EVALUATION OF THE RESULTS ASSESING MOTOR ABILITIES OF BOYS AND GIRLS AGED 11-14 DURING SELECTION IN ROWING

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Summary
The goal of this work was to confirm whether or not the chosen form of tests for evaluation of motor skills can be an indicator for the purpose of selection of children in rowing.. The test sample was made up of 266 boys and 170 girls aged 11 to 14. The testees were examined by the tests for evaluation of motor abilities as follows: *the speed of movement frequency (MTR), initial burst of strength (MSD), coordination (MTR), repetitive strength (MPT15s), flexibility (MPR), static strength (MIV) and also by the test for evaluation of specific abilities when the rowing ergometer Concept II was used at the distance of 500 meters simulating perfectly the conditions of rowing on water. It was confirmed that explosive strength, flexibility and coordination were the most important factors predicting the success of the boys when using the ergometer at a distance of 500 meters, while for the girls, the most important factors were flexibility, explosive strength, speed and repetitive strength. Among the boys, the multiple correlation coefficient was 0,50 while among the girls, it was 0,53, with a statistically significant error of p< 0,00. The joint variability of the predictable variables and criteria among the boys was 0,25 while among the girls, it was 0,28. The largest correlation coefficient with criteria was evident for the male students in the tests of explosive strength (MSD) with the value of -0,25, whereas the same, for the female sample, was flexibility (MPR), with a value of -0,32. The results show that by using selection, we can include the motor-skill testing used in the education system of primary schools, keeping in mind the importance of the testing difference between male and female.*

Key words: *rowing, motor and functional abilities, selection, rowing ergo meter*

Introduction
Selection in rowing means an optimal choice, direction and improvement of a potential rower. Selection requires knowledge and skills to collect information about a candidate, as well as the recognition of the most specific and the safest methods for detection and objectification of the required features and abilities together with the prediction of their definite range (Bompa 2000). As late as 1978, Žeželj emphasized that it is very difficult to make selection to choose talented candidates (rowers) because they are, in their mutual connection, connected with the apparatus (boat), and also because it is a team sport and for that reason it is very difficult to monitor the work of an individual and objectively evaluate his progress. The evaluation should include all the skills and features (Lanc, 1986, Šentija, 1998, Yves et al, 1999) which will be of help in diagnostics in regard to the equation for specification of rowing.

Aim
The aim of this research was to determine if motor abilities at children aged 11 to 14 years that were checked by motor tests: the speed of movement frequency, explosive strength, coordination, repetitive strength, flexibility and static strength. Those abilities can be an important indicators at selection process in rowing.

Methods
The sample was consisted of 266 male pupils and 170 female pupils aged 11 to 14 /Table 1) from three primary schools at the territory of Zagreb („Alojzije Stepinac", „Bartol Kašić I" and „Ivan Meštrović).

Table 1. Number of male and female pupils according to age

Boys age	N	Girls age	N
11	78	11	42
12	78	12	49
13	65	13	46
14	45	14	33
Total	266	Total	170

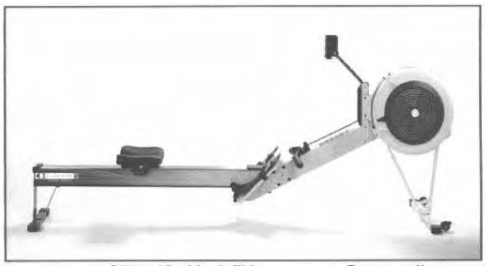
The sample of predictor variables consisted of 6 tests (Table 2.): the speed of movement frequency (MTR – hand tapping), explosive strength (MSD –standing long jump), coordination (MPN –testing range backward), repetitive strength (MPT15s – lifting body in 15 seconds), flexibility (MPR – touch-toe with legs apart) and static strength (MIV –standing pull-up).

Table 2. The list of variables with their purpose and unit of measurement

Variable	Description of variable	Purpose	Unit
MTR	Hand tapping	Movement speed	Iteration
MSD	Standing long jump	Explosive strength	Cm
MPN	Testing range backward	Coordination	Sec.
MPT15	Lifting body	Repetitive strength	Iteration
MPR	Touch-toe with legs apart	Flexibility	Cm
MIV	Standing pull-up	Static power	Sec.
E500	Results at ergometer – 500m	Stamina	Sec.

The results that children acquired on rowing ergo meter Concept II (picture 1) with the maximal test at the distance of 500m were used as the criterion variable. Concept II gives opportunity for a true simulation of the burden in a boat, together with a continuous monitoring of the data on burden (expressed in Watts, m/s or Kal/h), frequency of strokes and mechanical work realized (in meters and joules) for each of the particular strokes and also for the total duration of mechanical work.

Picture 1. Rowing ergo meter Concept II



The results obtained in this research were computer processed with a standard program for analysis of metrical features, under the model of internal consistency, contained in the program Statistics for Windows Version 5.0. The standard descriptive indicators were calculated for all of the variables (arithmetic mean and standard deviation, minimal and maximal value). In the further processing, the data were processed by multiple regression analysis separately for boys and girls.

Results

As it can be seen from the numerical readings in the Table 3, it was confirmed by Kolmogorov and Smirnov's method that the distribution of data referring to the children aged 11-14 showed a normal distribution with an error of 0,05 (nonselected population). After the normal results distribution was confirmed, the standard descriptive parameters were calculated. The results of descriptive statistics were more realistically presented in the Table 1 and the Table 2.

The influence of motor variables on the success in results on the rowing ergo meter Concept II at the distance of 500 meters was determined by multiple regression analysis.

Table 3. Basic statistical parameters for the testees aged 11-14

Variable	N	Mean	Min	Max	St.dev.	N	Mean	Min	Max	St.dev.
	Boys aged 11.					Girls aged 11.				
MTR	78	31.12	20.0	55.0	7.64	42	32.17	25.00	40.00	4.01
MSD	78	161.86	110.0	202.0	19.48	42	155.31	105.00	207.00	22.64
MPN	78	12.66	7.0	23.5	3.26	42	12.79	8.00	22.00	3.04
MPT15	78	16.99	10.0	32.0	4.21	42	23.55	11.00	44.00	11.80
MPR	78	56.76	30.0	94.0	11.79	42	58.40	39.00	90.00	11.69
MIV	78	45.64	10.0	118.0	22.51	42	34.90	7.00	63.00	17.05
E500	78	147.99	126.0	185.4	11.28	42	152.82	132.30	186.50	13.00
	Boys aged 12.					Girls aged 12.				
MTR	78	34.33	24.0	49.0	5.36	49	34.59	27.00	48.00	3.65
MSD	78	171.60	120.0	220.0	22.13	49	162.06	120.00	193.00	18.28
MPN	78	10.66	6.6	20.0	2.54	49	12.14	7.80	24.10	3.45
MPT15	78	17.38	9.0	30.0	4.78	49	26.49	11.00	49.00	12.03
MPR	78	60.53	36.0	84.0	11.60	49	62.41	46.00	83.00	9.88
MIV	78	56.65	10.0	127.0	27.81	49	42.11	6.00	90.00	24.89
E500	78	141.73	197.6	187.8	13.81	49	147.54	120.20	175.70	12.37
	Boys aged 13.					Girls aged 13.				
MTR	65	35.97	25.0	51.0	5.72	46	36.54	25.00	50.00	4.87
MSD	65	184.55	130.0	236.0	22.60	46	170.10	124.00	206.00	21.56
MPN	65	10.33	5.9	18.1	2.74	46	11.91	5.90	21.00	3.60
MPT15	65	17.77	11.0	32.0	4.37	46	29.30	12.00	49.00	11.42
MPR	65	63.08	35.0	69.0	10.71	46	63.07	30.00	94.00	14.03
MIV	65	54.28	10.0	149.0	26.30	46	46.11	8.00	133.80	26.79
E500	65	133.92	112.2	211.8	16.12	46	139.10	118.10	167.20	10.55
	Boys aged 14.					Girls aged 14.				
MTR	45	36.58	27.0	45.0	3.78	33	37.82	31.00	45.00	3.30
MSD	45	195.56	150.0	250.0	21.52	33	172.30	141.00	207.00	17.84
MPN	45	9.26	5.6	12.1	1.95	33	10.27	7.20	18.30	2.46
MPT15	45	20.89	12.0	30.0	4.94	33	28.33	14.00	59.00	15.29
MPR	45	66.64	32.0	90.0	14.75	33	68.55	45.00	94.00	12.30
MIV	45	64.02	10.0	124.0	33.30	33	44.25	12.00	86.00	20.54
E500	45	121.54	97.5	175.5	15.80	33	137.60	122.90	155.20	9.37

Table 4. The results of regression analysis with boys

	Beta	St.err.	B	St.err.	p-level	Rank
Intercpt			185.08	11.28		
MTR	0.01	0.06	0.03	0.16	0.83	6
MSD	-0.25	0.07	-0.17	0.05	0.00	1
MPN	0.15	0.06	0.85	0.36	0.02	3
MPT15	-0.10	0.06	-0.36	0.23	0.12	5
MPR	-0.22	0.06	-0.29	0.09	0.00	2
MIV	-0.10	0.06	-0.06	0.03	0.09	4

(R – multiple correlation = 0.50, R2 – coefficient of determination of multiple correlation = 0.25, BETA – standardized partial regression coefficient, B – unstandardized partial regression coefficient, p- the level of significance, St.Err – standard error, RANK – ranking variables in regard to the calculated values)

The regression analysis results were presented in the Table 4. , so it can be concluded that a set of predictor variables have statistically important part of participation in prediction of results, with the error of $p< 0,00$. The coefficient of multiple correlation is 0, 50 and the proportion of the common variability of the set consisted of predictors and the criterion (R^2 - coefficient of determination of the multiple correlation) is 0, 25.

It means that it is possible, with only 25 %, to explain the criterion variable, in other words, to predict a successful result on ergo meter (E500).

Table 5. Results of regression analysis with girls

	Beta	St.err.	B	St.err.	p-	Range
Intercpt			218.27	13.63	0.00	
MTR	-	0.08	-0.64	0.22	0.00	3
MSD	-	0.09	-0.14	0.05	0.01	2
MPN	-	0.09	-0.19	0.36	0.60	6
MPT15	-	0.09	-0.22	0.09	0.01	4
MPR	-	0.09	-0.34	0.10	0.01	1
MIV	0.05	0.08	0.03	0.05	0.55	5

(R – multiple correlation = 0.53, R2 – coefficient of determination of multiple correlation = 0.28, BETA – standardized partial regression coefficient, B – unstandardized partial regression coefficient, p- the level of significance, St.Err – standard error, RANK – ranking variables in regard to the calculated values)

The regression analysis results for girls were presented in the Table 5. The set of predictor variables have statistically important part of participation in prediction of results, with the error of $p< 0,00$. The coefficient of multiple correlation (R) is 0,53 and the proportion of the common variability of the set consisted of predictors and the criterion (R^2 - coefficient of determination of the multiple correlation) 0,28., which means that with only 28%, it is possible to explain the criterion variable, in other words, to predict a successful result on rowing ergo meter (E500).

Based on the measures of the standardized partial regression coefficients (BETA), the variables having the strongest influence were defined in the same way as with boys.

Discussion and conclusion

It can be seen from the Table 3. that the motor abilities of children from all of the three primary schools were improved from year to year, except in static strength (MIV- standing pull-up) where a significant decrease in that ability was noted in the age 13 with boys and 14 with girls. One of the reasons for such a kind of situation is an abrupt growth in height and increase in ballast and muscle mass. The mentioned differences can be more realistically seen in the Table 1 and 2. The variables that had the greatest influence on criterion were determined on the basis of the values of standardized partial regression coefficients (BETA). The biggest partial regression coefficient (BETA) was given by explosive strength (MSD – standing long jump) with 0, 25, then by flexibility (MPR – touch-toe with legs apart) with -0,22 and coordination (MPN - testing range backward) with the value of 0,15.

It can be concluded that the testees' results in three predictor variables that were identified as explosive strength, flexibility and coordination turned to be good predictors for selection of children in rowing, in other words, in prediction of results on rowing ergo meter (E500). In the Table 4. it is visible that the variables MSD and MPR were incomplete , negative, due to the fact that the results with criterion variable were scaled negative. In most cases, the higher results of the mentioned variables match the lower (better) results on rowing ergo meter, in other words, the boys and girls having better results in the tests of standing long jump and touch-toe with legs apart acquired also better results on rowing ergo meter. The same can be said about the predictor variable MPN (testing range backward), which had both of its variables results scaled negative. The Table 5. shows that the biggest partial and statistically significant influence on criterion with girls was given by the predictor variables MPR with – 0,32, MSD with -0,23, MTR and (MPT15s) with an equal coefficient of -0,22. So, it can be said that the results of the following motor abilities at girls showed statistically significant in the process of selection, that is, prediction of results on rowing ergo meter: flexibility, explosive strength, speed of movement frequency and repetitive strength.

Strength and stamina were defined as crucial factors the good result depends on (depending on the length of route and time period of competition duration) on the basis of specification equation in rowing. The shorter route, the factor of strength more important is whereas the longer route, the factor of stamina more important is. In our criterion, the main factor was strength regarding the fact that the criterion test was 500 meters, but in regard to the growth and development of children aged 11-14, it is concluded that a very big influence on criterion prediction was performed by stamina, too.

According to Körner and Schwanitz (1985), strength has a stronger influence on competition result at top female rowers (1000m) than at top male rowers (2000m), where aerobic ability of stamina is more important for the competition result. The relation between strength and stamina is considerably different and with females it amounts 80% and with males 70%, which can be seen in this research, in which explosive strength and repetitive strength with girls turned to be significant for prediction of results, in contrast to boys where the influence was performed only by explosive strength.

The results of regression analysis with boys (Table 4) and girls (Table 5) referring to explosive strength and flexibility turned to be statistically significant for prediction of results on rowing ergo meter at distance of 500 meters. Motor ability of coordination appeared to be also important in the sample consisted of boys. In regard to explosive and static strength, boys acquired better results than girls (check the motor tests MSD and MIV results).

Since the girls were weaker than boys, the factors which also had an influence on their results were movement frequency speed (MTR) and repetitive strength 15s (MPT15s). The result was that the girls had a higher frequency of strokes (speed) and on the basis of it, the repetitive strength had one of crucial roles for their results.

On the basis of results acquired by the sample consisting of 436 boys and girls, it can be concluded that the chosen tests for motor abilities turned to be statistically important for prediction of results in rowing at 500 meters. Using a few samples of regression analysis, it was confirmed that explosive strength, flexibility and coordination turned to be important for prediction of success on rowing ergo meter in the sample with boys whereas in the sample with girls, the following were found to be important: flexibility, explosive strength, movement frequency speed and repetitive strength, too (arranged by their rank position). The results showed that selection can cover motor abilities tests which were anyway applied in primary schools, including the differences in importance of tests for boys and girls. The age which is definitely best for selection in rowing is between 11 and 14 because that age is found to be perfect for various forms of development and recognition of talents in children. Changes which occur during that age indicate a different rise in the scope of particular abilities in regard to the age and sex, due to the impact of laws referring to growth and development. It is well known that there exist some remarkable differences in regard to the level of motor and functional abilities, which should be taken into particular consideration in a regular selection together with the factor of interest and motivation for rowing.

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VREDNOVANJE REZULTATA ZA PROCJENU MOTORIČKIH SPOSOBNOSTI DJECE 11. – 14 GODINA PRILIKOM SELEKCIJE U VESLANJU

Sažetak

Cilj istraživanja bio je utvrditi da li odabrani testovi motoričkih sposobnosti mogu biti važan indikator u svrhu selekcije djece u veslanju. Uzorak ispitanika sačinjen je od 266 dječaka i 170 djevojčica u dobi od 11 – 14 godina. Ispitanici su testirani testovima za procjenu motoričkih sposobnosti: brzine frekvencije pokreta, eksplozivne snage, koordinacije, repetitivne snage, fleksibilnosti, statičke snage, te testom za procjenu specifičnih sposobnosti na veslačkom ergometru Concept II na distanci od 500 metara koji simulira uvjete veslanja na vodi. Utvrđeno je da su kod dječaka eksplozivna snaga, fleksibilnost i koordinacija važni za prognozu uspjeha u veslanju na ergometru na distanci 500 metara, a kod djevojčica fleksibilnost, eksplozivna snaga, brzina frekvencije pokreta i repetitivna snaga. Kod dječaka je koeficijent multiple korelacije iznosio 0,50, a kod djevojčica 0,53 i statistički je značajan s pogreškom od p< 0,00. Zajednički varijabilitet prediktorskih varijabli i kriterija kod učenika iznosio je 0,05, a kod učenica 0,28. Najveći koeficijent korelacije s kriterijem pokazao se kod dječaka u testovima eksplozivne snage (-0,25), zatim fleksibilnosti kod djevojčica (-0,32). Rezultati pokazuju da selekcijom možemo obuhvatiti odabrane testove motoričkih sposobnosti koji se primjenjuju u osnovnim školama, uključujući razlike u važnosti testova između dječaka i djevojčica.

Ključne riječi: *veslanje, motoričke i funkcionalne sposobnosti, selekcija, veslački ergometar.*

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