

Anaerobic ability in juvenile male Free- and Greco-Roman style wrestlers

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Summary

Background. Wrestling has very long tradition as a combat sport. The wrestling competitions were played during the ancient Olympic Games. In the modern Olympic Games wrestling is represented by two styles, free (FS) and Greco-Roman (GRS) style. There are differences regarding task structures, but in both cases physiological and physical demands are very high. We sought to check, whether wrestlers' anaerobic leg power and capacity are related to the wrestling style.

Material and methods. Juvenile male FS (n=20) and GRS (n=22) of the similar anthropometric and demographic characteristics were subjected to perform Wingate test(30s). Absolute values of relative peak power (PP), total work output (WO), time to PP (T att) and time sustained of at least 97.5 % of PP (Tsus). Resting blood cortisol and testosterone levels were determined on the day of testing.

Results. Both groups demonstrated almost the same values of PP, WO and hormonal status. The only slight differences regarded kinematic data. GRS wrestlers demonstrated shorter (by 16.4%) T att and longer (by 13,3%) T sus. Weak correlations were found between hormones and biomechanical variables.

Conclusion. Type of wrestling style does not affect anaerobic leg performance if the both groups of athletes do not differ in demographic and anthropometric characteristics.

Introduction

Wingate (30sec) test is considered as a still basic tool used for estimation anaerobic capacity of upper and lower body limbs in various sport disciplines, although an cycling exertion does not accurately reflex the structure of motion realized during all competitive efforts. On the other hand very high precision of measured power output with the frequency up to 1000Hz allow to differentiate anaerobic capacities in athletes of similar skills. There are several biomechanical parameters of high diagnostic values. For instance, peak power (PP) recorded during Wingate tests showed good relationships with the other explosive exertions and showed the rate of maximal force development [1-3]. Relative- PP is higher in more successful wrestlers as compared to less successful athletes [4]. For that reason level of Wingate test performance is useful for determination of effectiveness of the training period in judokas [5]. The other combat sport athletes whose anaerobic power and capacity have been extensively studied are male and female wrestlers [6-9]. It is worth to note that male wrestlers practice two type wrestling sports known as free style (FS) or Greco-Roman (GRS) style. Both styles use grap-

pling and throws, but there are different strategies and techniques during a match. For instance, GRS wrestlers cannot grab their opponents below the waist and lost physical contact after a throw to the ground, while in FS there are no above restrictions. FS derived from American wrestling that is based on a rule "catch-as-catch-can".

It is interesting, whether various match-task structures and competition-related demands of the two styles result in differences in some biomechanical features such as general physical fitness i.e. strength, anaerobic/aerobic capacity of whole body muscles. All of these physical capabilities contribute to the athletic success. It was established, that in Greco-Roman style levels of relative grip strength, pull-ups, peak of anaerobic power of upper/lower limbs are the best predictors of success [10], but it seems, the same is true for free style competitors. Typical wrestling tournament lasts one day and may consists up to five of consecutive matches, each of them implemented within one hour. These bouts are very intensive efforts, leading to biochemical changes in blood, muscles fatigue and deterioration in performance at the end of a competition [11,12]. Thus, physical demands regarding the both wrestling styles are very high.

An explanation of the question which athletes of the same weight category and skill level but practicing various wrestling styles are stronger has taken into consideration crucial factors affecting current physical abilities. Creditable study undertaken to compare these two styles has met several criteria. Firstly, wrestlers practicing each fighting style attend several tournaments throughout annual season, and some of them have to reduce their body mass [13,14], either by a restricted diet, or by a dehydration directly prior to a competition [15]. Wrestlers want to reach possible low body mass, because shift to a lower weight category favors these competitors who do not lose their physical performance [16]. For that reason around one quarter of the wrestlers lost on average body mass by 10 pound during the season [17]. Study of performance among wrestlers following typical weight reduction, occurring throughout competitive wrestling season or directly after the competition have been widely reported and the results are sometime confounding, partially because of various study protocols [18-24]. In some cases effect of body mass reduction on anaerobic capacity is so small that may be ignored. For instance, caloric restriction (18 kcal/kg of body weight) lasting 72 hours caused the decrease of total work by 8% with unchanged peak power [18]. When self-selected, optimal strategy of body mass reduction was used by the individuals, its negative effect on maximal strength and power did not exist [19]. Contrary to that wrestlers' muscular strength expressed as performance of bench press, back squat [22] and peak torque [23,24] as changed throughout wrestling season that depended on fluctuation of body mass. It seems that the relative weight decrease should not be higher than 4% of the initial values, otherwise, athletes demonstrate impaired muscles strength and power [20,21]. Another prerequisite to meet the reliable comparisons of both styles are similar means values for age, training experience and body mass and skill level.

One may speculate, that the style-dependent differences in physical performance are more likely to occur in a group of older athletes due to long-lasting adaptation to the specific task structures. Up to date there are few studies comparing performance in both styles and the results are not conclusive. The aim of this study was to verify hypothesis, that anaerobic power and capacity in male juvenile athletes practicing two wrestling styles are not differ.

Material and methods

The groups of juvenile Polish male wrestlers practising free style (FS, n=20) and Greco-Roman style (GRS, n=22)

were subjected to the examination of their anaerobic physical ability. All the FS and GRS athletes had not been tested earlier with the use of standardized supra-maximal cycling, and visited the laboratory at the same period of their annual training cycle. They undertook a Wingate test (30sec) forenoon by lower limbs. Cycling was performed against the resistance of 7.5% of body mass on Monark 824E bicycle ergometer. The test was preceded by standardized warm-up. A verbal encouragement was provided to exercises throughout the entire exertion by the same researcher. Power output was recorded on-line at very high frequency (1000 Hz). Free fat mass in a high extent represents an active, exercising tissue. It was determined based on three measures of skin folds thickness: triceps, biceps and subscapula according to the methodology describes by Durnin et al (1974). On the day of Wingate test, morning serum cortisol (C) and testosterone (T) was determined in unfrozen samples (ELISA kits, DRG-GERMANY). Non-parametric statistics Spearman's correlations and Mann-Whitney-U test were used for comparison of the biomechanical and kinematic mean values of the variables recorded in both groups. This study was approved by the Ethical Commission at Institute of Sport.

Results

Results of biological features in both groups are shown in Tables 1 and 2. Table 3 shows relationships (Spearman correlations) between independent variables. All statistical comparison were performed for real samples sizes, however, we decided to check out what would be results of statistical comparison for the same means, standard deviations and data distribution, but two-fold higher sample sizes. Result of that analysis was displayed in italic in Table 2 and 3.

Results showed that biomechanical variables of the test such as total work output and peak power output recorded in GRS and FS wrestlers were very alike. It seems however, that GRS wrestlers performed the test more vigorously, at least at its beginning, up to reaching Tsus. In GRS group peak power appeared somewhat earlier and that these athletes were able to generate power output at 97.5% of peak power somewhat longer as compared to FS participants. These mentioned differences, were not statistically significant, but it is known, that conclusions resulting from the calculations may depend on analyzed sample sizes, as was shown in Table 2. When the sizes would be two-fold higher, at the same values of means, SD, and data distributions, between-group differences in some variables would be significant. As was shown in Table 1 both

Table 1. Comparison of demographic, anthropometric and hormonal characteristics between free style (FS) and Greco-Roman style (GRS) wrestlers

Groups	Age y	BM kg	Height cm	BMI m/kg ²	FFM kg	FT %	T nmol/L	C nmol/L	T/C*10 ²
FS n=20	17.8 ±1.2	68.9 ±13.9	169.2 ±10.4	24.1 ±2.6	61.0 ±11.9	11.3 ±1.7	20.8 ±4.6	496 ±79	4.2 ±0.8
GRS n=22	18.3 ±0.9	74.8 ±13.4	173.7 ±6.6	24.9 ±2.9	66.0 ±10.9	10.9 ±1.8	20.6 ±4.2	474 ±74	4.4 ±1.1
Z-function	-1.900	-1.600	-0.165	-0.693	-1.700	0.491	0.693	0.743	-0.491
p-value	0.057	0.109	0.100	0.489	0.089	0.623	0.489	0.458	0.623

Table 2. The indexes of physical performance demonstrated during WINGATE(30 sec) leg test by free style (FS, n=20) and Greco-Roman style (GRS, n=22) wrestlers. Statistic based on Mann-Whitney test considering real samples sizes and artificially increased sizes, FS=40, GRS=44, with unchanged values of means and SD

Groups	work leg output		peak leg power		kinetic data		fatigue
	WO/BM	WO/FFM	PP/BM	PP/FFM	Tatt	Tsus	FI
	Joule/kg		Watt/kg		sec	sec	%
FS n=20	266.9 ±11.1	301.3 ±13.5	11.21 ±0.59	12.6 ±0.7	5.68 ±1.48	3.26 ±1.05	21.8 ±3.9
GRS n=22	265.0 ±10.3	299.6 ±14.9	11.25 ±0.36	12.7 ±0.5	4.88 ±0.81	3.76 ±1.06	23.6 ±3.9
Z-function	-0.239	-0.491	-0.844	-0.793	1.951	1.297	-1.599
p-value	0.810	0.623	0.398	0.428	0.051	0.195	0.109
comparison for FS, n=40 GRS, n=44							
Z-function	-0.354	-0.712	-1.214	-1.142	2.790	1.858	-2.288
p-value	0.724	0.476	0.225	0.253	0.005	0.063	0.022

Abbreviations:

BM-total body mass

FFM-free fat mass

WO-total work output

PP-peak power, maximal output

Tatt- time to attainment of PP of peak power

Tsus -time sustain of maximal power (≥97.5% of peak power).

FI-fatigue index, relative decrement of power at the end of the effort

(PP-P_{30 sec})*100/PP

DV- dependent variables, when the one is the derivative of the other

Table 3. Correlation coefficients between independent variables for real samples sizes total n=42) and two-fold plus sizes (n=84)

variables	T	T/C*10 ²	Age	PP/FFM	BM	Tatt	Tsus	FI
C	0.304 0.304	DV	0.269 0.269	-0.256 -0.256	0.079 0.079	0.325 0.325	0.068 0.068	-0.105 -0.105
T		DV	0.270 0.270	0.176 0.176	0.023 0.023	-0.227 -0.227	-0.054 -0.054	0.254 0.254
T/C*10 ²			-0.069 0.381	0.381 0.093	0.093 0.093	-0.454 -0.454	-0.025 -0.025	0.310 0.310
Age				0.113 0.113	0.239 0.239	-0.181 -0.181	0.043 0.043	0.250 0.250
PP/FFM					DV	-0.537 -0.537	0.332 0.332	0.511 0.511
BM						-0.388 -0.388	0.277 0.277	0.408 0.408
Tatt							-0.059 -0.059	-0.704 -0.704
Tsus								-0.125 -0.125

groups showed very similar demographic and anthropometric characteristics, and almost the same hormonal status in both groups. Blood testosterone and cortisol levels were within normal ranges in all athletes. Correlation of coefficients presented in Table 3 were very low. However, these correlations may point out that resting cortisol and testosterone levels have the opposite effect on value of peak power and time to its achievement, however, observed power of that effect is very weak.

Discussion

Both groups have met the criteria required for reliable comparisons, since their anthropometric, demographic, hormonal data, study protocol, term of testing and its circumstances did not differ. The calculus showed that all examined parameters in FS and GRS did not differ significantly for these sample sizes. Slight and non-significant between-group difference appeared for time to peak power. That may suggest, that GRS

wrestlers, as being somewhat heavier can develop somewhat higher absolute power at the beginning of the test (by 75 Watts) that allowed to overcome earlier the mechanical inertia of the wheels and reached PP. In fact, higher mean PP in GRS and FS athletes (847 vs 772 Watts, by 9,7%) may be excellently explain by the difference in their FFM (by 8.2%). That finding is consistent with that reported by the others, who showed very high and significant correlation ($r=0.90$) of FFM with mean power in young (17.3 ± 0.9 yrs) male wrestlers. That leads to the conclusion that FFM is predictor of anaerobic performance [25]. In mentioned study young male wrestlers were considered as athletes of national and/or international levels, despite of that they showed lower mean relative PP (8.5 Watts/kg), than our FS and GRS participants of the similar body mass. Interestingly, also elite Colombian senior male wrestlers demonstrated lower relative PP (9.1 Watt/kg) [26]. It is likely, that for juvenile athletes the use of higher resistive force (9.0% of body mass) was less optimal for development PP.

In our study lack of significant differences in anaerobic power and capacity between juvenile FS and GRS wrestlers does not exclude existing of the other physical differences between athletes of the styles. GRS wrestlers demonstrated higher relative strength of neck muscles [27] as well as back and legs muscles [28]. The other study conducted on young wrestlers the almost the same leg PP expressed as Watt/kg in FS (13.2) and GRS (13.5), but average relative power was significantly higher in GRS (7.1 vs 6.8). Moreover, these GRS wrestlers generated significantly higher arm power [29]. Contrary to these results among the other elite wrestlers there were no style-related differences neither in relative (per FFM) average power nor in relative PP [30]. As expected, absolute but not relative (per FFM) values of average power and PP were strongly related to the weight categories.

Our study showed very weak relationships between the hormonal status, mainly anabolic-catabolic index expressed as $T/C \cdot 10^2$ and PP/FFM, and Tatt. Generally, the higher T/C

ratio promotes better results in anaerobic physical tests. Similar conclusion has been reported by Ratamess et al. who showed lower Wingate PP, maximal hand grip strength and vertical jump peak power along with reduced FFM and resting testosterone level occurring prior to the first match and after the last meet of the most competitive wrestling season [31].

Conclusion

Despite of various task structure of free style and Greco-Roman style wrestlers of the same skill levels there are no significant differences in anaerobic leg power and capacity.

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