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DIFFERENCES IN PHYSICAL FITNESS LEVELS OF GRECO-ROMAN WRESTLERS WITH VARYING DEGREES OF SUCCESS

RAZLIKE V TELESNI PRIPRAVLJENOSTI RAZLIČNO USPEŠNIH ROKOBORCEV GRŠKO-RIMSKEGA SLOGA

Abstract

The aim of this paper is to determine differences between wrestlers of various degrees of success as regards their physical fitness levels. The sample of subjects comprised 43 Croatian national team Greco-Roman wrestlers aged 15 to 17 years (cadets). They were divided into three groups on the basis of their sports achievements at the national championship (first, second and third places). 16 variables that to the largest extent comprise the Polish test battery for advanced wrestlers (Starosta & Tracewski, 1981, 1998) were used. The obtained results were processed by means of MANOVA and ANOVA. Results showed that three variably successful groups of wrestlers significantly differ in their level of physical fitness. A significant individual contribution to the intergroup differences was obtained for strength endurance of the arms, specific speed and specific endurance. The obtained intergroup differences can be explained by the higher values of sport experience (in years) with the more successful wrestlers. This thesis should be further verified because some expert wrestling coaches believe that the more successful wrestlers in the national team mostly come from the better organised wrestling clubs in which they train under the guidance of high quality, educated coaches. The results may help in defining the framework of model characteristics of cadet wrestlers.

Key words: cadet wrestlers, motor abilities, cardiorespiratory fitness, model characteristics

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Izvleček

Namen tega prispevka je opredeliti razlike v telesni pripravljenosti različno uspešnih rokoborcev. Vzorec je zajemal 43 rokoborcev grško-rimskega sloga iz hrvaške reprezentance, starih od 15 do 17 let (kadeti). Razdelili smo jih v tri skupine glede na njihove športne dosežke na državnem prvenstvu (prvo, drugo in tretje mesto). Uporabili smo 16 spremenljivk, ki v večini obsegajo poljsko baterijo testov za uspešnejše rokoborce (Starosta & Tracewski, 1981, 1998). Dobljene rezultate smo obdelali z MANOVO in ANOVO. Rezultati izbranih spremenljivk za ocenjevanje telesne pripravljenosti je pokazala, da so med tremi skupinami različno uspešnih rokoborcev značilne razlike. Posamične statistično značilne prispevke k razlikam med skupinami smo odkrili v moči in vzdržljivosti rok, specifični hitrosti in specifični vzdržljivosti. Ugotovljene razlike med skupinami lahko pojasnimo z več športnimi izkušnjami pri uspešnejših rokoborcih. To tezo je potrebno še nadalje preveriti, saj nekateri trenerji rokoborbe, ki so strokovnjaki v tem športu, menijo, da uspešnejši rokoborci v reprezentanci večinoma prihajajo iz bolje organiziranih rokoborskih klubov, kjer trenirajo pod vodstvom izobraženih, vrhunskih trenerjev. Dobljeni rezultati pa lahko služijo za določitev okvirnih značilnosti modela rokoborcev kadetov.

Ključne besede: rokoborci kadeti, motorične sposobnosti, kardiorespiratorna telesna pripravljenost, značilnosti modela

INTRODUCTION

An increase in one's physical fitness level is a basic component of all types of wrestlers' preparations for competition. This is an extremely important part of the training programme and a prerequisite for the appropriate preparation for high-performance achievements (Baić, Marić, & Valentić, 2004; Starosta & Tracewski, 1998). The importance of certain physical fitness components for success in a bout varies between wrestlers across various ages. The development of co-ordination is the most important in physical conditioning of boys and younger cadets. In that age differences in strength are not yet pronounced not important, so most victories are won on the expense of better co-ordination and flexibility of wrestlers. However, strength and endurance are becoming ever more important for the performance of older cadets and younger juniors. Intensive growth and development induced by puberty facilitates training programmes aimed at enhancing strength and endurance, high levels of which are extremely important for the good performance of senior wrestlers (Marić, Baić, & Aračić, 2003).

There are few research studies investigating differences in the structure of the physical condition of variably successful wrestlers of the cadet age. Stine, Ratliff, Shierman and Grana (1979) found greater isokinetic upper body strength in successful secondary-school wrestlers than in less successful ones. Cisar, Johnson, Fry, Housh and Hugheas (1987) came to the same conclusions and for school-age wrestlers found that the composition of isokinetic strength separated the more successful from the less successful wrestlers. Faff, Starczewska-Czapowska and Borkowski (1999) found that anaerobic capacity discriminated more successful from less successful top-level senior wrestlers. The significance of specific endurance and co-ordination in distinguishing between top-level cadet wrestlers of varying degrees of success was also confirmed by Baić (2003). Frequent changes to the rules further complicate the physical condition programme designing for cadet wrestlers.

The aim of this paper is therefore to determine the differences in physical fitness level indicators of variably successful Croatian cadet wrestlers as regards their competition results.

METHOD

Participants

The sample of participants comprised 43 Croatian national team wrestlers aged 15-17 years (cadets). They were divided into three groups on the basis of their result-specific successfulness (rankings) at the national championships. The first groups of wrestlers (H1) comprised of 16 wrestlers who were ranked first at the national championships, the second one (H2) of 14 wrestlers ranked second at the national championships and the third group (H3) of 13 that were ranked third. Their characteristics are presented in the Table 1.

Instruments

An esteemed Polish test battery for assessing the basic and specific preparedness of advanced wrestlers was used in this study. This test battery is described in detail in many articles (Baić, 2003; Baić, Starosta, & Marić, 2003; Starosta, 1984; Starosta & Tracewski, 1981, 1998). One part of these tests was not used in this research (trunk lifts with twists and loads, lift, snatch, forward handspring, forward somersault in squat position, backward somersault in squat

Table 1: Characteristics of the sample

	Group 1 (H1)	Group 2 (H2)	Group 3 (H3)
Numerus	n = 16	n = 14	n = 13
Age (years)	M = 16.06 SD = 0.77	M = 15.79 SD = 0.80	M = 15.85 SD = 0.69
Body weight (kg)	M = 66.20 SD = 12.74	M = 66.61 SD = 15.07	M = 65.97 SD = 15.77
Body height (cm)	M = 172.81 SD = 7.84	M = 173.18 SD = 7.76	M = 171.22 SD = 8.05
Sport experience (years)	M = 5.56 SD = 1.49	M = 4.89 SD = 1.40	M = 4.62 SD = 1.67
Training sessions per week	M = 4.56 SD = 1.09	M = 4.69 SD = 0.63	M = 4.00 SD = 0.91

position and the *strive – running around the head (merry-go-round),* whereas one test was used in a somewhat changed form *(undergrasp pull-ups on the horizontal bar).* In several articles by various authors (Marić, Baić, Sertić, & Vujnović, 2005; Sertić, Baić, & Segedi, 2005; Starosta, Baić, & Sertić, 2005) the very good metric characteristics of this test battery were determined on a sample of top-level wrestlers.

The tests used for the assessment of basic preparedness were: *maximum turn in jump, zigzag run, run with turnover, undergrasp pull-ups on the horizontal bar, arm bending and stretching with support on parallel bars (dips), maximal load press in a recumbent position – bench press, squat with a maximal load, maximum high jump from both feet (vertical jump), 20-m run with a flying start, 1,500-m run and back lifts.*

The tests for assessing specific (wrestling) preparedness were: *backward handsprings, bridge from a standing position, the snatch from the neck, bridge from a standing position, pirouettes* and *throwing the manikin applying the belly to back souplé.*

Procedure

This study was carried out in Zagreb in annual cycles ranging from the year 2000 to 2001 and to 2002 according to the 'Set of tests assessing basic and specific preparedness of advanced wrestlers' (Starosta & Tracewski, 1981). In such a perennial experiment the standardisation of measurement conditions involves meeting the requirements regarding measurements conducted in the same training (preparatory) period, in the same part of the day (hour), in the same order and with the same, prescribed sport appliances and the same sport outfit of subjects, with the same warm-up conditions and under the leadership of the same research leaders.

Arithmetic means and dispersion parameters were determined for all the variables. When determining the differences between the variables for the assessment of the physical fitness level of three variably successful groups of Croatian wrestlers the multivariate (MANOVA and univariate (ANOVA) analyses of variance were used. Since the univariate analysis of variance cannot confirm the contribution of a certain group to the overall difference between all groups, this was determined by a series of *post-hoc* analyses, that is, by means of the Newmann-Keuls test. The obtained data were processed using the software package *Statistica 5.*

RESULTS

By analysing the arithmetic means and obtained dispersion parameters (see Table 2) of the variables for assessing the physical fitness levels in three variously successful groups of Croatian wrestlers it was found that in all the tests applied for assessing strength: *undergrasp pull-ups on the horizontal bar, dips, maximal load press in a recumbent position – bench press, squat with a maximal load and maximum high jump from both feet (vertical jump), endurance (1,500-m run and throwing the manikin applying the belly to back souplé), flexibility (back lifts) and in some tests of specific co-ordination (backward handsprings and the snatch from the neck)* and specific speed *(bridge from a standing position)* the results decreased with a drop in the successfulness (rankings) of the group of wrestlers.

Table 2: Central and dispersion parameters of variables for assessing the physical fitness level of the three variously successful groups of Croatian cadet wrestlers

No.	VARIABLES	GROUP (H1) n = 16		GROUP (H2) n = 14		GROUP (H3) n = 13	
		M	SD	M	SD	M	SD
1.	Maximum turn in jump (no. of degrees)	687.20	56.18	**728.64**	82.57	684.54	73.39
2.	Zigzag run (s)	23.60	1.06	23.68	0.89	**23.50**	0.96
3.	Run with a turnover (s)	12.67	0.96	12.66	0.73	**12.61**	0.92
4.	Undergrasp pull-ups on the horizontal bar (no. of repetitions)	**16.00**	5.93	11.43	5.30	11.33	5.12
5.	Dips on parallel bars (no. of reps.)	**15.75**	4.66	11.86	5.75	11.75	8.15
6.	Maximal load press in recumbent position – bench press (kg)	**70.43**	18.98	65.58	13.78	60.46	13.08
7.	Squat with maximal load (kg)	**95.83**	21.41	85.32	17.85	83.55	22.56
8.	Maximum high jump from both feet (cm)	**56.93**	6.69	56.91	8.81	53.98	6.49
9.	20-m run with flying start (s)	**2.51**	0.16	2.64	0.27	2.55	0.16
10.	1,500-m run (s)	**390.42**	35.18	400.10	31.04	404.00	45.23
11.	Back lifts (cm)	**58.30**	11.10	56.89	7.39	53.33	7.52
12.	Backward handsprings (s)	**3.29**	0.92	3.30	0.85	3.34	0.73
13.	Bridge from above upper, so-called bridge execution (s)	**2.00**	0.29	2.08	0.22	2.11	0.33
14.	The snatch from the neck (s)	**8.42**	0.95	8.78	1.10	9.05	1.26
15.	Pirouettes (s)	6.38	0.88	**5.98**	0.68	7.12	1.30
16.	Throwing the manikin applying the belly to back souplé (no. of repetitions)	56.30	6.36	54.00	7.29	47.67	6.77

Legend:

H1   winners of the first place at a national championship

H2   winner of the second place at a national championship

H3   the third place at a national championship

The best results in the tests employed for defining the framework characteristics of Croatian cadet wrestlers are bolded.

The results obtained by applying the multivariate analysis of variance showed that the three variably successful different groups of Croatian wrestlers differed from each other in a statistically significant way *(Wilk's lambda* = 0.22, $F(32,50)$ = 1.76; $p < 0.05$). The univariate analysis of variance made it possible to determine that out of all the variables for assessing the physical fitness levels of the athletes (see Table 3) the variables for assessing the strength endurance of the arms

(undergrasp pull-ups on the horizontal bar), specific speed *(pirouettes)* and specific endurance *(throwing the manikin applying the belly to back souplé)* contributed statistically significantly to the differentiation between the groups.

Table 3: Univariate analysis of variance of the variables for assessing the physical fitness of wrestlers (n = 43)

No.	VARIABLES	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p - level
1.	Maximum turn in jump	17049.631	2	8524.816	197452.845	39	5062.893	1.684	0.199
2.	Zigzag run	0.239	2	0.119	36.999	39	0.949	0.126	0.882
3.	Run with a turnover	0.034	2	0.017	28.947	38	0.762	0.022	0.978
4.	Undergrasp pull-ups on the horizontal bar	211.048	2	105.524	1182.095	39	30.310	3.481	0.041
5.	Dips on parallel bars	154.012	2	77.006	1484.964	39	38.076	2.022	0.146
6.	Maximal load press in recumbent position	614.638	2	307.319	8668.079	35	247.659	1.241	0.302
7.	Squat with maximal load	1001.351	2	500.675	12809.028	30	426.968	1.173	0.323
8.	Maximum high jump from both feet	77.790	2	38.895	2140.446	39	54.883	0.709	0.499
9.	20-m run with flying start	0.091	2	0.045	1.102	25	0.044	1.029	0.372
10.	1,500-m run	854.924	2	427.462	30467.817	24	1269.492	0.337	0.717
11.	Back lifts	169.956	2	84.978	3001.144	37	81.112	1.048	0.361
12.	Backward handsprings	0.011	2	0.005	21.653	30	0.722	0.007	0.993
13.	Bridge from above upper, so-called bridge execution	0.091	2	0.046	2.747	35	0.078	0.581	0.565
14.	The catch (snatch) from the neck	1.401	2	0.700	23.352	19	1.229	0.570	0.575
15.	Pirouettes	7.889	2	3.944	33.279	36	0.924	4.267	0.022
16.	Throwing the manikin applying the belly to back souplé	449.112	2	224.556	1400.767	30	40.692	4.809	0.015

Legend:

SS   the sum of squares between the groups

df   degrees of freedom between the groups

df Effect = k – 1

SS Error   the sum of squares within the groups

df Error   degrees of freedom within the groups

SS Error = MS Error – MS Effect

df Error = F – F = MS Effect / MS Error

p   level of significance of difference

By comparing the arithmetic means (by means of *post hoc* analysis) individual differences were determined between all the analysed groups of variously successful wrestlers H1 and H2, H2 and H3 and H1 and H3 (see Table 4). The statistically significant difference seen between the groups H1 and H2 is reflected in the differences between the values of the test for assessment of the strength endurance of the arms *(undergrasp pull-ups on the horizontal bar).* The test for the assessment of specific speed *(pirouettes)* statistically significantly differentiated between the groups H2 and H3, whereas the statistically significant difference found in the test for the assessment of specific endurance *(throwing the manikin applying the belly to back souplé)* was

responsible for the differences between the groups of wrestlers H1 and H3, as well as between the groups H2 and H3.

Table 4: Post-hoc comparison of arithmetic means (M) of the variables *undergrasp pull-ups on the horizontal bar, pirouettes and throwing the manikin applying the belly to back souplé*

VARIABLES	M	GROUPS	GROUP H1	GROUP H2	GROUP H3
Undergrasp pull-ups on the horizontal bar	16.00	H1	/	0.035*	0.079
Undergrasp pull-ups on the horizontal bar	11.43	H2	0.035*	/	0.964
Undergrasp pull-ups on the horizontal bar	11.33	H3	0.079	0.964	/
Pirouettes	6.38	H1	/	0.300	0.059
Pirouettes	5.98	H2	0.300	/	0.013*
Pirouettes	7.12	H3	0.059	0.013*	/
Throwing the manikin applying the belly to back souplé	56.30	H1	/	0.438	0.016*
Throwing the manikin applying the belly to back souplé	54.00	H2	0.438	/	0.030*
Throwing the manikin applying the belly to back souplé	47.67	H3	0.016*	0.038*	/

Legend:

* $p < 0.05$

H1   winners of the first place at a national championship

H2   winner of the second place at a national championship

H3   the third place at a national championship

DISCUSSION

In the interpretation of the results of the selected variables for the assessment of physical fitness level it was found that the three variously successful groups of Croatian wrestlers differ statistically significantly. The significant individual contribution to the intergroup differences were obtained for the following variables: *undergrasp pull-ups on the horizontal bar* (strength endurance of arms), *pirouettes* (specific speed) and *throwing the manikin applying the belly to back souplé* (specific endurance). These results are in concordance with previous research (Marić, Baić, & Aračić, 2003), where the mentioned dimensions are the first three dimensions in the hypothetical factor structure of the successful performance of wrestlers.

The obtained statistically significant differences in the test for assessing the strength endurance of the arms *(undergrasp pull-ups on the horizontal bar)* between the groups of wrestlers H1 and H2 may be interpreted in accordance with the importance of this component for increasing the tempo of a bout and for the realisation of stronger wrestling holds upon which the efficacy of throwing and number of pull-ups due to a static hold on the horizontal bar depend. Great strength endurance of the arms creates the basis for mastering the advanced technical-tactical complexes of arm-positioning that result in an efficient way of fighting in the second and third parts of a bout when the opponent is sweaty and therefore slippery. Statistically significant differences in the test for the assessment of specific speed *(pirouettes)* between the H2 and H3

groups of wrestlers can be interpreted in line with the great significance of speed when applying a greater number of techniques employed in a bout in a standing position or in a position on the floor. An adequate level of specific speed enables an efficient and more highly assessed execution of advanced wrestling techniques performed through the wrestling bridge on one hand but, on the other, it makes the counterattack of an opponent impossible. The comparison of results obtained for strength endurance, speed and explosive strength with the results of previous research involving top-level European-level cadet wrestlers (Baić, 2003; Kokinidis, Tselios, & Galov, 2002) showed that the Croatian groups of wrestlers had worse results in the tests for assessing strength endurance and speed, but performed better in the tests for explosive strength. The statistically significant differences obtained in the test for assessing specific endurance *(throwing the manikin applying the belly to back souplé)* between the H1 and H3 groups of wrestlers, as well as between the H2 and H3 groups, are explained by the importance of this ability for success in wrestling since motor co-ordination, that is, the stability of technique and tactics at a high tempo of a fight throughout the whole bout depend on endurance. A higher level of endurance enables the preconditions for the improved concentration of wrestlers during a bout. The higher the concentration the more accurate the realisation of techniques, which makes it possible to score a point and to increase one's technical efficiency.

The obtained intergroup differences can be explained by the higher values of sport experience (in years) of the more successful wrestlers. This thesis should be further verified because some expert wrestling coaches believe that the more successful wrestlers in the national team come mostly from the better organised wrestling clubs in which they train under the guidance of high quality, educated coaches.

The obtained results will help define the framework of model characteristics of cadet wrestlers. The model values would be the best results in all the applied tests taken by the winners of one of the top three places at the national Greco-Roman wrestling championship for cadets.

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