THE IMPACT OF MORPHOLOGICAL AND MOTOR DIMENSIONS ON EXPLOSIVE STRENGTH OF BOYS AGED 11-12

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Original scientific paper

Summary
The sample of 97 boys aged 11 ± 6 months was applied to the system of 27 variables of which 3 were explosive strength variables (as the system of criteria variables), 12 morphological and 12 motor variables (as the system of predictor variables). The aim was to establish the impact of predictor variables on criteria variables. Relations between manifesting variables on some anthropological fields were processed by correlation matrix while the influence of the system of morphological and motor variables (as the system of predictor variables) on particular criteria variables of explosive strength was calculated by regressive analysis. Analysing intercorrelation matrix concerning particular anthropological fields relatively high and statistically significant variable correlations were got with the majority of applied variables. The results of regressive analysis showed that the predictor system of variables of morphological characteristics and motor abilities significantlly influences all particular criteria variables of explosive strength on the level of .00 (p=.00) except morphological variables of explosive strength of arms (p=.04). The conclusion is that morphological characteristics and motor abilities have great impact when explosive strength of boys of this age is involved.

Key words: *boys, morphological characteristics, motor abilities, relations, impact*

Introduction

The effectiveness of transformation af any human ability, as well as the widest range of that process, depends significantly on the structure and some other ability characteristics wished to be influenced so when analysing and practicaly interpreting some additional requirements and limitations are involved. Concerning transformation of explosive strength as motor quality or personality dimension it is suggested to firstly answer the question of definition of explosive strength, of its inner structure, how real it is to changed it and to what extent and what are its relations with other types of strength. (Malacko, & Rađo, 2004).

Scientonic literature most often defines the term strength as a human ability to master an external resistance or to oppose it by muscle strain. In fact, the term strength is most often connected to the power of muscle or group of muscles that is activated when mastering a resistance which practically means that it is the result of muscle contraction. Depending on the type and strength of contraction, amount of resistance and some other factors the strength can be demonstrated differently which is often concerned as relatively autonomous characteristic or strength ability. (Šturm, 1975). Explosive strength is most often defined as an ability to activat energy maximum in one single move in the shortest time possible.

It is represented in all movements in which the whole body, its parts or load (apparatus) make its movement longer for the impuls got that is start acceleration and its inborn coefficient is about .80 (H2= .80) so to conclude it is necessary to start with this ability development from the early age between 5-7. While researching the structure of latent motor abilities the factor of regulation of excitement intensity has been omitted and this factor is in correlation with the number of activated motor units as well as with variability and covariability of all characterictics of explosive strength (Kurelić et al, 1975). While in one motor situation one type of constitution directly obstructs realization of kinetic program the same constitution in another situation can be of a great advantage. When the development of explosive strength is concerned almost in all sport activities depending on the age and/or sex the aids that are by their structure, character and load intensity similar to those activities involved in competitions are applied. (Mraković, 1987; Findak, 1999; Malacko, 2005).

Determination of relations between variables in morphological and motor space as well as their multivariate impact on particular relevant motor abilities still represents current issue of kinesiology especially if explosive strength of boys aged 11-12 is concerned. This is the case not just because it has not been enough researched so far but because it is considered that this ability is not enough developed.

Meaning at this age concerning the fact that it is very important in almost all sport disciplines. (Blašković, 1979; Mraković, 1994; Findak, 1998). The number of research that dealt with the issue of relations between morphological characteristics and motor abilities is huge whether the motor abilities were assessed by exact motor tests or by success in a sport discipline. However, there are few research that limited motor abilities to explosive strength in order to determine their connection with morphological dimensions and other dimensions of motor abilities. So these relations can be analysed better in the scope of some more global research of interactions of anthropological systems. (Malacko, Popović, 2005).

Aim

The aim of this research was to firstly determine relations between manifesting variables in morphological and motor space and secondly their impact on particular criteria variables of explosive strength in order to plan and program curricula which would be rational and so achieve optimal development of those relevant morphological characteristics and motor abilities that directly or indirectly contribute most to expression and development of explos. strength of boys aged 11-12.

Methods

The sample of 97 boys aged 11 +/- 6 months was applied to the system of 27 variables of which 3 were explosive strength variables (as the system of criteria variables), 12 morphological and 12 motor variables (as the system of predictor variables). To assess explosive strength the following manifesting variables were applied: standing long jump (MLJ), medicineball throw from supine lying (MTL) and 20m run from standing start (20R). To assess morphological characteristics the following latent that is manifesting variables were applied: skeleton dimension – body height (ABH), shoulders width (SW), pelvis width (PW), body volume and weight – body volume (BV), circumference of forearm (ACF), circumference of upper-arm (ACU), circumference of upper-knee (ACUK), circumference of fore-knee (ACFK), circumference of stomach (ACS) and subdermal fatty tissue – upper-arm skin fold (UAS), subscapular skin fold (SUS) and stomach skin fold (SSF).

To assess motor abilities the following latent that is manifesting variables were applied: body coordination – passing through and jumping over (PTJ), agility in the air (AGA), obstaclecourse backwards (OCB), the speed of motion frequency – hand tapping (HTA), foot tapping (FTA), foot tapping against the wall (FTW), repetitive strength – declined sit-ups on the bench (ABS), hyperextension from prone lying (AHB), undergrip chin-ups on the bar (UCB), flexibility – declined sit-ups on the bench (ABS), straddling decline (SD) and bend (BEND).

Relations between applied manifesting variables of the three factors (explosive strength, morphological characteristics and motor abilities) were done by matrix of correlation variables. Estimation of the impact of the system of morphological variables and the system of motor variables (as the system of predictor variables) on particular variables of explosive strength was done by regressive analysis. While estimating and analyzing the results the following univariate statistical parameters were applied: β-individual impact of each standardized predictor variable on individual criterion variable by application of regressive coefficient (beta ponder), t-tests concerning the importance of impact of each predictor variable on individual criterion variable by t-test and p- statistical importance of impact of each predictor variable on individual criterion variable on the level from .05 to .00 (p=.05-.00). Multivariate values were estimated by the following parameters: Ro2-multiple correlation square or total variance of the system of predictor variables on criterion variable, Ro-miltiple correlation between the whole system of predictor variables and criterion variable, F-testing of importance by F-relations and p-statistical importance of impact of the whole system of predictor variables on criterion variable on the level from .05 to .00 (p =. 05-.00).

Results

By correlation martix analysis according to particular anthropological levels (Table 1) relatively high and statistically significant correlations of variables of most applied variables were got. By matrix correlation review concerning morphological variables it can be clearly seen that there are statistically important correlations between all individual applied morphological variables on the level of .01 (p= .01), except for the variable of circumference of stomach (ACS) and subscapular skin fold (SUS). By correlation martix analysis between motor variables it is noticed that between majority of them there are statistically important correlations: variable of passing through and jumping over (PTJ) is statistically very connected on the level of p=.01 with all variables except with variable of agility in the air (AGA); variable of agility in the air (AGA) is statistically very connected on the level of p=.01 with variable of obstaclecourse backwards (OCB) and with all variables of repetitive strength; variable of obstaclecourse backwards (OCB) is statistically very connected on the level of p=.01 with all variables except with variable of agility in the air (AGA); variable of hand tapping (HTA) is statistically very connected on the level of p=.01 with all variables except variable of agility in the air (AGA), declined sit-ups on the bench (ASB) and straddling decline (SD); variable of foot tapping (FTA) is statistically very connected with all applied variables except variable of agility in the air (AGA); foot tapping against the wall (FTW), declined sit-ups

on the bench (ABS) and hyperextension from prone lying (AHB) are statistically very connected with all applied variables; variables undergrip chin-ups on the bar (UCB) and declined sit-ups on the bench (ASB) are statistically very connected with all applied variables except with variables of agility in the air (AGA) and hand tapping (HTA); variable of straddling decline (SD) is statistically very connected with all applied variables except with variables of agility in the air (AGA).

By inspection of correlation matrix on the level of criteria variables of explosive strength it can be clearly seen that there are statistically significant correlations on the level of .01 (marked with **) only between standing long jump (MLJ), medicineball throw from supine lying (MTL) and 20m run from the standing start (20R), while between medicineball throw from supine lying (MTL) and 20m run from the standing start (20R) there are no statistically significant correlations.

Table 1: Correlations between manifesting, morphological and motor variables of explosive strength

Variables	1	2	3	4	5	6	7	8	9	10	11
1. BH	-										
2. SW	.73**	-									
3. PW	.66**	.79**	-								
4. BV	.73**	.80**	.86**	-							
5. ACF	.51**	.69**	.73**	.77**	-						
6. ACU	.59**	.76**	.84**	.92**	.81**	-					
7. ACUK	.63**	.76**	.83**	.93**	.76**	.92**	-				
8. ACFK	.64**	.79**	.77**	.88**	.74**	.85**	.88**	-			
9. ACS	.30**	.29**	.32**	.31**	.26**	.34**	.38**	.28**	-		
10. UAS	.52**	.70**	.76**	.87**	.68**	.85**	.81**	.78**	.27**	-	
11. SUS	.50**	.67**	.75**	.86**	.69**	.84**	.78**	.77**	.15	.90**	-
12. ABS	.53**	.69**	.81*	.88**	.71**	.85**	.82**	.79**	.30**	.92**	.91**
1. PTJ	-										
2. AGA	.14	-									
3. OCB	.79**	.29**	-								
4. HTA	-.33**	-.02	-.33**	-							
5. FTA	-.41**	-.05	-.43**	.59**	-						
6. FTW	-.46**	-.15	-.47**	.55**	.62**	-					
7. ABS	-.55**	-.33**	-.50**	.28**	.40**	.46**	-				
8. AHB	-.56**	-.26**	-.55**	.37**	.45**	.46**	.76**	-			
9. UCB	-.55**	-.38**	-.56**	.31**	.41**	.42**	.78**	.73**	-		
10. ASB	-.44**	-.10	-.28**	.13	.31**	.31**	.42**	.37**	.37**	-	
11. SD	-.43**	-.02	-.24**	.12	.19*	.31**	.41**	.38**	.38**	.73**	-
12. BEND	.45**	-.10	.39**	.33**	-.26**	-.25**	-.44**	-.39**	-.47**	-.50**	-.58**
1. MLJ	-										
2. MTL	.33**	-									
3. 20R	-.52**	-.01									

(Legend: *p (.05) = .19 **p (.01) = .25)

Results of regression analysis (Table 2) showed that predictor systems of variables of morphological characteristics and motor abilities have statistically significant impact on all individual criterion variables of explosive strength on the level of .00 (p=.00) except on morphological variables of explosive strength of arms – MTL (p=.04).

On the basis of analysis of contribution of individual morphological predictor variables it can be said that statistically significant impact on criterion variable standing long jump (MLJ) has only variable shoulders width (SW), criterion variable medicine ball throw from supine lying (MTL) is influenced by variable circumference of stomach (CS) and statistically significant impact on criterion variable 20m run from the standing start (20R) have the following variables: body volume (BV), circumference of upper-knee (ACUK) and upper-arm skin fold (UAS).

Table 2: The impact of the system of morphological variables on particular criteria variables

Variables	MLJ (p)	MTL (p)	20R (p)
BH	.60	.06	.48
SW	.00*	.18	.17
PW	.11	.28	.76
BV	.39	.11	.05*
ACF	29	.44	.89
ACU	.64	.67	.14
ACUK	.81	.11	.05*
ACFK	.28	.16	.35
ACS	.46	.03*	.64
UAS	.11	.84	.00*
SUS	.55	.20	.32
ABS	.41	.21	.43
R02	.38	.21	.53
R0	.62	.46	.73
F	4.47	1.89	8.00
p	.00*	.04*	.00*

(Ro2 - multiple correlation square; Ro - multiple correlation; F- F-test; p - statistical importance)

Table 3: Predictor impact on criteria variables

Variables	MLJ (p)	MTL (p)	20R (p)
PTJ	.65	.04*	.02*
AGA	.32	.49	.52
OCB	.05	.89	.53
HTA	.60	.02*	.13
FTA	.00*	.05*	.23
FTW	.70	.28	.27
ABS	.04*	.39	.37
AHB	.75	.62	.00*
UCB	.44	.00*	.62
ASB	.36	.16	.39
SD	.76	.59	.33
BEND	.08	.02*	.62
R02	.64	.40	.56
R0	.80	.63	.75
F	12.90	4.78	9.24
p	.00*	.00*	.00*

(Ro2 - multiple correlation square; Ro - multiple correlation; F- F-test; p - statistical importance)

Analysing the contribution of individual predictor motor variables on criterion variable (Table 3) it can be concluded that statistically significant impact on criterion variable standing long jump (MLJ) have variables foot tapping ((FTA) and declined sit-ups on the bench (ASB), concerning criterion variable medicineball throw from supine lying (MTL) it can be concluded that statistically significant impact on it have variables undergrip chin-ups on the bar (UCB), hand tapping (HTA), bend (BEND), passing through and jumping over (PTJ) and foot tapping (FTA) and impact on criterion variable 20m run from the standing start (20R) have variable hyperextension from prone lying (AHB) and passing through and jumping over (PTJ).

Discussion and conclusion

Reviewing correlation matrix between predictor morphological variables it is clearly noticed that there are statistically significant correlations between all individual morphological variables on the level of .01 (p= .01) except between variables circumference of stomach and subscapular skin fold which in research very often appear as independent variables. Analysing correlation matrix between predictor motor variables it is seen that between the majority of the variables there are statistically significant correlations except for the variable agility in the air which does not show statistically significant correlation with variables the speed of motion frequency and flexibility. Reviewing correlation matrix between criteria variables of explosive strength there are statistically significant correlations on the level of p=.01 only between standing long jump, medicineball throw from supine lying and 20m run from the standing start while between medicineball throw from supine lying and 20m run from the standing start there is no statistically significant correlation which could be expected concerning their different topological proportion. Generally it can be stated that the applied system of variables concerning anthropological levels was well balanced by choice of variables and their mutual correlations which is of a special importance for research of relations and impact between different levels. By determination of connection and impact of predictor system of morphological variables and predictor system of motor variables respectively on individual criterion variables of explosive strength the expected conclusion appeared. It says that predictor systems of variables on both levels have statistically significant correlation and impact on all individual criteria variables of explosive strength on the level of .00 (p=.00) except between predictor systems of morphological variables and criterion variable medicineball throw from supine lying (p=.04) which is also statistically significant according to which it can be concluded that for explosive strength performance the necessary part is optimal morphological development and motor ability on integral basis. In predictor systems of morphological variables statistically significant impact on individual criteria variables of explosive strength had the following morphological variables (standing long jump: shoulders width - p= .00; medicineball throw from supine lying: circumference of stomach - p= .03; 20m run from the standing start: body volume - p= .05, circumference of upper-knee - p= .05 and upper-arm skin fold - p= .00). In predictor systems of motor variables statistically significant impact on individual criteria variables of explosive strength had the following motor variables (standing long jump: foot tapping - p= .00 and declined sit-ups on the bench - p= .04; medicineball throw from supine lying: passing through and jumping over - p= .04, hand tapping - p= .02, foot tapping - p= .05, undergrip chin-ups on the bar - p= .00 and bend - p= .02; 20m run from the standing start: passing through and jumping over - p= .02 and hyperextension from prone lying - p= .00). On the basis of general and partial results analysed in this research it can generally be concluded that completely satisfactory and expected (wished) results were got. It is encouraging that this research confirms that teaching and sport activity of boys in the 5th class of primary school is aimed at necessary integrity, balance and wished efficiency and effectiveness.

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UTJECAJ MORFOLOŠKIH I MOTORIČKIH DIMENZIJA NA EKSPLOZIVNU SNAGU KOD DJEČAKA 11-12 GODINA

Sažetak

Na uzorku OD 97 dječaka, uzrasta 11 godina +/- 6 mjeseci, bio je primjenjen sustav od 27 varijabli, od toga 3 varijable eksplozivne snage (kao kriterijske varijable), 12 morfoloških i 12 motoričkih (kao prediktorske varijable), s ciljem utvrđivanja utjecaja prediktorskih varijabli na kriterijske varijable. Relacije između manifestnih varijabli po pojedinim antropološkim prostorima utvrđene su izračunavanjem korelacijske matrice, a utjecaj sustava morfoloških varijabli i motoričkih varijabli (kao sustava prediktorskih varijabli) na pojedinačne kriterijske varijable eksplozivne snage, bio je izračunat regresijskom analizom. Iz analize matrice interkorelacije po pojedinim antropološkim prostorima dobivene su relativno visoke i statistički značajne korelacije varijabli kod većine primjenjenih varijabli. Rezultati regresijske analize su pokazali da prediktorski sustav varijabli morfoloških karakteristika i motoričkih sposobnosti ima statistički značajan utjecaj na sve pojedinačne kriterijske varijable eksplozivne snage na razini od .00 (p=.00), osim morfoloških varijabli na eksplozivnu snagu gornjih ekstremiteta (p=.04). Zaključeno je da morfološke karakteristike i motoričke sposobnosti imaju jako veliki utjecaj pri iskazivanju eksplozivne snage kod dječaka ovog uzrasta.

Ključne riječi: *dječaci, morfološke karakteristike, motoričke sposobnosti, relacije, utjecaj*

Received: February 23, 2008
Accepted: May 20, 2008
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