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# **Coordination Motor Abilities in Scientific Research**

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# METRIC CHARACTERISTICS OF CHOSEN ACROBATIC TESTS FOR ADVANCED WRESTLERS

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## INTRODUCTION

Acrobatic tests are used to evaluate specific quickness of wrestlers needed for overall training, and they are a part of a battery of tests for evaluating the basic and specific training status for advanced wrestlers (Starosta, Tracewski 1981). This battery of tests is the result of work done by scientists from the Institute for Sport and experienced wrestling coaches. Before the tests were made, the importance of motor abilities for success in wrestling was assessed, and coordination abilities were found to be the most important (Starosta 1998). This was also reflected in creation of the battery of tests, in which coordination abilities have the most important role (for cadets and juniors 52.2%, and for seniors 28.6% of the total number of tests). According to the author (Starosta 1997) the result of this long-term approach to training was the later success of Polish wrestlers.

The wish of the author is to find out whether the metric characteristics of tests for specific training status (acrobatics) have high results on some other populations of advanced wrestlers. This result would permit professionals of the field of sport and science of other countries to use this battery, and to have as much scientific information about its metric characteristics, and most of all about its reliability.

## METHODS

The sample of participants comprised 35 top cadet Greco-Roman wrestlers (15-17 years old) from 8 different Croatian clubs. This sample may be considered as representative sample of Croatian top wrestlers. All of these wrestlers were chosen according to their ranking (1-4 place) at the national championships of 2004. A small number of participants who did not respond could not be foreseen, and was the result of injuries, sickness or some other objective circumstances. All tested as healthy, which was determined by a physical examination.

Four acrobatic tests were chosen from the battery of tests for the assessment of the basic and specific training status of advanced wrestlers. A detailed description of these tests together with a point scale of demands is in the written work (Starosta,

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Tracewski 1981), and the translation into Croatian is in the written work (Baić 2003).

1. Forward pass (Forward handspring) (PRE\_NAP) – From a run-up the subject executes a forward handspring in accordance with the general rules of apparatus gymnastics. The number of points the subject receives for the execution equals the mark assigned. The marking scale ranging from 0 to 5 points is used for the test evaluation.
2. Forward somersault in squat position (SAL\_NAP) – From a run-up the subject executes a forward somersault, his body crouched in accordance with the general rules of apparatus gymnastics. The number of points the subject receives for his execution equals the mark given for the execution. The marking scale ranging from 0 to 5 points is used for the test evaluation.
3. Backward somersault in squat position (SAL\_NAT) – The subject stands in the middle of the mat (his back towards the mat if he uses it). On the sign or according to his own will he executes, as correctly as possible, the backward somersault in accordance with the general rules of apparatus gymnastics. The marking scale ranging from 0 to 5 points is used for test evaluation.
4. Backward pass (*Backward handsprings*) (PRE\_NAT) – The subject starts the test by standing at the end of the mat, his heels together and his arms above his head. On the sign or according to his own will he starts the series of three interconnected backward handsprings and the time of exercise execution is taken into account. The time is measured from the moment his feet 'leave' the mat to the moment of landing after the third handspring – this is the moment when the feet touch the mat. The accuracy is 0.1 seconds.

The research was conducted in January 2005 at the Faculty of Kinesiology in Zagreb, and 7 basic and 8 specific wrestling tests were conducted. The subjects went from one test to another by random choice, and for the necessity of this research only the above mentioned four specific acrobatic tests for wrestlers were analysed. Five wrestling coaches (graders) graded the acrobatic elements of the tests. All five graders are students of the Faculty of Kinesiology so they are familiar with these acrobatic elements of gymnastics. The graders were seated around the working area and they studied the standards for every grade in detail, and giving grades was secret so they could not influence one another. The participants did the element twice and the average grade was taken into account. The gyms where the testing was done were normally heated according to the season, and the testing took place between 9am and 2pm.

## RESULTS

The average age of the group of wrestlers was 16.24+/- 0.74 years. Their average number of training sessions per week was 4.65 +/- 0.94, years of training 5.69

+/- 0.29, body height 172,28+/-1.49 cm, and body weight 66.47+/-1.92 kg. Other results are shown in tables 1 and 2.

Table 1. Analysis of basic statistic parameters for each item, and the influence of each item on the reliability amplitude of test (n=35)

R.b.	Test	n	Mean	Min.	Max.	Std.Dev	Skewne	Kurtosi	Factor	Cra id
1.	PRE_NAP (points)	1	3,629	0	5	1,024	-1,385	3,473	0,973	0,982
		2	3,971	0,5	5	1,057	-1,288	1,949	0,948	0,987
		3	3,800	0	5	1,093	-1,461	3,135	0,973	0,982
		4	3,757	0	5	1,107	-1,304	2,656	0,982	0,980
		5	3,871	0	5	1,094	-1,564	3,528	0,985	0,979
2.	SAL_NAP (points)	1	2,243	0	4	1,395	-0,372	-1,268	0,963	0,987
		2	2,386	0	4	1,409	-0,463	-1,195	0,978	0,984
		3	2,143	0	4	1,422	-0,405	-1,340	0,979	0,983
		4	2,329	0	4	1,465	-0,459	-1,266	0,991	0,981
		5	2,157	0	4	1,338	-0,279	-1,343	0,967	0,986
3.	SAL_NAT (points)	1	1,029	0	4	1,372	1,079	-0,300	0,983	0,990
		2	0,986	0	4	1,263	1,021	-0,347	0,976	0,992
		3	0,971	0	4	1,393	1,335	0,381	0,991	0,989
		4	0,900	0	4	1,265	1,175	-0,040	0,987	0,990
		5	1,000	0	4	1,388	1,242	0,048	0,989	0,989
4.	PRE_NAT (sec)	1	3,122	2,17	5,93	0,870	1,618	3,416	0,882	0,954
		2	3,046	2,09	4,24	0,625	0,533	-0,821	0,962	0,812
		3	2,994	2,21	4,87	0,647	1,341	1,571	0,944	0,840

Legend: n-ordinal number of items (graders); Mean-arithmetical mean; Minimum-minimum value; Maximum-maximum value; Std.Dev.- standard deviation; Skewness- asimetry coefficient; Kurtosis - curvature coefficient; Factor 1 - correlations of items with first main component; Cra id- evaluated Cronbach's a coefficient of reliability if the particle was excluded

Table 2. Analysis of the reliability of selected tests for advanced wrestlers (n=35)

R.b.	Test	n	SB	ac	Cra	ECra	R	Eigenval	Cumul. %
1.	PRE_NAP	5	0.986	0.985	0.985	0.976	0.937	4 726	0.945
2.	SAL_NAP	5	0.987	0.988	0.987	0.979	0.944	4 761	0.952
3.	SAL_NAT	5	0.993	0.993	0.992	0.987	0.966	4 854	0.971
4.	PRE_NAT	3	0.921	0.923	0.903	0.862	0.816	2 595	0.865

Legend: n- ordinal number of items (graders); SB-Spearman-Brown coefficient of reliability; ac-Kaiser-Caffry coefficient of reliability; Cra- Cronbach's a coefficient of reliability; Ecra-estimated Cronbach's a coefficient of reliability if two items are excluded; R-Average Inter - Item Correlation; Eigenval- absolute amplitude in characteristic values of the matrix of item correlation; Cumul. %- by percentage articulated cumulative part of characteristic values of the matrix of item correlation.

## DISCUSSION

The objectivity of the judges in the acrobatic tests, forward pass (PRE\_NAP), forward somersault in squat position (SAL\_NAP) and backward somersault in squat position (SAL\_NAT) evaluated by the Spearman-Brown procedure, Kaiser-Caffrey and Cronbach's  $\alpha$  coefficient, is very high (table 2). The arithmetical means of items are mostly unchanged, as are the minimal and maximal results (table 1). Distribution of the results in the forward pass test (PRE\_NAP) shows a tendency of slightly negative asymmetry, and in the backward somersault in the squat position test (SAL\_NAT) - slightly positive asymmetry. The average correlations between the grades of the graders show very high values (table 2), which indicate a very high objectivity of the judges. The authors feel that the evaluation of the acrobatic tests is enabled by the standards set for every grade (Brindl 1997), which favoured objectivity and reliability. The Kolmogorov-Smirnov test of normality of distribution has been used, and the Hi-square test determined that there is no statistic difference between the noticed and expected distributions of results. However, in research done with a large number of tests and participants it is very hard to organise five judges. Because of that reason Cronbach's coefficient was tested for three and four graders. The given results show that even with a smaller number of graders, objectivity would remain at a high level (table 1 and 2), which makes this research easier to organise. The results of earlier research point to the validity of the results for testing coordination (Baić 2003) where these tests got the biggest number of statistically important correlations with other tests for evaluating coordination (maximal turn in jump and backward passes). The same tests participated in defining the factor of agility in the air. The validity of the Forward pass test (PRE\_NAP), regarding the criterion of success in wrestling was confirmed by further research (Baić 2003), where it was determined that the results in this test are better if the wrestling group is better.

The reliability of the backward pass test (PRE\_NAT) evaluated by the Spearman-Brown procedure, Kaiser-Caffrey and Cronbach's  $\alpha$  coefficient is high (table 2). The arithmetical means of items are unchanged, similar to the minimal and maximal results (table 1). Regarding the variability and range of results, we could say that the sensitivity of this measuring instrument is good. However, the results mostly vary in a positively asymmetric manner in relation to the arithmetical mean, so we can say that this test is very hard for this sample of participants, especially if we take into account that only 71% of wrestlers succeeded in doing this test. An increased number of advanced wrestlers (juniors and seniors) would influence the percentage of success in doing this test and the improvement of the metric characteristic of this test. The average correlation between the items shows high values (table 2), which indicates a high homogeneity of the test. In researches with a larger number of participants and motor or other tests, often it is not necessary to have composite tests (Bala 1990). For that reason Cronbach's  $\alpha$  coefficient of reliability is measured for

the rest of the items if one is excluded (table 1). The given results show that even with only two items, the reliability would still be acceptably high. The order and size of item correlations to the first main important component brings us to the conclusion that the first attempt should be treated as probationary, because by excluding the first item, the homogeneity between the other two items would increase (table 1). The results of earlier research point to the validity of the test in terms of evaluating coordination (Baić 2003) where these tests got the biggest number of statistically important correlations with other tests for evaluating coordination (maximal turn in jump, forward passes, forward somersault in squat position, backward somersault in squat position). The same tests participated in defining the factor of agility in the air.

The authors can conclude that applied acrobatic tests have good metric characteristics, and could be recommended for use on a population of advanced Croatian wrestlers. The authors feel that in research conducted on top athletes, where they are evaluated with a great number of tests, of which there are several regarding particular dimensions, often it is not necessary to have tests with a large number of items and graders. That is only justified in the cases of clearly set standards for every grade, and scientifically and practically determined necessary number of items and graders for every test.

## REFERENCES

1. Baić, M. (2003). Razlike u razini izabраниh motoričkih i funkcionalnih sposobnosti kod poljskih i hrvatskih kadeta hrvača klasičnim načinom. Unpublished master's thesis, Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu.
2. Bala, G. (1990). Logičke osnove metoda za analizu podataka iz istraživanja u fizičkoj kulturi. Novi Sad: GRO Sava Munčan.
3. Brindl, V. (1977). Objektivnost ocjenjivanja elemenata tehnike u gimnastici. U V. Horvat (Ur), Kineziologija. Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu, 137-156.
4. Mejovšek, M. (2003). Uvod u metode znanstvenog istraživanja u društvenim i humanističkim znanostima. Zagreb: Edukacijsko – rehabilitacijski fakultet Sveučilišta u Zagrebu.
5. Starosta, W., Tracewski, J. (1981). Zestaw prob sprawności ogólnej i specjalnej dla zaawansowanych zawodników zapasów. Warszawa, Instytut Sportu.
6. Starosta, W. (1984). Sprawność ogólna i specjalna zaawansowanych zapaśników (styl klasyczny i wolny) w świetle badań prowadzonych w latach 1981-1984. Warszawa, Instytut Sportu.
7. Starosta, W. (1997). Correlation between Co-ordination and Physical Abilities in the Theory and Practice of Sport Training. In: P. Blaser (Eds), Proceedings book of fifth international scientific conference of International Association for Sport

Kinetics, Magdeburg Theories of human motor performance and their reflections in practice Hamburg, 57-69.

8. Starosta, W., Tracewski, J. (1998). An objective method of assessing the level of motor abilities in advanced wrestlers. In J. Sadowski, & W. Starosta (Eds.), *Biala Podlaska Movement Coordination in Team Sport Games and Martial Arts* Warsaw: Academy of Physical Education, & Biala Podlaska: The Institute of Sport and Physical, 249-254.