho, 2013). For example, a freestyle wrestling match can elevate blood lactate concentrations in excess of 15 mmol/L and nearly 20 mmol/L in between 6 and 8 minutes (Horswill, 1992; W. J. Kraemer et al., 2001) which can lead serious muscle damage and fatigue(Ozkan & Ibrahim, 2016). Wrestlers must be able to buffer the high-acidic muscle and blood concentrations in order to demonstrate optimal strength and power during training and competition (William Kraemer, Vescovi, & Dixon, 2004). In such a case, physiological skills such as anaerobic capacity, anaerobic power, late fatigue and quick recovery, continue to compete in anaerobic stress become very important features. Unfortunately, there is no universally accepted method of evaluating these capacities relative to physical performance in wrestlers (Horswill, 1992). However continuous and repeated jump tests are using for evaluating anaerobic (mechanic) capacity and power for this manner in many studies. It has been shown that power output scores from the 15s Bosco Jump test correlated well with ($r = 0.86$, $P < 0.05$) the percentage of fast twitch muscle fiber which effects the anaerobic work intensity and duration, obtained from the measurement of the vastus lateralis muscle (C Bosco, Komi, Tihanyi, Fekete, & Apor, 1983). In the same study 60 s jumping test demonstrated sensitivity in assessing fatigue among a group of subjects with similar fiber composition. That gives the idea that the continuous jumping test can be accepted by researchers as a test for estimation of human anaerobic power output and fatigue. The power output from the first 15s of the Bosco test is measure of anaerobic power and the >30s score is an indication of anaerobic capacity or endurance (Detanico, Pupo, Gheller, Dias,

& Dos Santos, 2013; Richard Hovey, 1989). Dotan proposed that a test of 30 s is more adequate than 60 s to anaerobic (glycolytic) capacity request, as it may contribute more effectively to maintain the subject driven during the entire test (Dotan, 2006). In addition, it is well known that most of the free wrestling training sessions involve resistance trainings with short rest to improve anaerobic capacity and resistance to fatigue (Fleck Steven J & Kraemer William, 2014; W. Kraemer, Noble, Clark, & Culver, 1987). For these reasons, this study aimed to evaluate these most important components' (anaerobic capacity and fatigue) change and development with 30s Bosco test thorough the preparation season of the national level Olympic athletes.

2. Method

2.1 Subjects

10 talented national level freestyle wrestlers who were in the Olympic qualification competitions and giving the struggle to qualify in the Olympic Games participated to the study. Detailed information about the study was given to the subjects before the measurements and the voluntary confirmation form get signed. The study protocol was approved by the ethics committee of Kyrgyzstan State Sports Academy (Ethics Committee no. 2017/115).

Table 1. Descriptive mean and standard deviations of participants

n	Age	Height (cm)	Body Weight (kg)
10	22,10 ± 3,21	164,31 ± 4,75	64,75 ±6,34

2.2 Measurements

Within the scientific project of the evaluation of Kyrgyzstan Olympic athletes, the measurements were repeated three times in January, May and September 2016. The Bosco et al. vertical jump test was used to evaluate mechanical power and capacity by measuring flight of consecutive vertical jumps during time intervals of 30 seconds. Repeated jumping data of the athletes were obtained by Fusion sport Smart jump brand jumping mat. Formula below with a 30 second version of the Bosco test used to calculate average power/weight scores of athletes(Carmelo Bosco, Luhtanen, & Komi, 1983). The fatigue index is obtained by dividing the average jump height in the first 15 seconds by the average jump height in the last 15 seconds.

$$\text{watts/kg}^{-1} = \frac{g^2 \cdot T_f \cdot T_s}{4 n (T_s - T_f)}$$

g^2 = acceleration due to gravity - (9.81 m/sec), T_f = total flight time; T_s = test duration(sec) n = number of the jumps
Bosco jump test formula(Carmelo Bosco et al., 1983).

2.3 Statistical Analyze

Repeated measure one-way variance analysis used for each variable with Spss 19 software and statistical significance was taken as 0.05.

3. Results

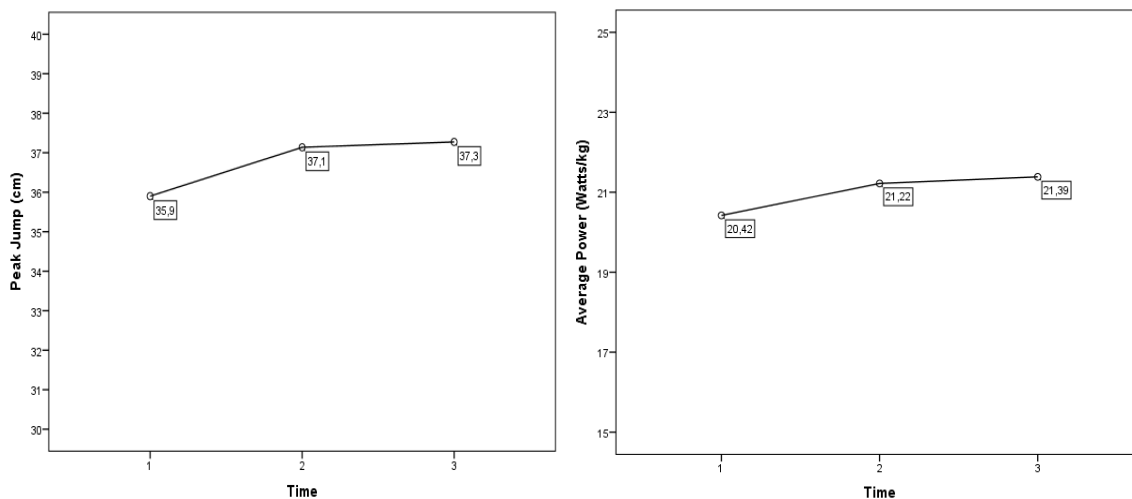


Figure 1. Peak jump and average power/kg means of wrestlers

Table 2. Mean and std. dev. values of variables in 3 measurement periods.

	Time			F	p
	1	2	3		
Weight (kg)	66,6 ± 4,53	66,5 ± 4,48	66,6 ± 4,67	0,231	0,796
Flight Time (ms)	12761,6 ± 909,5	13071,0 ± 919,1	13084,9 ± 1089,0	0,662	0,528
Average Power/Weight (W/kg)	20,42 ± 1,56	21,21 ± 2,05	21,38 ± 2,22	1,913	0,177
First 15sec Average Jump (cm)	31,84 ± 2,42	32,82 ± 2,47	32,28 ± 2,71	1,192	0,326
Last 15sec Average Jump (cm)	26,97 ± 2,51	28,11 ± 3,71	28,49 ± 3,50	3,190	0,065
Fatigue Index	1,185 ± 0,09	1,179 ± 0,10	1,142 ± 0,09	1,710	0,209

As it shown in figure and table, while average power, maximum jump, relative power per weight values are increased no statistical change has emerged for the wrestlers in three period outcomes of the preparation season for any variables.

4. Discussion

In the present study, the values obtained as a result of three measurement periods were not changed for any variables in qualification season of Olympic Games. Even if it seems that at least some improvement in performance variables this change is not statistically significant (Table 2). For example, average power/weight output increased from 20,42 W/kg to 21,28 W/kg and fatigue index is decreased from 1,185 to 1,142. That means the percentage of power and fatigue index development were approximately 4,21 and 3,62. In a study which evaluates the seasonal change of anaerobic capacity; after four months training of soccer players, their average power output increased by 17% from a pre-season score of 20.8 W/kg to 24.3 W/kg at mid-season (D. T. Kirkendall, 1985). This result explains the Bosco test was found to be reliable and sensitive in detecting changes in power output due to training. However, this limited development in the present study can be explained by the lack of training stimulus athletes exposed through the preparation season, the reduction of short-term power outputs because of incorrectly chosen training loads, the limited effect of training due to athletes' reaching of upper-limit performance thresholds or 60s variation of Bosco test. In this study we used 30s Bosco test, which is more practical and holds a more specific stimulus for sports that are acyclic and present the stretch-shortening cycle but it may be more invalid to show degree of fatigue (Detanico et al., 2013).

The mean relative power scores of the athletes in the present study tented to be developed more than other college wrestlers in one study in which wrestlers generated significantly less power than indoor soccer and basketball athletes (D. Kirkendall, 1986). In wrestlers, publications measuring anaerobic capacity with Bosco test are rare. Besides, comparing the results of the Bosco test with other anaerobic tests is difficult despite the high positive correlation between them (Viitasalo, L, Alen, P, & E, 1987; William et al., 2004). The power output generated in the Bosco test is higher than, for example, the Wingate Anaerobic Test (e.g., 8,12 W/kg for international wrestlers in one study (Koçak & Karli, 2003)), because the effect of the elastic energy and properties of jumping movement (Carmelo Bosco et al., 1983; William et al., 2004). In this regard, it was not possible to discuss the results of this study with similar publications. A variety of tests have been used in wrestlers as well as other athletes, making comparisons somewhat difficult (Horswill, 1992). In a study to determine successful wrestlers' profile for anaerobic power values are found as mean range of 6,1 to 7,5 W/kg for arms and mean range of 7,5 to 19,9 W/kg for legs with Margaria stair climb tests. Anaerobic capacity is ranged between 4,8 to 6 for arm cracking and 7,4 to 9,4 for Wingate tests in the same study (Horswill, 1992). But in studies with subjects from different athletic teams showed varied average power outputs in Bosco test which is between 18,79 to 26,6 W/kg for volleyball, basketball, handball, footballers. (Carmelo Bosco et al., 1983; Hespanhol, Gonçalves, Neto, & De Arruda, 2006; D. Kirkendall, 1986; Viitasalo et al., 1987). Bosco test's average power values of volleyball players and basketball players is higher than the other athletes in these studies may be explained as the jumping ability and using elastic energy kinetics is more developed in these athletes (Carmelo Bosco et al., 1983). As a result, in six months of qualification and preparation period wrestlers' anaerobic capacity did not changed and it is thought to have been caused by some reasons such as having already reached a certain anaerobic peak level or athletes' competition level and frequency which might made it difficult for them to have a proper periodization during the year.

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