RELATIONS BETWEEN MOTOR ABILITIES AND THE WRESTLER'S COMPETITIVE EFFECTIVENESS

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Abstract
There was applied a battery of tests using a total number of 22 variables, on a sample of 103 wrestlers. The battery of tests had 17 tests for motor skills' assessing and 5 tests for assessing the wrestler's competitive effectiveness. The study was done aiming to determine the basic mutual relations. By the analysis of results obtained using the canonical correlation analysis, was showed that the canonical factors could be interpreted as an integral general motor factor, while based on the structure of the wrestler competitive efficiency; the canonical factor can be interpreted as a factor for competitive success. These relations of the canonical factors' structure suggest that wrestlers with these motor abilities achieve very good results in competitions, which fully confirmed the hypothesis of a positive link between these two areas. Based on these obtained research results, can be concluded that for good results and successful competitive efficiency in the wrestling, are necessary quality motor skills.

Key words*: canonical correlation analysis, motoric, athletes, competitive success*

Introduction

In a group of sports that are characterized with a polystructural acyclic movements belongs the wrestling too, with elements that are very complex. The very same elements are performed in different stages of the fight (Kajčevski & Kostovski, 2004). The successful performance of specific techniques used during the competitive struggle depends on many factors and dimensions (Cvetković, Marić & Marelić, 2005). The number of technical elements and various variants is very large in which they can perform, also there are countless varieties that are performed with the aim to implement wrestling tactics, makes the wrestling in the ranks of sports where apart of the motor and functional skills are also relevant and the cognitive and conative traits (Bojović, 1983). It is a fact that in one particular fight a single situation is never repeated twice in the same way, athletes are forced to reorganize learned stereotypes of motion in a short period, depending on whether they are in the phase is attack or defense. In the wrestling training program is added a great attention to the development of anthropological characteristics in accordance with their specific preparation (power, speed, coordination, balance and flexibility). Although these are probably the most important skills for success in wrestling, it is hard to calculate their independent effect on the very success. In fact, some of these skills are different at wrestlers who belong to different weight and age categories.

Problem and aim

The problem researched in this work is to determine the canonical connection between the battery of tests for assessing motor skills (17 variables) and a battery of tests for assessing the competitive effectiveness (5 variables) of wrestlers, with the primary aim to determine their mutual relations. That is, as a specific objective of this study is to determine how to adjust the training to the wrestler's training opportunities, in order to achieve a more efficient success and overall progress of athletes. From the already placed object and problem of this research, can be also set and one hypothesis that could be moved in the direction, expecting positive canonical connections of these two areas.

Methods

Sample of respondents
The sample of respondents in this study was 103 wrestlers from the active sport wrestling clubs of Kosovo. In the period of taking measurements the subjects were healthy, regularly trained and were without significant morphological, motor and physiological aberrations. The measurements of motor variables, for the purposes of this study were conducted before the happening of the state championship in December 2010, and the battery of tests for competitive efficiency was ensured from the very championship. To get real data the study was conducted in the halls in which the sportsmen train and during regular training. Results were analyzed by the package Statistica 6.0.

Sample of variables
For the assessment of wrestler's motor abilities, was applied the following battery of tests: Variables for assessment the explosive power /standing long jump (MSDS), hurling a medical ball from lying position (MBML), hurling a medical ball (MBMU)/, Variables for coordination assessment /agility in the air (MOZR), drumming by feet and hands (MBRN), figure-eight with bending (M8SA), agility on the

floor (MOTL)/, Variables for estimation of the speed movement frequency /hand-tapping (MTAR), foot-tapping (MTAN)/, Variables for flexibility assessment /a deep bent (MDPR), flexibility with a stick (MISP)/, Variables for repetitive strength evaluation /lifting the trunk in a shelter (MDTZ), push-ups (MSKL), chinning (MZGV), raising the trunk from sitting (MPTS)/, Variables for balance assessment /standing along on one leg with open eyes (MSJN), transverse standing on two legs, with open eyes (MSDN)/, For estimation of the competitive wrestler efficiency, were applied the following battery tests /The official competitive success (TEOU), Cumulative points won in the competition (TEOP), Victory by touchdown (TEBT), Points gained as five points (TEB5), Points gained as three points (TEB3)/. With the aim of establishing relations between the two different batteries of manifest motor skills variables, and competitive success of the wrestlers was applied the canonical correlation analysis. The aim of these statistical methods is the formation of linear combinations in the set of independent variables, but in the way that inside these linear combinations there exists maximum correlation. Assuming that these two applied batteries of variables are linearly connected, first was performed interpretation of the cross-correlation matrix, then by Bartlett's test was tested the statistical significance of canonical correlation coefficients.

Results and discussion

In Table 1, were shown the results of basic descriptive motor skills' parameters , where it is clearly evident that in the applied distributive variables are generally symmetrical, because their value does not exceed values greater than 1.00, except for motor variables: Eight-figure by bending (MOSS 1.41), agility on the ground (MONT 1.49), hand-tapping (MTAR 1.62), push-ups (MSKL 1.04), and standing along on one leg (MSJN .1.32), from a total number of 17 motor variables, 15 of them have a positive asymmetry, while 2 have a negative asymmetry.

Table 1. Descriptive parameters (basic motor skills)

	Mean	Min	Max	SD	Skew	Kurt
MSDS	2.29	1.8	2.72	0.13	-0.51	2.28
MBML	6.18	3	9.8	1.35	0.14	-0.53
MBMU	5.73	2.7	9.7	1.42	0.40	-0.06
MOZR	5.16	3.31	7	0.85	0.14	-0.23
MBNR	10.40	5	17	2.52	0.15	-0.04
MOSS	19.37	15	26.3	1.33	1.14	8.34
MONT	10.90	0	22	2.45	1.50	11.73
MTAR	35.37	28	60	6.21	1.62	3.27
MTAN	30.40	20	41	4.23	0.60	0.08
MDPR	9.74	1	23	5.13	0.79	0.15
MISP	90.43	58	117	12.44	-0.35	-0.35
MDTZ	25.70	5	60	14.42	0.86	-0.46
MSKL	26.17	10	75	11.43	1.05	1.87
MZGV	10.93	1	22	5.10	0.41	-0.75
MPTS	22.92	15	35	5.44	0.41	-0.97
MSJN	44.66	4	120	29.04	1.33	1.41
MSDN	33.30	4	90	21.17	0.97	0.52

In Table 2 were presented the results of basic descriptive parameters of successful competitive wrestler, where was noted that at the applied variables ,the distributions were asymmetric, because their values exceeded values greater than 1.00, and all have a positive asymmetry.

Table 2. Basic descriptive parameters of successful competitive wrestler.

	Mean	Min	Max	SD	Skew	Kurt
TEOU	5.13	1	17	3.96	1.15	1.14
TEOP	5.31	0	20	4.37	1.03	5.94
TEBT	0.32	0	3	0.64	2.04	3.61
TEB5	0.04	0	2	0.24	6.79	4.92
TEB3	0.45	0	3	0.80	1.58	1.22

From the analysis of the cross-correlation matrix between the structure of motor skills and the structure of variables belonging to the competitive effectiveness of the wrestler (Table 3), can be observed that the highest coefficients and statistically significant correlations with the competitive wrestler's success have tests: lifting the trunk in a shelter (MDTZ .70) and pushups (MPTS. 66) and the lowest coefficients and statistically significant correlations with the variables of competitive wrestler's success have the eight-figure tests with bending (MOSS .19) and hurling a medical ball from lying position (MBML .19). In this study, as well as in the second (Marić, 1982; Jozić, 2002; Shala, 2008), was obtained an average connection of motor variables and the competitive success of the wrestler, the cross-correlation coefficients between the variables motor skills and variables of competitive wrestler's success are ranged in the values from .19 to .70.

Table 3. Cross-correlation motor skills and competitive efficiency of the wrestler

	TEOU	TEOP	TEBT	TEB5	TEB3
MSDS	-0.22	0.35	0.36	0.29	0.32
MBML	-0.14	0.18	0.15	0.19	0.20
MBMU	-0.15	0.20	0.20	0.26	0.24
MOZR	0.15	-0.36	-0.26	-0.32	-0.35
MBNR	-0.16	0.46	0.35	0.35	0.45
MOSS	0.19	-0.41	-0.36	-0.29	-0.43
MONT	-0.08	-0.03	-0.05	-0.12	-0.01
MTAR	-0.30	0.56	0.51	0.33	0.54
MTAN	-0.28	0.51	0.44	0.32	0.49
MDPR	-0.28	0.45	0.43	0.27	0.30
MISP	0.39	-0.59	-0.48	-0.28	-0.51
MDTZ	-0.60	0.70	0.60	0.35	0.69
MSKL	-0.60	0.66	0.58	0.14	0.44
MZGV	-0.47	0.62	0.46	0.26	0.56
MPTS	-0.64	0.63	0.49	0.13	0.51
MSJN	-0.20	0.35	0.25	0.13	0.36
MSDN	-0.20	0.32	0.26	0.22	0.35

Significance = p (.05)=.19; p (.01)=.24.

In determining the relations between the structure of motor skills variables, and the structure of competitive success of a wrestler (Table 4), using Bartlett's Hi-square test ($\chi 2$), was found that at the wrestler there was a statistically significant correlation of the two pairs of canonical factors.

In the first pair at the level of (p =.000) the canonical correlation is (Rc =.86), and at the second pair at the level of (p =.00) the canonical correlation is (Rc =.65), indicating that this pair contains a significant percentage of the common variance of the first and second sets of variables in relation to the other pairs of canonical factors, that are not statistically significant and do not contain a significant amount of common variance.

Table 4. Significance of canonical correlation

Canonical – R Cr	R-sqr Cr-sqr	Canonicl Chi-sqr.	df	p	Lambda prime λ
0.86	0.74	220.61	85	0.00	0.09
0.65	0.43	97.02	64	0.00	0.34
0.49	0.24	46.90	45	0.39	0.60
0.40	0.16	21.84	28	0.79	0.79
0.26	0.07	6.32	13	0.93	0.93

(Rc = canonical correlation, Rc2 = coefficient of determination, Hi-square test χ2, p = statistical significance, λ = lambda).

Analyzing the calculated matrix of canonical structure factors in the variables' space of the wrestler's motor skills (Table 5), it is clear that the structure of the first canonical factor is composed of all motor variables, especially motor variables for evaluation of the repetitive strength: lifting the trunk in a shelter (MDTZ .86), push-ups (MSKL .82), raising the trunk from sitting (MPTS .81), chinning (MZGV .64), motor variables for assessment the flexibility - flexibility with a stick (MISP -. 73), variables for assessment of coordination: agility in the air (MOZR - .87), drumming his legs and hands (MBNR .86), figure-eight with bending (MOSS-.63), variables for assessment of the explosive power, hurling a medical ball from lying position (MBML .76), hurling a medical ball (MBMU .74), standing long jump (MSDS .59), variables for estimation the speed frequency of the movement, foot-tapping (MTAN .71), and hand-tapping (MTAR .70), variables for assessing balance, standing along on one leg with open eyes (MSJN .64), transverse standing on two legs with open eyes (MSDN .56), so that it was interpreted as an integral general canonical motor factor.

In the space of variables competitive wrestler's efficiency (Table 6) the first canonical factor is interpreted as the wrestler's factor of success, given that its structure consists of all variables applied for the wrestler's competitive efficiency; the official summary points at the competition (TEOP .86), points for three points (TEB3 .73), the victory by touchdown (TEBT .72), the official competitive successfulness (TEOU .71), and points for five points (TEB5 .33), so that it was interpreted as a canonical factor for the wrestler's competitive success. As for the second canonical factors the wrestler's variables of competitive success there is no statistically significant correlation and due to the poor information variables' value, those cannot be defined nor interpreted.

The structural relations of canonical factors suggest that the wrestlers who have a greater co-ordination, larger explosive power, larger speed, frequency of movement and greater balance achieve better results in the wrestling competitions.

Table 5. Canonical structure of motor variables

Variables	Fc 1	Fc 2
MSDS	0.59	0.22
MBML	0.76	-0.04
MBMU	0.74	0.02
MOZR	-0.87	-0.10
MBNR	0.86	0.19
MOSS	-0.63	-0.22
MONT	-0.43	0.18
MTAR	0.70	0.46
MTAN	0.71	0.41
MDPR	0.46	0.42
MISP	-0.73	-0.11
MDTZ	0.86	0.05
MSKL	0.82	-0.05
MZGV	0.64	0.44
MPTS	0.81	0.04
MSJN	0.64	0.25
MSDN	0.56	0.24

Table 6. Structure of canonical factor in the area of wrestlers variables

	Fc 1	Fc 2
TEOU	-0.71	-0.07
TEOP	0.86	0.29
TEBT	0.72	0.26
TEB5	0.33	0.31
TEB3	0.73	0.32

Conclusion

Relations between the motor space variables and space variables of competitive wrestler efficiency were determined using Hotelling's canonical correlation analysis, the significance of canonical correlation coefficients was tested by the Bartlet's χ2 test at the level of significance (p=.00). The canonical analysis indicated on a high correlation between motor variables and the variables of competitive wrestler success that can be seen through two significant pairs of canonical factors. The first pair of canonical factors extracted 86% of the common variance and 74% of variance from these sets of variables. The other statistically significant pair of canonical factors extracted 65% of the common variance and explained 43% variance of these sets of variables. The structure of the first canonical factor make all motor variables, especially variables: agility in the air (MOZR -. 87), drumming by legs and hands (MBNR .86), lifting the trunk in a shelter (MDTZ .86), push-ups (MSKL .82), raising trunk from sitting (MPTS .81), hurling a medical ball from lying position (MBML .76), hurling a medical ball (MBMU .74), with a flexibility with a stick (MISP -. 73), foot-tapping (MTAN .71), and hand-tapping (MTAR .70), chinning (MZGV .64), standing along on one leg with open eyes (MSJN .64), figure-eight with bending (MOSS-.63), standing long jump (MSDS.59), transverse standing

on two legs with open eyes (MSDN .56), so that it is interpreted as an integral general canonical motor factor. The structure of the second canonical factor in the variables' space of the wrestler's competitive success is mostly comprised of the following variables: cumulative points won in the competition (TEOP .86), points for three points (TEB3 .73), the victory by touchdown (TEBT .72), the official competitors' success (TEOU -. 71), and points for five points (TEB5 .32). High values of canonical correlation between the two areas, the variables are realistic given the choice of the variables themselves, and the way of realization of the training process with a high level of the wrestler's motivation. The general motor canonical factor, as well as the competitive factor of the wrestler's success, show that the wrestler who has a larger quantity of explosive and repetitive power, with a greater speed frequency of movements, coordination, flexibility and balance, have better results in wrestling competitions. The results of this study will enable optimal usage of motor tests for monitoring training effects and for better planning and programming of the training.

Literature

Bojović, S. (1983). *Rvanje slobodnim stilom*. Beograd: Sportska knjiga.

Findak, V., Metikoš, D., Mraković, M., & Neljak, B. (1996.). *Primijenjena kineziologija u školstvu/Norme*. Zagreb: Hrvatski pedagoško-književni zbor.

Jozić, M. (2002.). Relacije između morfoloških karakteristika i motoričkih sposobnosti učenika 5. i 6. razreda. *Rovinj. Zbornik radova 11. ljetne škole kineziologa RH.* Zagreb: HKS.

Kajčevski, A., & Kostovski, Ž. (2004). *Borenje*. Skopje: Pakung.

Malacko, J. (2002). Relations of coordination, morphological characteristics and motor abilities. *U D.Milanović, F.Prot (Ur.), Proceedings Book of 2rd International scientific conference "Kinesiology for the 21st century", Zagreb, 1999*, (pp. 291-295), Zagreb: Faculty of Kinesiology.

Marić, J. (1982). *Utjecaj antropometrijskih i motoričkih dimenzija na rezultate u rvanju klasičnim načinom*. /Dissertation/, Zagreb: Fakultet za fizičku kulturu.

Mikić, B., Shala, S., Goletić, E., & Kamberi, H. (2008). Relacije kognitivnih sposobnosti i situaciono-motoričkih testova kod rvača. *Sportski logos*, 10-11, 8-10.

Shala. S., Mikić, B., & Mehinović, J. (2008). Uticaj bazično-motoričkih sposobnosti na uspješnost izvođenja situaciono-motoričkih sposobnosti rvača. *Sportski logos, 10-11*, 19-23.

Viskić-Štalec, N., & Mejovšek, M. (1975). Kanoničke relacije prostora koordinacije i prostora motorike. *Kineziologija, 5*(1-2), 83-112.

RELACIJE IZMEĐU MOTORIČKIH SPOSOBNOSTI I NATJECATELJSKE UČINKOVITOSTI HRVAČA

Sažetak

U ovom istraživanju primjenjena je baterija od ukupno 22 testa, na uzorku od 103 hrvača, od čega je bilo 17 testova procjene motoričkih sposobnosti i 5 procjene natjecateljske učinkovitosti hrvača. Istraživanje je ciljano da utvrdi temeljne zajedničke relacije ova dva seta varijabli. Analizom rezultata dobivenih kanoničkom korelacijskom analizom, pokazalo se da prvi kanonički faktor može biti interpretiran kao generalno mototrički factor temeljno strukturiran na natjecateljskoj učinkovitosti hrvača, tj. moglo bi se reći da se radi o hrvačevoj natjecateljskoj učinkovitosti. Ovakve relacije kanoničke faktorske strukture sugeriraju da hrvači s takvim motoričkim sposobnostima postižu jako dobre rezultate na natjecanju, što u potpunosti potvrđuje hipotezu o pozitivnoj povezanosti ova dva prostora. Temeljeno na dobivenim rezultatima istraživanja, može se zaključiti da su za dobre rezultate i uspješnu natjecateljsku učinkovitost u hrvanju potrebne neke nužne kvalitete motoričkih sposobnosti.

***Ključne riječi**: kanonička korelacijska analiza, motorika, sportaši, natjecateljski uspjeh*

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