PREDICTIVE CONTRIBUTION OF MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES ON THE RESULT OF RUNNING THE 60m HURDLES IN BOYS AGED 12-13 YEARS[1]

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Abstract

The subject of this study is to determine predictive contributions of morphological characteristics and motor abilities on the 60m hurdles, with an aim to form a group of easily applicable field tests so as to identify boys who are talented in hurdle racing. The subject sample of this study was comprised of 60 boys aged 12-13. The variable sample consisted of a 60m hurdles criterion variable and a set of 13 predictor variables comprising of morphological characteristics, speed - strength abilities and the subjects' coordination qualities. Applying the regression analysis, the predictive contribution of a complete variable set of morphological characteristics and motor abilities was determined as an above average statistical significance, influencing 60m hurdle outcome. The greatest individual statistically significant predictive contribution was achieved by the variables of speed-strength quality assessment: 20m flying start race result with a standing long jump; and only one variable from the field of morphological characteristics: the shin length. The results support the following conclusion: the two specific variables of speed-strength quality, and 20m flying start race results along with standing long jump, can be relevant predictors of successful outcome in hurdle races.

Key Words: Athletic hurdle running, identification and selection

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1. Introduction

Hurdles belong to the one of the most demanding athletics disciplines in terms of motor and technical skills characterised by cyclic, fast and powerful movement. The main problem in adopting the hurdling technique is clearing, i.e. running the hurdles in a stride pattern. Elite hurdlers should possess good flexibility, speed-strength athletic qualities, high -level of technical preparation and mental stability (Smajlović, 2010).

A great number of studies dealt with the problem of different factors contributing to the success of the hurdle race outcome (Čoh, 1988; Foreman, 1989; Gollhofer and Kyrolainen, 1991; Čoh, 2003; Likić and co-authors 2008; Čoh and co-authors, 2010). This and other relevant studies have demonstrated that the outcome success in hurdling depends on a wide range of different and extremely important anthropological characteristics and the quality of technical movement performance. Elite results in hurdle races require above average coordination, the sense for rhythm, speed, strengths, flexibility, strength endurance and a perfect movement technique.
In hurdling it is important to maintain a high level of track speed which should be effectively used during the hurdle clearing. Without strength, especially distinctive strength, success in hurdle races is inconceivable. Flexibility is of a great importance for an elite hurdle clearance technique, which is characterised by specific elasticity of muscle-connective tissue and an extreme flexibility in the joints between of thigh bones and pelvis.

2. Materials and Methods

The study sample consisted of 60 boys who were primary school children attending 6th grade, aged 12-13. Variable sample consisted of criterion variable of 60m hurdle races (T60MP) and a set of 13 predictor variables comprising of morphological characteristics – 5 variables: body height (AVT), body mass (AMT), leg length (ADN), shin length (ADP), foot length (ADS); motor abilities with evaluated speed-strength qualities – 5 variables : 20m flying start race (MT20L), standing long jump (MSDM), standing triple jump (MTROM), number of jumps per foot in 10m (MSJN10), sargent jump (MSVM); and coordination qualities – 3 variables: the time required to clear five hurdles (MKO5P), slalom like exercise with three medicine balls (MKOSM), stick coordination (MKOP).

Applying Mathematical Statistics programme SPSS 19, basic descriptive characteristics of variable distribution were obtained. Regression analysis was used for a multivariate analysis of acquired data, in which case the contribution of predictor variable was determined for the variables of morphological characteristics and motor abilities in relation to the specified 60m hurdle criterion variable.

3. Results

For a better insight into acquired study results, basic measurements of central tendency, variability and variable distribution for the assessment of morphological characteristics, speed-strength and coordination qualities have been demonstrated separately in tables 1 to 4. Results of the regression analyses have been displayed in table 5 and 6. Considering that the regression analysis of a complete set of predictor variables has been adjusted in relation to the criterion variable for 60m hurdle races, general contribution results of predictor variable group have been displayed in table 5, and the result of individual contribution of

morphological characteristics along with motor, speed-strength and coordination qualities are presented in table 6.

Table 1. Measurement of central tendency, variability and criterion variable distribution for 60m hurdle races

Variable	Range	Min.	Max.	AS	SD	Skew.	Kurt.
T60MP (s)	6.95	9.85	16.80	12.40	1.310	.609	1.040

Table 2. Measurements of central tendency, variability and variable distribution for the assessment of morphological characteristics

Variable	Range	Min.	Max.	AS	SD	Skew.	Kurt.
AMT (kg)	39.5	35.5	75.0	54.63	10.216	.049	-.845
AVT (cm)	43.0	142.0	185.0	163.18	9.005	.124	.034
ADN (cm)	31.3	82.7	114.0	97.89	6.177	.186	.269
ADP (cm)	13.2	41.8	55.0	49.56	3.215	-.433	-.610
ADS (cm)	4.2	24.3	28.5	26.13	.918	.734	.374

Table 3. Measurements of central tendency, variability and variable distribution for the assessment of speed-strength quality

Variable	Range	Min.	Max.	AS	SD	Skew.	Kurt.
MT20L (s)	1.53	2.65	4.18	3.26	.3107	.507	.840
MSDM (cm)	100	111	211	142.45	21.752	.773	.818
MTROM (cm)	234	310	544	419.85	49.389	-.105	.131
MSJN10 (no)	6	7	13	9.45	1.320	.478	-.227
MSVM (cm)	40	18	58	28.50	7.308	1.600	4.028

Table 4. Measurements of central tendency, variability and variable distribution for the assessment of coordination quality

Variable	Range	Min.	Max.	AS	SD	Skew.	Kurt.
MKOP5 (s)	11.43	12.33	23.76	17.77	2.730	-.066	-.524
MKOSM (s)	34.25	22.20	56.45	37.73	5.764	.440	1.158
MKOP (s)	8.23	3.37	11.60	6.55	1.703	.936	.821

Table 5. General predictive contribution of variable groups in morphological characteristics and motor abilities regarding the result criterion for 60m hurdle races

CRITERION VARIABLE T60MP				
R	R Square	Adjusted R Square	F	Sig.
.808[a]	**.652**	.554	6.635	.000

Table 6. Individual predictive contribution of variable groups in morphological characteristics and motor abilities regarding the result criterion for 60m hurdle races

CRITERION VARIABLE T60MP						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.899	5.219		1.705	.095
	AMT	-.010	.021	-.082	-.495	.623
	AVT	.138	.075	.947	1.827	.074
	ADN	-.041	.095	-.195	-.437	.665
	ADP	**-.209**	**.079**	**-.513**	**-2.632**	**.012**
	ADS	-.229	.192	-.160	-1.195	.238
	MKO5P	.072	.051	.150	1.420	.162
	MKOSM	.006	.026	.027	.239	.812
	MKOP	-.085	.096	-.111	-.886	.380
	MT20L	**1.607**	**.524**	**.381**	**3.067**	**.004**
	MSDM	**-.018**	**.008**	**-.295**	**-2.236**	**.030**
	MTROM	-.004	.003	-.135	-1.130	.265
	MSJN10	.083	.139	.084	.599	.552
	MSVM	-.033	.024	-.186	-1.392	.171

4. Discussion

With the analysis of central tendency measurement results, variability and criterion variable distribution (T60MP), average time which is required of boys to finish the 60m hurdle race was established. The height of hurdles was set at 40cm, and the time needed to clear the race was 12, 40 seconds, where it was stated that the results express week homogeneity.

With the analyses of central tendency measurement results, variability and variable distribution for assessment of morphological characteristics in boys aged 12-13, it has been established that they possess average values of longitudinal skeletal dimensionality : body height (AVT) 163,18 cm, body mass (AMT) 54,63 kg, leg length (ADN) 97,89 cm, shin length (ADP) 49,56 cm and foot length (ADS) 26,13 cm. High range values can be visible in the results of longitudinal skeletal dimensionality measurements, which confirm the previous study results that the increase in heights is non-linear, and that in the period between 12 and 13 years of age it is significantly faster (Kurelić and co-authors 1975).

With the analysis of central tendency measurement results, variability and variable distribution for assessment of speed-strength qualities in treated sample of boys aged 12-13 it has been established that the average standing long jump equals to (MSDM) 142,45 cm , with a considerable range of 100cm, taking into account the best (211 cm) and the worst (111 cm) result. This indicates the significant differences in explosive horizontal jumping strength amongst the sample subjects. That can come as a result of having one group of subjects with a very low and one group with very high explosive strength potential. Average result value of sargent jump (MSVM) was 28, 50 cm. In a triple standing jump, average value was estimated

at 4m and 19cm, with a significant range between the best and the worst score estimated at 2m and 34 cm, which supports the statement that there are significantly great differences in explosive strength among the studied sample of boys aged 12-13. Average 20m running time with flying start was estimated at 3, 26 seconds. While the average number of jumps in clearing the 10m race on one leg (better score) was 9, 45.

With the analysis of the acquired results in speed-strength quality, we can conclude that almost all the variables have a standard negative and positive result distribution.

Likewise during the analysis of central tendency measurement results, variability and variable distribution for assessment of coordination qualities in treated sample of boys aged 12-13, significant range in results for all three treated variables was established. Average variable value of time required to clear all five hurdles was calculated at 17, 77 seconds, and as such it confirms normal distribution criteria. Variable of slalom like exercise with three medicine balls (MKOP) – 37, 73 s and stick coordination variable – 6, 55 have proven to be complicated and too demanding during the testing.

Regression analysis results of 60m hurdle race outcome as a criterion analysis in regards to predictor variable from the field of morphological characteristics, coordination skills and speed-strength quality can be seen in table 5 and 6.

When analysing the values of multiple correlation and its significance, looking at it as predictive values within the system of predictor variables, it can be concluded that the high value of multiple correlation from .808 indicates that the system of predictors holds a statistically significant connection to the criterion variable. Predictor variable system explains up to 65% of criterion variability, while for the rest of criterion variable variability some other characteristics and skills are responsible, which are not a part of applied predictor system.

The highest statistical predictive value (p=.004) was assigned to time variable needed to clear 20m flying start race (MT20L).

This benefits the statement that boys with a maximum running speed, resulting from the length and frequency of stride, achieve better results in hurdle races. It is evident that the maximum speed is an excellent predictor of success in hurdle races.

This is a logical outcome since the maximum speed performance is based on takeoff power and increased stride frequency. These two parameters are important for efficient running before reaching the first hurdle and the distance running between the hurdles.

Next, regarding the predictive contribution to the regression formula, is the shin length variable (ADP). The level of significance is at .012, and this value has a negative characteristic considering that this variable is inversely scaled indicating that the lower values represent a better result. It can be concluded that boys with longer shin clear the hurdle race much easier, faster and more efficient. Despite the fact that only this variable was able to be used in the regression formula, it can be stated that regarding the high covariates of all morphological variables, this variable is a good representative of longitudinal dimensionality. For this reason we should not ignore other measurements in talented children, regarding the longitudinal dimensionality analysis, most importantly regarding body height and leg length.

Regression analysis contains a standing two foot jump variable (MSDM) with a statistical significance of .030. By all means this data is to be expected, and this motor test is a perfect example of speed-strength qualities which demonstrate explosive power of force performance in a very short time period. Muscle excitation intensity is used as a base for successful

outcome in hurdle races. Performance of this skill can be found in every running stride, especially in hurdle races where it is performed multiple times during the takeoff phase of attacking the hurdle.

It is interesting to note that none of the coordination quality variables have been listed in regression formula. Evidently we are dealing with tests that, regarding movement structure, are not in close correlation with the movement structures which are dominant in hurdle races. This is specifically related to tests-stick coordination (MKOP) and slalom like exercise with three medicine balls (MKOSM).

Possible answer may be that the height of the hurdle which is 40 cm is a special demand regarding coordination skills for this sample. All in all it would be a good idea to analyse predictive values in the follow up studies, taking into account treated variables in relation to different hurdle heights.

5. Conclusion

Results of this study have given us information relevant to important anthropological characteristics which should be taken into account during the selection and orientation of boys talented for hurdle races. In the interest of science and athletics, information regarding the accomplishments of boys aged 12-13 in 60m hurdle races (40m height) can be significant.

Above average statistical significance was established, regarding the importance of predictive contribution of variable group in morphological characteristics and motor abilities of the 60m hurdle outcomes. The biggest individual statistically significant predictive contribution was achieved by the variables for the speed-strength quality estimate: 20m flying start running results (MT20L), standing long jump (MSDM); and only one variable regarding the field of morphological characteristics: shin length (ADP).

The stated conclusions confirm that there is statistically significant cause-and-effect relationship, primarily in the speed-strength quality parameters and some morphological characteristics which have been assigned with longitudinal dimensionality. With the help of selected variables for the assessment of coordination quality in subjects of this study, general coordination qualities have been estimated, however they cannot be presented as good predictors of the hurdle race results.

This primarily indicates the necessity of choosing a significantly more specific test, which should be focused on a specific structure of hurdle races.

The results support the conclusion that the two distinct speed-strength quality variables, 20m flying start running result and standing long jump, can be relevant predictors of the successfulness in hurdle results and they can be used in forming a group of simple and applicable field tests, which could be used during regular anthropological measurements as a part of the school system.

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