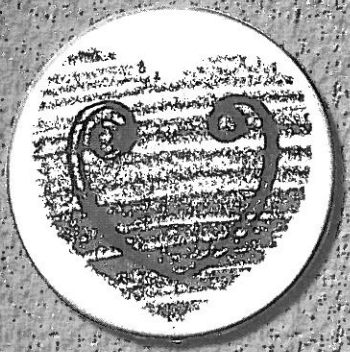

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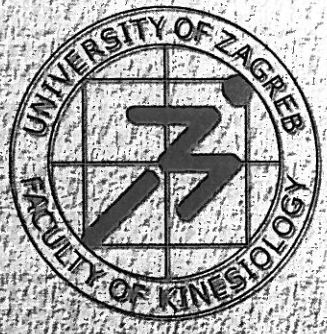

CONSTRUCTION AND VALIDITY OF THE NEW TEST FOR EVALUATION OF FLEXIBILITY AND VELOCITY OF WRESTLERS' MOVEMENTS

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Abstract

Within the scope of this research a specific sample of subjects consisting of 30 attenders of wrestling training in a wrestling club in Zagreb was measured. The subjects are aged 13±1 and their wrestling experience is approximately equal. The aim of this paper was to determine metric characteristics of a measure instrument for which it is assumed to be serving for the evaluation of the flexibility and velocity of movement. The research showed high reliability of the test according to the classic and Guttman and Harris's measuring model. The normality of distribution of the test result is confirmed with the Kolmogorov-Smirnov test, although a slight positive asymmetry and mild elongation of distribution was noticed. With the factual analysis of the tests according to the Guttman-Kaiser criterion of extraction, we were given a common factor with very high correlation of variable and the factor, and this determined the factual validity of the newly designed test. This confirmed that the test evaluates dimensions defined as specific flexibility and velocity of movements considering it is statistically significantly correlated with the tests that evaluate the above mentioned motor abilities.

Key words: *Greco – Roman wrestling, motor abilities, seniors*

Introduction

By the term flexibility we understand the production of a movement with the maximum amplitude in a joint or a series of joints involved in the movement. It is not justified to talk about a general level of flexibility of the locomotor system, but it has to be said that the flexibility is characteristic of a joint or a group of joints. Whereas in some sports it is important to achieve high level of flexibility, in other sports these demands are not so noticeable. In wrestling, the flexibility of the spine, of the shoulder blade and of the pelvic bones is the most important. The velocity is the ability to react quickly or to produce one or more movements, which can be seen in surmounting the longest possible path in the shortest possible time. In wrestling, all forms of velocity are of the utmost importance, and especially the frequency of movement (i. e. fast production of more connected simple or complicated movements).

The construction of the tests is a complex kinesiometric procedure and as such demands a fulfillment of certain kinesiometric characteristics, like validity, reliability, sensitivity and objectivity. Given the fact that the sportspersons who are active in wrestling find the test simple to perform (because these and similar forms of movement are practiced at every training), it is believed that the test would confirm all of its metric characteristics. Such a test will definitely be used in the analysis of wrestlers' conditioning readiness. A test of a similar kind has been included in one of the most famous sets of tests for older advanced wrestlers (Starosta & Tracewski, 1981; 1998).

Methods

The aim of this paper is to construct and validate i. e. to establish the metric characteristics of a measure instrument. The construction is started with the assumption that the instrument serves to evaluate the manifestation of the flexibility and the velocity of movement. Within the scope of a pilot research a sample of subjects consisting of 30 attenders of wrestling trainings of a wrestling club in Zagreb has been measured. The subjects are aged 13±1 and their wrestling experience is approximately equal. The sample of variables consists of standardized measure instruments of known metric characteristics for the evaluation of flexibility and velocity of movement:

1. Pirouettes in 30 seconds (PIRUET30) – a test to evaluate the specific flexibility and the velocity of movement
2. Semipirouettes(PIRPAR) – a test to evaluate the specific flexibility and the velocity of movement
3. Strive- running around the head (SESTARENJE) – a test to evaluate the specific flexibility and the velocity of movement

Metric characteristics in the first two tests were verified by Marić, J. et al. and the third test was verified by Starosta, W et al. (2005). During the construction of the new measure instrument it was assumed that it would also evaluate the flexibility and the velocity of movement. The new measure instrument was named *Semistrive* (*POLSES*).

Description of the new measure instrument

Semistrive (POLSES) – a test to evaluate the specific flexibility and the velocity of movement.

Description of the test:

The test semistrive serves to evaluate the specific flexibility and the velocity of movement that can be seen in wr and which is based on the ability to pass from the front walkover to the back walkover and vice-versa. Flexib velocity of this kind are of great importance in wrestling.

Description of the place where the exercise is performed: the exercise is performed in a wrestling gym on a wr mat.

Exercise: the subject takes the initial position "the front walkover" – the position in which the subject has turn chests towards the mat, leaning against the mat on the balls of his toes, his forehead and palms of his hands, in w process he is holding both his feet on the other side of the line that has been drawn on the mat with a chalk.

Performing the exercise: on the mark "now" the subject begins the turning on the chosen side, but in a wa he only performs one passing from the front to the back walkover and then returns to the initial position of the walkover. After that he makes the same movement on the other side. The stop – watch is turned on at the moment o subject's crossing the line with his foot. The exercise is over when the subject performs six semi turnings (i. e. thr each side), at the moment of crossing the line with both feet. During the performance semi turnings are counted fo subject. The exercise is performed three times. Between each attempt the subject can take a break during which the o 3-4 subjects do the exercise.

Evaluation: time is recorded in one hundredth of a second of every of the three test particles.

Comment: the exercise is repeated if the prior performing does not count.

Duration: estimation of the total duration of the test for one subject is 4 minutes.

Number of examiners: 1

Aid: one stop – watch, one chalk

For the analysis of the reliability, three successive measurings (particles) in all the tests were conducted. All analyses were done with the help of the statistical system *Statistica*, version 7.1, (StatSoft, Inc., Tulsa, OK) and *Statistica*, version 5.0 expanded with the *RTT.stb* program that was written by Dizdar (Dizdar, 1999) and implemented into the program langua for multivariate data analysis, *STATISTICA BASIC*. The *RTT.stb* program enables the reliability of the composing measu instruments under the classic measuring model to be established and enables the reliability after the transformation of the results into Harris's and image metric to be established. The following features have been calculated: basic variab parameters, average correlation among the test particles, Cronbach-α, standardized α reliability coefficient, Cronbach- with the exclusion of a particular particle and reliability through the use of *RTT.stb* program.

Results

The descriptive indicators for all variables have been calculated, i. e. arithmetic mean (AS), minimum (MIN), maximum (MAX), standard deviation (SD) and the measures of elongation kurtosis (KURT) and asymmetry skewness (SKEW) of the result distribution.

Table 1. Descriptive indicators of all variables

	AS	MIN	MAX	SD	SKEW	KURT
PIRUET30	16,12	9,33	22,67	2,57	-0,05	1,38
PIRPAR	9,64	7,73	16,30	1,60	2,80	10,20
SESTARENJE	12,73	9,76	14,52	1,22	-0,53	-0,39
POLSES	7,00	5,82	8,72	0,63	0,85	1,20

Metric characteristics of the tests

Reliability according to classic measuring model

The average correlation between the test particles is 0,93. The analysis of reliability gave us the following coefficients: Cronbach α: 0,971 and standardized α: 0,973. Such high coefficients, almost 1, prove the high reliability of the *POLSES* test. The coefficient α data without including certain particles (Alpha without=Alpha bez) in the analysis, show that repeating the exercise three times is enough.

Table 2. Analysis of the reliability of the POLSES test (n=30)

	POLSES1	POLSES2	POLSES3	AS	SD	Alpha bez
POLSES1	1,00	0,89	0,91	7,02	0,68	0,979
POLSES2	0,89	1,00	0,97	7,00	0,67	0,949
POLSES3	0,91	0,97	1,00	6,98	0,60	0,944

Reliability according to Guttman and Harris's measuring model

Based on the matrix of the correlation between the particles, and with the classic measuring model, with the application of the RTT.stb program, the following reliability measures were calculated in this research:

RTT – calculated under the assumption that all the particles in the real object of measuring were equally included (Cronbach, Spearman-Brown).

Table 3. Coefficients of reliability, representative quality and homogeneity for the POLSES exercise (n=30)

RTT	ALPHA	ALPHA 1	ALPHA 2	LAMBDA 6	RH 1	RH 2
0,973	0,973	0,421	0,877	0,973	0,947	0,999
TAU	MSA	AVR	HOMI			
0,942	0,998	0,923	0,990			

When observing the table 3 we can conclude that slightly higher values of the RHO1 and RHO2 coefficient were achieved. When we consider lower and upper limits of reliability achieved within the two different measuring models, the predominance of Guttman's model is obvious, especially at the lower limit of reliability (RHO2). Momirović's homogeneity coefficient (HOM1) is predominant in the evaluation of homogeneity based on the average correlation of all.

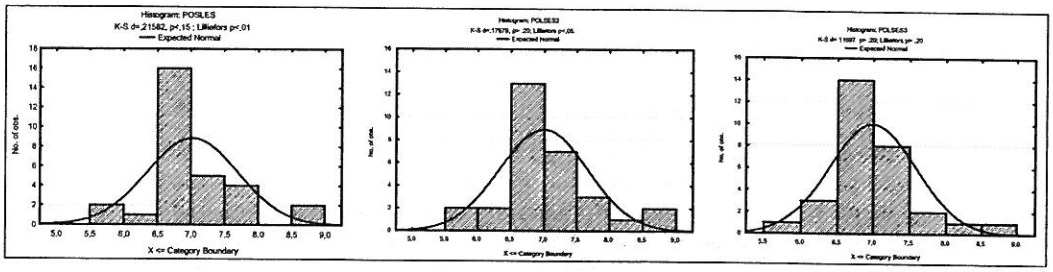
Homogeneity

We were given the following average correlation for the *POLSES* test: 0,93. High average correlation among the three repeated measurings is a proof of good homogeneity of the measure instrument in the test.

Sensitivity

Table 4. Descriptive parameters for the POLSES exercise (n=30)

POLSES	AS	MIN	MAX	SD	SKEWNESS	KURTOSIS
Measuring 1	7,02	5,76	8,80	0,68	0,87	1,36
Measuring 2	7,00	5,79	8,71	0,67	0,95	1,26
Measuring 3	6,98	5,92	8,64	0,60	0,75	1,08



Graph 1. Distribution of the results of the POLSES test in three measurings

In this research it is visible from graph 1 that the distribution is almost symmetrical. Slight positive asymmetry (skewness bigger than zero) is visible in every measuring. A slight leptokurtosis, elongation of distribution is also visible. But, Kolmogorov-Smirnov test showed that the distribution was normal (table 5).

Table 5. Test for determining the normality of the empirical distribution of the POLSES test

	max D	K-S
POLSES1	0,21	p > .20
POLSES2	0,18	p > .20
POLSES3	0,12	p > .20

Validity

With the matrix of cross-correlation of the results of the subjects condensed into the first main component in the *PIRUET30, PIRPAR, SESTARENJE and POLSES* tests, a statistically significant correlation between those tests (table 6) was recognized. With the factual analysis of the *PIRUET30, PIRPAR, SESTARENJE and POLSES* tests according to the Guttman-Kaiser criterion of extraction, a common factor with very high correlation of variables with the factor (table 7) was achieved. On the basis of all these results we can conclude that the *PIRUET30, PIRPAR, SESTARENJE and POLSES* tests measure the same dimension, and the *POLSES* test is a factually valid test.

Table 5. Matrix of cross-correlation of the results of the subjects condensed into the first main component in the PIRUET30, PIRPAR, SESTARENJE and POLSES (n=30) tests

	PIRUET30	PIRPAR	SESTARENJE	POLSES
PIRUET30	1,000	-0,823	-0,766	-0,808
PIRPAR	-0,823	1,000	0,575	0,739
SESTARENJE	-0,766	0,575	1,000	0,661
POLSES	-0,808	0,739	0,661	1,000

*correlations marked are statistically significant on the level of error p<0,05

Table 6. Matrix of factual structure, variant of the extracted factor (Expl.Var) and the proportion of the explained part of the variant (Prp.Totl)

	PIRUET30	PIRPAR	SESTARENJE	POLSES	Expl.Var	Prp.Totl
Factor 1	0,954	-0,880	-0,835	-0,900	3,193	0,798

Discussion and conclusions

Flexibility and velocity of movement, i. e. specific manifestation of these abilities through movement in the wrestling walkover is of great importance for success in wrestling. Construction and validity of a measure instrument for evaluation of specific flexibility and velocity of movement, shown in this research, determined the following: the test is highly reliable, therefore an error in measuring is small; the test is satisfyingly sensitive and factually valid. It really does evaluate dimensions defined as specific flexibility and velocity of movement, and it is statistically significantly correlated with the tests that evaluate the above mentioned motor abilities. With metric characteristics, it was established that the POLSES test can be used as a good instrument for the selection of subjects who are active in wrestling, which demands high level of flexibility and velocity of movement because it distinguishes the subjects according to these abilities. Since this was a pilot research, a surprisingly good sensitivity, homogeneity and reliability of the instrument was achieved, that can significantly improve in the continuation of the research.

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