

## DIFFERENCES IN PHYSICAL FITNESS LEVELS BETWEEN THE CLASSICAL AND THE FREE STYLE WRESTLERS

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### Abstract:

Increasing the physical fitness level is the basic goal of all types of sport preparation. The importance of certain physical fitness abilities for success in a wrestling bout varies in wrestlers of various wrestling styles and age. The aim of this research was to identify the differences between the classical style (Greco-Roman) and the free style wrestlers in the variables assessing physical fitness. The research was conducted on the sample comprised of 107 top-level classical style (n=46) and free style (n=61) wrestlers 17 to 20 years of age, all Polish junior national team members. The measuring instrument consisted of 18 tests, most of them being the test battery of Starosta and Trocewski for advanced wrestlers, aimed at assessing the general and the wrestling-specific physical fitness level. The obtained results were processed by the canonical discriminant analysis and by the univariate analysis of variance (ANOVA). The discriminant factor defined as the *strength endurance of the trunk and upper extremities* statistically significantly discriminated between the classical and the free style wrestlers. It was found that the group of top-level junior free style wrestlers had statistically significantly more expressed strength endurance of the trunk and upper extremities than the group of top-level junior classical style wrestlers. The authors assumed the obtained results had been induced by the specific features of each wrestling style.

**Key words:** wrestling, Polish national team, juniors, basic and specific motor abilities

### Introduction

Increasing the level of physical fitness is the main goal of all types of wrestlers' preparation for a competition. Therefore, the training contents contributing to the fitness level enhancement are extremely important segments of any training programme and a precondition of high performance. An inappropriate 'basis' of physical fitness at a lower level causes a decreased achievement peak at a higher level of an athlete's sport-specific development (Starosta & Tracewski, 1998; Baić, Marić, & Valentić, 2004).

However, the number of previous research studies in which authors have dealt with the differences in the physical fitness training of wrestlers in various types of wrestling is very small (Rybalko, 1966; Starosta, 1984, 2006; Rezasoltani, Ahmadi, Nehzate-Khoshroh, Forohideh, & Ylinen, 2005), and the obtained results point to the following conclusions. The relative strength of trunk extensors is more expressed in free style wrestlers, whereas the relative strength of upper arm flexors and extensors is more expressed in classical style wrestlers. The most important place in the physical fitness train-

ing of younger- and medium-school-age boys belongs to the development of coordination (Sertić, 1994; Sertić & Kuleš, 1999), whereas strength and endurance are ever more important in older-school-age boys and adolescents (Marić, Baić, & Aračić, 2003). Apart from the small number of previous studies, the trend in the development of physical fitness training in wrestlers has been evident in the last decade (Dinev, Petrov, & Jankova, 1991; Starosta & Tracewski, 1998), although the dilemmas regarding the execution of physical fitness training of wrestlers of various age categories and of various wrestling styles remain open.

The problem increases in that most countries (and among them also Croatia) do not have either the necessary conditions or sufficient number of international-quality-level high-performance wrestlers. That is the reason why the collaboration was started in this project with Professor Włodzimierz Starosta (Institute for Sport in Warsaw) whose focus for many years has been the diagnostics of physical fitness levels of high-performance wrestlers in Poland. This collaboration guaranteed a sample of high-performance wrestlers – members of the

national team, that was large enough and whose number as regards their quality would be approximately equal in both wrestling styles (classical/Greco-Roman and free style wrestling). Top-level Polish wrestlers belong to the highest rank of European and world wrestling, and they achieve significant results in all age categories (for example, five medals at the Olympic Games in Atlanta in 1996). Such a research made on a large and a high-quality sample of wrestlers will make it possible to tell whether there were any differences, and if yes, then what the structure of those differences in the physical fitness level of classical and free style wrestlers was. The results would define the values of the physical fitness level that should be achieved by top-level junior wrestlers in accordance with the wrestling style of their choice.

## Methods

### The sample of subjects

The total number of subjects was 107 top-level classical and free style wrestlers, aged between 17 and 20 years (juniors). All subjects were of the same quality class – they were members of the Polish national team. The first group of subjects was comprised of 61 top-level classical style/Greco-Roman wrestlers (mean±SD; age 18.31±0.91 years; years of sport participation 6.84±1.72 years; body weight 74.75±14.80 kg; body height 174.90±9.02 cm). The second group of subjects was comprised of 46 top-level free-style wrestlers (age 18.46±1.11 years; years of sport participation 6.37±2.03 years; body weight 74.5±14.06 kg; body height 175.75±8.34 cm). All participants accepted the conditions of research as issued by the Ethical Board of the Institute for Sport (Warsaw) which approved the measurement protocol.

### The sample of variables

The battery of tests applied in this research was described in detail and illustrated in the battery of tests of general and specific preparedness for advanced wrestlers<sup>1</sup> written by Starosta and Tracewski (1981), and Starosta (1984, 2006). Coordination was assessed by the *maximum turn in the jump* and the result was expressed in degrees (the greater the number of degrees, the better the coordination). Agility was assessed by *zigzag running (envelope)*, and by *run with a turnover*. Absolute maximal strength was assessed by the 1 repetition maximum (1RM) in *bench press, maximal load snatch, lifting maximum load onto the chest and back squat*. Strength endurance was assessed by the number of *pull-ups, parallel bars dips* and

*sit-ups with side twists and with load*. The *vertical jump* (Starosta, 1984) served to assess explosive strength, *trunk bending (decline bench)* to assess flexibility and the *20-m run from the flying start* to assess speed. *Backward handsprings, the catch (snatch) from the neck, pirouettes, strive (merry-go-round), and bridge from the above upper stance* were used to assess the wrestling-specific coordination abilities. The metric characteristics of the previously listed tests were described in many research studies (Starosta, 1984; Starosta, Baić, & Sertić, 2005; Marić, Baić, Sertić, & Vujnović, 2005; Sertić, Baić, & Segedi, 2005), and the research results pointed to the conclusion that the applied tests had very good metric characteristics.

### Measurement protocol

Measurements were done in Poland during the training camp of the Polish national team in the years 1998 and 2000. The standardisation of measurement conditions, described in detail by Starosta and Tracewski (1981), had an important role in such years-long execution of the experiment. In three days the athletes executed 18 tests. Eight were done on the first day (*maximal turn in the jump, zigzag running, vertical jump, 20m-run from the flying start, bench press, pirouettes, strive / merry-go-round and bridge from the above upper stance*). On the second day the athletes performed the following tests – *task-run with a turnover, backward handsprings, maximal load snatch, lifting maximum load onto the chest, sit-ups with side twists and with load and back squats*. The tests *trunk bending, the catch (snatch) from the neck, pull-ups and parallel bars dips* were done on the third day. All measurements were carried out within the same training period (preparatory) under the supervision of the same principal researcher Włodzimierz Starosta.

### Data analysis

The data analysis was done by means of the statistical package *Statistica 5*. All the variables assessing the physical fitness level of athletes were expressed in terms of arithmetic means and standard deviations. The normality of distribution of the results for the variables applied was tested by the Kolmogorov-Smirnov test. The significance of the differences in the variables assessing physical fitness level between the classical and free style wrestlers was assessed by the discriminant analysis. Upon confirming the significance, the pair-wise univariate analysis of variance (ANOVA) was used to compute the statistical differences among all the variables. The  $p < .01$  level of statistical significance was selected. The calculation of arithmetic means

<sup>1</sup> Some tests from that battery were not used in this research (forward handspring, forward somersault in squat position, backward somersault in squat position, 1,500m-run and throwing the manikin applying the belly-to-back souplé).

(AM) into points on the basis of the 100-point T-scale (Starosta, 1984) was later applied to present the obtained results graphically.

## Results

Table 1 contains the differences between the classical and the free style wrestlers in the variables assessing physical fitness. Kolmogorov–Smirnov test was used to test the normality of distribution for all the variables listed. None of the variables was found to deviate significantly from normal distribution, so all the variables were included into further analyses. The discriminant analysis was used to test the differences between the two groups of wrestlers – the classical and the free style junior wrestlers – in the physical fitness variables. The parameters presented in Table 2 were calculated within the discriminant analysis.

Upon confirming that the discriminant function statistically significantly differentiated between the two groups – the classical and the free style wrestlers, the structure of the discriminant function was determined (Table 3).

Table 3. Results of the discriminant analysis for classical and free style wrestlers – correlation of variables assessing physical fitness level with the discriminant function (n=107)

Variables	Discriminant function
Maximal turn in the jump (degrees)	0.23
Zig-zag running, the so-called <i>envelope</i> (s)	-0.21
Run with a turnover (s)	0.04
Pull-ups (repetitions)	-0.33
Parallel bars dips (repetitions)	-0.39
Bench press (kg)	-0.28
Sit-ups with side twists and with load (repetitions)	-0.42
Maximal load snatch (kg)	-0.18
Lifting maximum load onto the chest (kg)	-0.09
Back squats (kg)	-0.09
Vertical jump test (cm)	-0.21
20-m run from the flying start (s)	-0.06
Trunk bending (decline bench) (cm)	0.21
Backward handsprings (s)	0.21
Strive, the so-called merry-go-round (s)	0.02
Bridge from above the upper stance (s)	0.30
The catch (snatch) from the neck (s)	0.31
Pirouettes (s)	0.06

Table 1. Differences between the classical and the free style junior wrestlers in variables assessing physical fitness (mean±SD)

Variables	Classical style wrestlers n=61 Mean ± SD	Free style wrestlers n=46 Mean ± SD
Maximal turn in the jump (degrees)	808.39 ± 137.94	733.24 ± 117.26
Zig-zag running, the so-called <i>envelope</i> (s)	23.36 ± 1.07	24.67 ± 1.19
Run with a turnover (s)	12.01 ± 0.57	11.95 ± 0.65
Pull-ups (repetitions)	14.83 ± 8.84	22.14 ± 8.26
Parallel bars dips (repetitions)	26.271 ± 10.21	36.80 ± 11.18
Bench press (kg)	92.66 ± 18.74	107.68 ± 23.27
Sit-ups with side twists and load (repetitions)	18.45 ± 9.92	30.13 ± 11.41
Maximal load snatch (kg)	58.33 ± 8.17	63.14 ± 12.74
Lifting maximum load onto the chest (kg)	82.56 ± 12.42	85.84 ± 17.29
Back squats (kg)	111.71 ± 21.58	117.44 ± 30.15
Vertical jump test (cm)	53.93 ± 5.63	57.41 ± 7.68
20-m run from the flying start (s)	2.64 ± 0.09	2.66 ± 0.14
Trunk bending (decline bench) (cm)	58.35 ± 7.98	53.96 ± 8.37
Backward handsprings (s)	2.99 ± 0.61	2.65 ± 0.50
Strive, the so-called merry-go-round (s)	12.17 ± 1.82	12.09 ± 1.88
Bridge from above upper stance (s)	2.12 ± 0.31	1.91 ± 0.23
The catch (snatch) from the neck (s)	7.35 ± 1.16	6.50 ± 0.83
Pirouettes (s)	5.56 ± 0.90	5.42 ± 0.77

Table 2. Results of the discriminant analysis for classical and free style wrestlers – test of significance and of the power of the discriminant function (n = 107)

Discriminant function	Eigenvalue	Canonical R	Wilks' Lambda	Targ %	$\chi^2$	df	p-level
I.	1.58	0.78	0.39	100	91.11	18	0.00

Legend: Eigenvalue – the variance of the discriminant function; Canonical R – canonical discrimination coefficient; Wilks' Lambda – inverse measure of intergroup variability; Targ % – the percentage of explained variance;  $\chi^2$  – chi-square; df – degrees of freedom; p-level – probability of error.

The centroids (arithmetic means of all the variables) of groups of wrestlers on the discriminant function were also calculated to interpret the obtained results clearly and meaningfully (Table 4).

Upon confirming the statistical significance of the differences between the classical and the free

style wrestlers, each variable was tested for its significance (Table 5). ANOVA (Table 5) helped to identify the differences between arithmetic means of twelve out of 18 variables assessing the physical fitness level of athletes.

The average numerical results assessment (Table 1), performed by means of a 100-point T-scale (Starosta, 1984), was used as the additional method for a detailed interpretation of the obtained results. A line plot was used (Figure 1) to present the obtained differences between the physical fitness variables of junior classical and free style wrestlers.

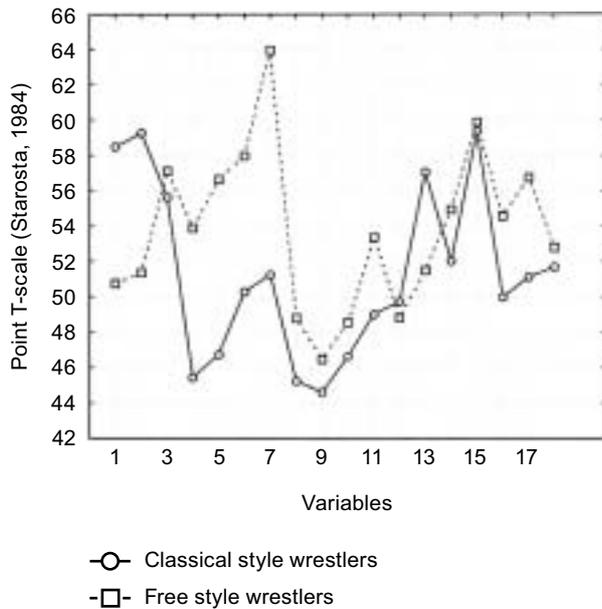
Table 4. Centroids of groups on the discriminant function

Junior wrestlers	Discriminant function
Free style	-1.43
Classical style	1.08

Table 5. Univariate analysis of variance for the variables assessing the physical fitness level of classical and free style junior wrestlers (n=107)

VARIABLE	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p - level
<b>Maximal turn in the jump (degrees)</b>	<b>145977.73</b>	<b>1</b>	<b>145977.73</b>	<b>1722288.40</b>	<b>103</b>	<b>16721.25</b>	<b>8.73</b>	<b>0.00</b>
<b>Zig-zag running, the so-called envelope (s)</b>	<b>17.23</b>	<b>1</b>	<b>17.23</b>	<b>82.03</b>	<b>69</b>	<b>1.19</b>	<b>14.49</b>	<b>0.00</b>
Run with a turnover (s)	0.10	1	0.10	37.06	102	0.36	0.28	0.59
<b>Pull-ups (repetitions)</b>	<b>1345.27</b>	<b>1</b>	<b>1345.27</b>	<b>7471.49</b>	<b>101</b>	<b>73.98</b>	<b>18.19</b>	<b>0.00</b>
<b>Parallel bars dips (repetitions)</b>	<b>2867.73</b>	<b>1</b>	<b>2867.73</b>	<b>11668.90</b>	<b>103</b>	<b>113.29</b>	<b>25.31</b>	<b>0.00</b>
<b>Bench press (kg)</b>	<b>5728.97</b>	<b>1</b>	<b>5728.97</b>	<b>44006.52</b>	<b>102</b>	<b>431.44</b>	<b>13.28</b>	<b>0.00</b>
<b>Sit-ups with side twists and with load (repetitions)</b>	<b>3367.55</b>	<b>1</b>	<b>3367.55</b>	<b>11135.23</b>	<b>100</b>	<b>111.35</b>	<b>30.24</b>	<b>0.00</b>
<b>Maximal load snatch (kg)</b>	<b>559.36</b>	<b>1</b>	<b>559.36</b>	<b>10390.81</b>	<b>97</b>	<b>107.12</b>	<b>5.22</b>	<b>0.02</b>
Lifting maximum load onto the chest (kg)	262.08	1	262.08	21165.65	98	215.98	1.21	0.27
Back squats (kg)	811.83	1	811.83	64699.06	99	653.53	1.24	0.27
<b>Vertical jump test (cm)</b>	<b>313.18</b>	<b>1</b>	<b>313.18</b>	<b>4493.38</b>	<b>103</b>	<b>43.63</b>	<b>7.18</b>	<b>0.01</b>
20-m run from the flying start (s)	0.01	1	0.01	1.03	76	0.01	0.59	0.44
<b>Trunk bending (decline bench) (cm)</b>	<b>500.84</b>	<b>1</b>	<b>500.84</b>	<b>6906.72</b>	<b>104</b>	<b>66.41</b>	<b>7.54</b>	<b>0.01</b>
<b>Backward handsprings (s)</b>	<b>2.39</b>	<b>1</b>	<b>2.39</b>	<b>27.84</b>	<b>86</b>	<b>0.32</b>	<b>7.39</b>	<b>0.01</b>
Strive, the so-called merry-go-round (s)	0.14	1	0.14	347.11	102	3.40	0.04	0.84
<b>Bridge from the above upper stance (s)</b>	<b>1.10</b>	<b>1</b>	<b>1.10</b>	<b>7.63</b>	<b>102</b>	<b>0.07</b>	<b>14.69</b>	<b>0.00</b>
<b>The catch (snatch) from the neck (s)</b>	<b>16.55</b>	<b>1</b>	<b>16.55</b>	<b>98.24</b>	<b>93</b>	<b>1.06</b>	<b>15.66</b>	<b>0.00</b>
Pirouettes (s)	0.47	1	0.47	71.20	100	0.71	0.66	0.42

Legend: SS Effect – the sum of square between groups; Df Effect – degrees of freedom between groups; MS Effect – mean squares between groups; SS Error – sum of squares within groups; Df Error – degrees of freedom within groups; MS Error – mean squares within groups; F – F approximation; p-level – probability of error; bold – statistically significant.



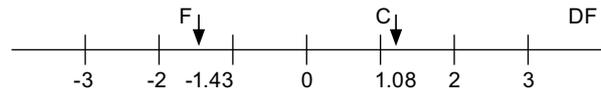
Legend: (1 = Maximal turn in the jump, 2 = Zig-zag running, 3 = Run with a turnover, 4 = Pull-ups, 5 = Parallel bars dips, 6 = Bench press, 7 = Sit-ups with side twists and with load, 8 = Maximal load snatch, 9 = Lifting maximum load onto the chest, 10 = Back squats, 11 = Vertical jump test, 12 = 20-m run from the flying start, 13 = Trunk bending, 14 = Backward handsprings, 15 = Strive, 16 = Bridge from the above upper stance, 17 = The catch (snatch) from the neck, 18 = Pirouettes)

Figure 1. Differences between top-level Polish classical and free style wrestlers (17-20 years of age) in the variables for the assesment of the physical fitness level

## Discussion and conclusions

The results of this research confirm the existence of the discriminant function (Table 2) that statistically significantly differentiated between the classical and the free style wrestlers as regards the variables applied for the assesment of physical preparedness (fitness) level of wrestlers. The highest correlations between the variables assesing physical fitness and the discriminant function (Table 3) were found in variables assesing the strength endurance of the trunk – *sit-ups with side twists and with load*, and the strength endurance of the arms – *pull-ups* and *parallel bars dips*. Both on the basis of those correlations and on the basis of previous research (Baić, 2006) this discriminant function was defined as the strength endurance of the trunk and upper extremities. The calculation of centroids of groups (Table 4) helped to draw the discriminant function (Figure 2) that showed the top-level free style wrestlers to have a statistically more expressed strength endurance of the trunk and upper extremities than the classical style wrestlers.

The better results achieved by the free style wrestlers in the tests assesing the strength endurance of the trunk and arms may probably be explained by a greater complexity of this style of



Legend: DF – discriminant function (strength endurance of the trunk and of upper extremities); F – free style wrestlers, C – classical style wrestlers.

Figure 2. Position of the centroids of the groups of junior classical and free style wrestlers in the space of significant discriminant function (DF)

fighting (Marić, 1990; Shahmuradov, 1996). In free style wrestling all techniques may be used that include leg locks either by using arms or legs. That is the reason why the free style wrestling bouts end in a greater number of efficiently executed technical actions than the classical-style wrestling bouts. It can be said that in free style wrestling the *attack-oriented wrestling* in a standing position or on the floor has a far more important role for performance in a bout, in contrast to the classical style wrestling that is frequently characterised as the *passive wrestling* in the standing position for the purpose of takedowns and completing the bout on the floor. Consequently, a good physical preparation of the trunk and upper extremities in free-style wrestlers is gaining in importance which is also the result of the long-term drilling of technical-tactical elements during the training process, and their efficient and frequent execution in difficult competition conditions.

The analysis of the significance of differences for each variable (Table 5) helped to reach the conclusion that the variables *maximal turn in the jump*, *zigzag running*, *undergrasp pull-ups on the horizontal bar*, *dips on parallel bars*, *maximal bench press*, *sit-ups with side twists and with load*, *maximal load snatch*, *vertical jump*, *trunk bending*, *backward handsprings*, *bridge from the above upper stance* and *the catch (snatch) from the neck* statistically significantly differentiated between the junior classical and free style wrestlers. On the basis of the values of differences that can be seen in Figure 1 the conclusions that follow can be drawn with great certainty.

1. Junior classical style wrestlers have a better global coordination – specific airborne dexterity in twisting around the longitudinal axis, agility – changing the direction of movement, and better flexibility of the lumbar spine.
2. Junior free style wrestlers have a better global coordination – specific airborne dexterity in rotation around the medial axis, strength endurance of the trunk and arms, absolute maximal strength of arm and trunk extensors, explosive strength in jumping and specific speed of assuming the bridge stance from the standing position.

Such results obtained by the univariate analysis of variance may be explained by the peculiarities of each wrestling style. When executing a great number of classical style wrestling techniques, very complex coordination-specific requirements are set regarding the twist around the longitudinal axis, because a great number of takedowns are done by side twists and twists/rotations of the whole body. Likewise, agility (change of the direction of movement) has an important role in executing the techniques of bringing the opponent down onto the mat. Flexibility of the trunk, manifested as the mobility of the lumbar spine towards the back, is very important in the techniques of belly-to-back *souplé* and in various types of assuming the bridge stance. In contrast to the classical style wrestling, the better results obtained by the free style wrestlers in the tests assessing strength endurance, absolute and explosive strength, and specific speed can be explained by a greater complexity of that type of wrestling (Marić, 1990; Shahmuradov, 1996). In free style wrestling all techniques from classical style wrestling can be used, as well as all the techniques that include leg locks executed by using either arms or legs. That is the reason why the global coordination regarding the specific dexterity in twisting around the longitudinal axis is not so frequently manifested on the one hand, and the execution of movements that require the global coordination (specific airborne dexterity in rotation around the medial axis) on the other. Wrestling is executed at a larger distance, so that the explosive movements are the basis of the phase

of entering the takedowns, and strength endurance and absolute maximal strength are a precondition for the successful execution of this phase.

The obtained results may have a two-fold effect - they may make the selection of athletes for participation in one of the two styles of wrestling easier for the coaches, and they may also make the physical preparation of top-level junior classical and free style wrestlers easier. This is of particular importance for wrestling in Croatia because the sample of quality classical style wrestlers in Croatia is very small and the free style wrestling has only just started on its way.

The obtained results differ to some extent from previous research (Rybalko, 1966; Starosta, 1984). Such results may be the consequence of specific features of the population of wrestlers that has been tested which is special as regards its utilisation of motor abilities during the bout, which was also confirmed by a well known Russian coach (Preobrazhenskiy, 1978). The second reason for the differences from the previous research studies may probably be explained to some extent by the differences between the specific features of wrestling schools in which the aforementioned investigations took place. Such a hypothesis could find its support in some previous research, too (Song & Graviea, 1980). However, such a thesis about the diversity of wrestling schools should be checked in further research, and thus help to accept or reject the expert opinion of some top-level wrestling coaches.

## References

- Baić, M., Marić, J., & Valentić, M. (2004). Bazične i specifične hrvačke vježbe u parovima za razvoj snage i fleksibilnosti trupa. [Basic and wrestling-specific pair drills aimed at the development of trunk strength and flexibility.] *Kondicijski trening*, 2(2), 34-43.
- Baić, M. (2006). *Razlike između vrhunskih poljskih i hrvatskih hrvača različitih stilova, dobi i težinskih skupina u prostoru varijabli za procjenu kondicijske pripremljenosti*. [Differences between top-level Polish and Croatian wrestlers of different wrestling styles, age and weight categories in variables assessing physical fitness.] (Unpublished doctoral dissertation, University of Zagreb). Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu.
- Dinev, P., Petrov, K., & Jankova, R. (1991). *Iskustva diferenciranog pristupa fizičkoj pripremi mladih hrvača*. [Experiences of the differentiated approach to physical conditioning of young wrestlers.] Sofija: Fizička kultura.
- Marić, J. (1990). *Rvanje slobodnim načinom*. [Free-style wrestling.] Zagreb: Fakultet za fizičku kulturu.
- Marić, J., Baić, M., & Aračić, M. (2003). Kondicijska priprema hrvača. [Physical conditioning of wrestlers.] In D. Milanović & I. Jukić (Eds.), *Proceedings, Međunarodni znanstveno-stručni skup "Kondicijska priprema sportaša"*, Zagreb, February 21&22, 2003 (pp. 339 – 346). Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu; Zagrebački športski savez.
- Marić, J., Baić, M., Sertić, H. & Vujnović, I. (2005). Metric characteristics of selected tests for the evaluation of basic training status in top level wrestlers. In D. Milanović & F. Prot (Eds.), *Proceedings Book of the 4<sup>th</sup> International Scientific Conference "Kinesiology – New Perspectives"* (pp. 435-438). Zagreb: Faculty of Kinesiology.
- Preobrazhenskiy, S.A. (1978). *Borba zanjatije muškog*. Moskva: Fizkultura i sport.
- Rybalko, B.M. (1966). *Fizičeskaja podgotovka borca (izučenie nekotoryh zakonomernostej skorostno – silovoj podgotovki borca)*. Na borcovskom kovre. Moskva: Fizkultura i sport.

- Rezasoltani, A., Ahmadi, A., Nehzate-Khoshroh, M., Forohideh, F., & Ylinen, J. (2005). Cervical muscle strength measurement in two groups of elite Greco-Roman and free style wrestlers and a group of non-athletic subjects. *British Journal of Sports Medicine*, 39(7), 440-443.
- Sertić, H. (1994). *Utjecaj koordinacije i snage na uspješnost u judo borbi kod djece od 11 godina*. [Influence of coordination and strength performance in a judo bout of children 11 years of age.] (Unpublished Master of Science thesis, Faculty of Physical Education.). Zagreb: Fakultet za fizičku kulturu.
- Sertić, H., & Kuleš (1999). Odnos koordinacije i snage kod judaša starih 11 godina. [Relations between coordination and strength in judokas 11 years of age.] In E. Hofman (Ed.), *Proceedings, 4. konferencija o sportu Alpe – Jadran, Rovinj, 23.-26.06.1999* (pp. 213-218). Zagreb: Fakultet za fizičku kulturu.
- Sertić, H., Baić, M., & Segedi, I. (2005). Metric characteristics of chosen acrobatic tests for advanced wrestlers. In J. Sadowski (Ed.), *Proceedings Book of the International Scientific Conference "Coordination motor abilities in scientific research"*, Biala Podlaska (pp. 247-252). Biala Podlaska: Jozef Piłsudski Academy of Physical Education in Warsaw, Faculty of PE in Biala Podlaska.
- Shahmuradov, Y.A. (1996). *Free style wrestling*. Rome: FILA.
- Song, T., & Garvie, G. (1980). Anthropometric, flexibility, strength, and physiological measures of Canadian wrestlers and comparison of Canadian and Japanese Olympic wrestlers. *Canadian Journal of Applied Sport Science*, 5, 1-8.
- Starosta, W., & Tracewski, J. (1981). *Zestaw prob sprawnosci ogolnej i specjalnej dla zaawansowanych zawodników zapasow*. [Set of tests assessing basic and specific preparedness of advanced wrestlers.] Warszawa: Instytut sportu – zakład selekcji sportowej.
- Starosta, W. (1984). *Sprawność ogólna i specjalna zaawansowanych zapaśników (styl klasyczny i wolny) w świetle badań prowadzonych w latach 1981-1984*. [Basic and specific preparedness of advanced wrestlers (classic- and free style) in the research conducted in the period 1981-1984.] Warszawa: Instytut sportu – zakład selekcji sportowej.
- Starosta, W., & Tracewski, J. (1998). An objective method of assessing the level of motor abilities in advanced wrestlers. In J. Sadowski & W. Starosta (Eds.), *Proceedings Book of the International Scientific Conference "Movement Coordination in Team Sport Games and Martial Arts"*, Biala Podlaska (pp. 249-254). Warsaw: Academy of Physical Education; Biala Podlaska: The Institute of Sport and Physical Education.
- Starosta, W., Baić, M., & Sertić, H. (2005). Reliability of the chosen Polish test for evaluating specific training status in advanced wrestlers. In J. Sadowski (Ed.), *Proceedings Book of the International Scientific Conference "Coordination motor abilities in scientific research"*, Biala Podlaska (pp. 144-149). Biala Podlaska: Jozef Piłsudski Academy of Physical Education in Warsaw, Faculty of PE in Biala Podlaska.
- Starosta, W. (2006). *Global and local motor coordination in physical education and sport*. Warszawa: International Associations of Sport Kinetics.

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## RAZLIKE U KONDIICIJSKOJ PRIPREMLJENOSTI IZMEĐU HRVAČA KLASIČNIM I SLOBODNIM NAČINOM BORENJA

### Sažetak

#### Uvod

Podizanje razine kondicijskih sposobnosti bazični je dio svih vrsta pripreme hrvača za natjecanje. To je jedan od izuzetno bitnih segmenata trenažnog programa i uvjet adekvatne pripreme za vrhunska sportska dostignuća. Međutim, broj dosadašnjih istraživanja u kojima su se autori bavili razlikama u kondicijskoj pripremi hrvača različitog načina borenja vrlo je malen (Rybalko, 1966; Starosta, 1984; Starosta, 1984, 2006; Rezasoltani i sur., 2005). Uz navedeni problem malog broja dosadašnjih istraživanja, uočena je i tendencija napretka kondicijske pripreme u hrvanju unatrag desetak godina (Dinev i sur., 1991; Starosta i sur., 1998).

Cilj ovoga istraživanja bio je utvrditi razlike između vrhunskih hrvača slobodnog i klasičnog načina borenja u varijablama za procjenu kondicijske pripremljenosti.

#### Metode

Istraživanje je provedeno na uzorku od 107 vrhunskih hrvača klasičnog i slobodnog načina borenja u dobi od 17 do 20 godina. U navedenom uzorku nalazi se 46 hrvača klasičnog načina borenja i 61 hrvač slobodnog načina borenja, a svi su imali isti sportski razred – bili su članovi poljske reprezentacije. Uzorak mjernih instrumenata činilo je 18 testova opće i specifične kondicijske pripremljenosti, koji najvećim dijelom čine poznati poljski komplet testova za napredne hrvače (Starosta i Tracewski, 1981), koji je preveden i na hrvatski (Baić, 2006). Dobiveni rezultati obrađeni su kanoničkom diskriminacijskom analizom i univarijantnom analizom varijance (ANOVA). Mjerenja su provedena u Poljskoj za vrijeme održavanja kampa reprezentacije u 1998. i 2000. godini.

#### Rezultati

Rezultati ovoga istraživanja potvrđuju postojanje diskriminacijske funkcije koja statistički značajno razlikuje hrvače juniore klasičnog i slobodnog načina borenja u prostoru primijenjenih varijabli za procjenu kondicijske pripremljenosti. Najveće korelativne veze između varijabli za procjenu kondicijskih sposobnosti i diskriminacijske funkcije izračunate su kod varijabli za procjenu repetitivne snage trupa – podizanje trupa sa zasucima i opterećenjem, te za procjenu repetitivne snage ruku – zgibovi na preči i sklekovi na ručama. Na temelju takvih korelativnih veza te saznanja iz prijašnjih istraživanja (Baić, 2006), ta diskriminacijska funkcija definirana je kao *repetitivna snaga trupa i gornjih ekstremiteta*.

ta. Izračunavanjem centroida grupa, utvrđeno je da grupa vrhunskih hrvača slobodnog načina borenja ima statistički značajno više izraženu repetitivnu snagu trupa i gornjih ekstremiteta od grupe hrvača klasičnog načina borenja.

Nakon što je potvrđena statistička značajnost razlika između grupe hrvača klasičnog i slobodnog načina borenja, testirana je značajnost razlika za svaku pojedinu varijablu. Univarijantnom analizom varijance, utvrđeno je da su varijable: *maksimalni okret u skoku, trčanje cik-cak, zgibovi na preči nathvatom, sklekovi na ručama, podizanje maksimalne težine iz ležanja, podizanje trupa sa zasucima i opterećenjem, trzaj maksimalne težine, skok u vis s mjesta, zaklon trupa iz ležanja potrbuške, premeti unatrag, most iz stojećeg položaja te sklopka s vrata* statistički značajno razlikovale hrvače juniore klasičnog i slobodnog načina borenja. Kao dopunska metoda za detaljniju interpretaciju dobivenih rezultata korišteno je vrednovanje prosječnih numeričkih rezultata pomoću 100-bodovne T-skale (Starosta, 1984).

#### Rasprava i zaključci

Rezultate dobivene diskriminacijskom analizom autori objašnjavaju specifičnostima svakog načina borenja. Za razliku od hrvača klasičnim načinom borenja hrvači slobodnim načinom borenja ostvarili su bolje rezultate u testovima za procjenu repetitivne snage trupa i ruku. To je moguće objasniti većom kompleksnošću toga načina borenja (Marić, 1990; Shahmuradov, 1996). Naime, u slobodnom načinu borenja mogu se koristiti sve tehnike iz klasičnog načina borenja, ali i tehnike koje uključuju hvatove za noge bilo rukama bilo nogama. Posljedica svega toga je i veća važnost dobre kondicijske pripreme trupa i gornjih ekstremiteta kod hrvača slobodnim načinom borenja, koja omogućuje dugotrajno vježbavanje velikog broja tehničko-taktičkih elemenata za vrijeme treninga te njihovo efikasno i učestalo izvođenje u otežanim uvjetima na natjecanjima.

Na temelju analize značajnosti razlika, provedene univarijantnom analizom varijance, s velikom sigurnošću se može zaključiti i sljedeće:

1. Hrvači juniore klasičnim načinom imaju bolju specifičnu koordinaciju tipa okretnosti u zraku oko uzdužne osovine, agilnosti tipa promjene smjera kretanja te bolju fleksibilnost lumbalnog dijela kralježnice.
2. Hrvači juniore slobodnim načinom imaju bolju specifičnu koordinaciju tipa okretnost u zraku oko poprečne osovine, repetitivnu snagu ruku i trupa, apsolutnu maksimalnu snagu opružaka ruku i trupa, eksplozivnu snagu tipa skočnost i specifičnu brzinu tipa spuštanja u stražnji most iz stojećeg stava.