

THE INFLUENCE OF VOLUMINOSITY AND SKIN FOLDS ON FUNCTIONAL ABILITIES OF FIFTH GRADE PUPILS

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Abstract

The survey was conducted on a sample of 30 male subjects aged 11-12 years who attend the Elementary School "Prva vojvođanska brigada" in Novi Sad. The aim of this study was to analyze the existence of the influence of the anthropometric characteristics on the manifestation of the aerobic abilities of boys of elementary school age. It has been conducted the measuring of anthropometric characteristics (weight, scope of the abdomen, scope of upper arm, skin fold of upper arm, skin fold of abdomen) and functional ability by modified Harvard step test according to Bergman. By applying regression analysis it has been determined that the system of predictor variables is not significant in relation to the criterion of P index for assessment of functional ability, and that none of the predictor variable has no statistically significant effect on the expression of functional ability of boys of the mentioned age, but all predictor variables were in negatively significant relation with the same criteria.

Key words: aerobic ability, Harvard step test, relations, voluminosity

Introduction

Functional capabilities indicate the efficiency of energy processes in the body, and are related to the development of aerobic and anaerobic functional mechanisms. They have been in the so far research investigated with different methods and on the different populations. However, in the area of functional ability still there is no valid theoretical model about the latent structure of these capabilities because they are very complex and complicated (Coen, Schwary, Urhausen, & Kindermann, 1991). Obesity during childhood and physical inactivity are dramatically increased worldwide in recent years. Children of low socioeconomic status are particularly at risk. In general, the overall effectiveness of the school curriculum in the outcomes of children's health state is negative, that is it is worrying. In obese children, children with high levels of subcutaneous fat, aerobic capacity (maximal oxygen uptake) is significantly lower than in children of normal nutritional status (Maciejczyk, Szymura, Cempla, & Gradek, 2012). Physical activities in which dominates aerobic component maintain energy balance in the body, thus preventing the occurrence of excess weight (Hill, & Wyatt, 2005). Functional skills are associated with the ability of the system to transport oxygen (aerobic capacity) and with the efficiency of the anaerobic energy mechanisms that enable high-intensity athletic activity and when oxygen consumption is less than the need for oxygen, so the difference of the energy required is taken from glycolytic or phosphagene compounds (Milanović, 1997). Hill & Wyatt (2005) suggest that physical activities in which dominates aerobic component serve to reduce excess body weight and are considered the most natural way to waste energy. From these statements it appears that higher values of skin folds have negative correlation with aerobic components.

By its actions physical activity affects the reduction of subcutaneous adipose tissue and to speed up the metabolism and also significantly affects the hormonal composition which again with its action prevents excess weight. Condition of subcutaneous fat is negatively correlated with the manifestation of greater aerobic ability in all ages (Hackney, 2006 by Cheng & Ng, 2007). Medved et al (1989), Petric and Novak (2007) in their research suggest on significantly greater aerobic capacity of students from rural areas and conclude that to this certainly partly contribute the favorable weather conditions and a longer stay in the outdoors, and much more use of outdoor sports fields by students of urban areas.

These data show that the way of life and place of residence, may have an impact on the manifestation of the aerobic component of children. The study Jabbour, Lambert, O'Loughlin, et al. (2012) demonstrated that there was no statistically significant correlation between maximal oxygen consumption and individual anthropometric dimensions in children aged 8-10 years. These results point out that pre pubertal children are equally effective, because they are able to perform physical work such as cycling using the same amount of energy, regardless of their weight status. Čule, Petric and Petkovic (2013) suggest that the effect of body weight on aerobic endurance is negative, which confirms the known fact that increased body weight is an important limiting factor for the overall functional abilities of students in higher grades of primary school. Guided by previous studies, conflicting results, both domestic and foreign authors, this study aims to investigate the influence of anthropometric characteristics on the aerobic capacity of urban children male gender from Novi Sad.

The problem of research was the establishment of relations of anthropometric characteristics and aerobic abilities of students in fifth grade, while the subject of the research were anthropometric characteristics (body height, body weight, the abdomen volume, the upper arm volume, upper arm skinfold, abdominal skinfold) and aerobic ability. The aim of the study was to analyze the existence of possible influence of the anthropometric characteristics on the manifestation of the aerobic abilities of boys aged 11-12 years. Set up research hypothesis was: H1-relations of anthropometric dimensions and aerobic ability among students aged 11-12 years, from Novi Sad, will be positive and statistically significant.

Methods

The sample of respondents consisted of 30 students, boys from the Elementary School "Prva vojvođanska brigada" from Novi Sad, aged 11-12 years (± 6 months) who were at the time of research, attending the fifth grades, and were healthy persons without disabilities from families of different social conditions and lifestyle. Of the anthropometric characteristics were selected following variables: 1) Body weight (0,1 kg), 2) Scope of the abdomen (mm), 3) Scope of upper arm (mm), 4) Skin fold of upper arm (0,1mm), 5) Skin fold of abdomen (0,1 mm). Anthropometric characteristics were a system of predictor variables in the study. Measurement of anthropometric characteristics was conducted with the help of anthropometric instruments: medical decimal scale that provides accurate measurement of results of 100 g, in which there is the possibility of regulating the pointer to the zero position. Scale was calibrated after measured fifteen to twenty participants. Portable scale used for field conditions measures with an accuracy of 500 g, because the mechanism of balance is directly under the influence of atmospheric factors and with heavy use over 5000 measurements is completely excluded from use; Measuring the thickness of subcutaneous adipose tissue was done by the instrument calipers. The most suitable type of caliper is John Bull with a measuring range from 0 to 40 mm (minute hand describes two laps around the scale calibrated from 0 to 20 mm). Prior to the measurement it was necessary to check the instrument calibration. Pressure with which grips of the instrument compress the skin and subcutaneous tissue is standard and is 10 g/mm². The reading accuracy: 0.2 mm (interpolated - the accuracy of 0.1 mm). The measurement result is read for about 2 seconds after the grip affected skin folds, in this interval overcomes the elasticity of the tissues, so the readings are closer to the real. The longer hold of grips may require them to move and slide, which would reduce the accuracy of the results. Due to the high variability of the measurement of thickness of a skin fold in the same person, it is necessary to repeat the measurement consecutively at least three times.

As a final result of the measurement is taken the mean value of the measured thickness of a fold; Centimeter tape measures the perimeters of the body. Centimeter tape measured with an accuracy of 0.5 cm. Length of measuring tape was 150 cm, and after 100 measurements was needed to calibrate the tape according to anthropometer because of the possibility of its stretching. Favorable effects of influence on functional abilities are reflected in a person's medical, psychological and economic area. There are a number of tests that can assess the level of aerobic endurance (Cooper's test, running at 2400 meters, Harvard step test and its modifications). For the assessment of aerobic ability in this study will be applied the motor test which will be the criterion variable in the study: Bergman modification Harvard step test, on the basis of which will be the index of the functional capabilities I.

The formula for calculating the index

$$I = \frac{\text{test duration in seconds (s)} \times 100}{2 \times (P1 + P2 + P3)}$$

where P1, P2, P3 is pulse measured in the recovery., first after 1.5 min., the second 2.5 min., and the third 3.5 min.

One of the most popular modifications of Harvard step test is Bergman, with a step ergometer height of 40 cm. This test is used to examine women of all ages and men younger than 18 years, and given that the sample of respondents will be boys 11-12 years old, it is a logical choice of method for the assessment of aerobic ability. Test and index calculation is performed the same as in the original Harvard step test, only the scale for ranking capabilities changed and ranges from 30 to 40 points for the poor (lack of) and more than 60 points for excellent functional capacity. Total duration of the test is 3 minutes, a rate of climb and descent is 24/min. The test was interrupted earlier because of the subjective problems and objective symptoms. In mathematical statistical analysis was first realized calculating of descriptive statistics of anthropometric and motor variables: arithmetic mean (Mean), standard deviation (SD), minimum (Min) and maximum value of the measurement (Max), skewness - inclination (Skew.) and kurtosis - elongation (Kurt) of distribution. In order to determine the relationship between predictor and criterion variables the regression analysis has been used.

Results

Values of descriptive statistics in Table 1 indicate at increased variability of results among a given sample of respondents. Remarkable variability is caused by individual characteristics in morphological terms in boys of pubertal age (their body composition), which can be linked to socio-economic factors, environmental influences, cultural opportunities and the genetic heritage of their body.

Table 1 Descriptive statistics of variables

Variables	Mean	SD	Min	Max	Skew	Kurt
Body weight (0,1 kg)	447,23	95,44	325	730	1,01	1,09
Scope of the abdomen (mm)	683,80	96,60	578	992	1,37	2,12
Scope of upper arm (mm)	222,70	29,07	183	283	0,62	-0,55
Skin fold of upper arm (0,1mm)	140,30	69,50	54	318	0,80	-0,19
Skin fold of abdomen (0,1 mm)	114,13	78,98	36	312	1,11	0,09
P index	54,60	7,71	43	78	1,36	2,78

Mean-arithmetic mean of the measurement results; SD-standard deviation; Min-minimum values of measurement results; Max-maximum values of measured results, Skew (inclination distribution), Kurt (elongation distribution)

There can be observed large differences between individual subjects in body structure, which is directly reflected in functional ability. Average values of P index (54,60) indicate at good state of aerobic ability of this group of boys from Novi Sad. It should be noted that there are subjects with extremely high values of P Index, indicating a very good functional ability (the maximum recorded value of 78). Values obtained of skewness and kurtosis, from the same table, indicate that the distribution of the all analyzed variables are approximately of normal distribution. Further, in Table 2, is shown the result of regression analysis, the criterion variable of P index in the system of predictor (variables for assessing of voluminosity of skeleton and subcutaneous fat) variables.

Table 2 Regression analysis of the P index

Variables	r	p	R _{part}	P _{part}	Beta	P _{bete}
Body weight	-0,33	0,04	0,02	0,91	0,07	0,91
Scope of the abdomen	-0,41	0,01	-0,18	0,37	-0,59	0,37
Scope of upper arm	-0,31	0,05	0,16	0,42	0,49	0,42
Skin fold of upper arm	-0,40	0,02	-0,17	0,41	-0,47	0,41
Skin fold of abdomen	-0,41	0,01	0,03	0,89	0,08	0,89

R=0,47, R²=0,22, p index=0,29

r-Pearson correlation coefficient; p-level of statistical significance for r; R_{part}-coefficient of partial correlation; P_{part}-level of statistical significance for R-part; Beta-regression coefficient; P_{bete}-the level of significance of the regression coefficient; R-coefficient of multiple correlation; R²-coefficient of determination; p-significance of the coefficient of multiple correlation

Analyzing the results in Table 2, it can be concluded that there is no statistically significant influence of the system of predictor variables on tested criterion for assessing functional capabilities of P index (P = 0,29), the coefficient of multiple correlation from R = 0,47. Described common variance was only 22%, while the remaining percentage can be attributed to the influence of other characteristics (other anthropometric dimensions, primarily a measure for assessing the

longitudinal dimensionality of the skeleton because of the test, raising the center of gravity of the body up on the bench) and conative ability on manifestation of this functional ability (super ego and ego). None of the predictor variable did not show a statistically significant influence on the criterion (P bete > 0.05). All predictor variables were in the negative statistically significant (p ≤ 0,05) correlation with the criterion, but this significance can be considered as coincidental since the system was not statistically significant, and the fact that a sample of subjects was relatively small from one hand. But on the other hand, also confirm that the connection of greater voluminosity of skeleton and the state of greater subcutaneous fat in the abdomen and on upper arm significantly reduces functional ability of boys aged 11-12 years.

Discussion

In accordance with the results of research, it can be completely ruled out the set up research hypotheses h1. Predictor system consisting of variables for assessing the voluminosity of skeleton and variables for assessing subcutaneous adipose tissue was not significantly influencing on the level of functional abilities of boys in pubertal age. However it has been stated significant correlation of all tested predictor variables with the variable for assessing functional ability (P index), so we can conclude, though, the research sample was relatively small, that greater body mass, with greater the volume of the upper arm and the higher values of subcutaneous fat (balast) tissue reduce aerobic ability in boys.

These results confirm the so far results of the research of Čule et al. (2013) who pointed to the fact that increased body weight is an important limiting factor for the overall functional abilities of students in higher grades of primary school. Also confirmed are the results of research by foreign authors Hill & Wyatt (2005), which suggest a negative effect of subcutaneous fat on the functional abilities of elementary school children. Generally observed through average values of P index, it can be stated a good level of functional ability of a given sample of respondents (54,60), which is very close to excellent functional ability obtained by Bergman modified step test. Recommendations for further research of a similar type is the realization of research on a much larger sample of subjects, in order to get more credible information. In the predictor variables should be included other anthropometric characteristics (height, condition of subcutaneous fat on the other's reference points on the body: the forearm, scapula, upper thigh and lower leg).

This group of respondents is necessary to monitor over a long period of time in order to, after a certain period, by longitudinal research, stated changes in functional abilities that occur with changes in morphology structure of boys during and after puberty.

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UTJECAJ VOLUMINOZNOSTI I KOŽNIH NABORA NA FUNKCIONALNE SPOSOBNOSTI UČENIKA PETOG RAZREDA

Sažetak

Istraživanje je provedeno na uzorku od 30 muških ispitanika u dobi od 11 do 12 godina koji pohađaju OŠ "Prva Vojvođanska brigada" u Novom Sadu. Cilj ovog istraživanja bio je analizirati postojanje utjecaja morfoloških karakteristika na manifestaciju aerobnih sposobnosti dječaka osnovne škole. To je provedeno mjerenjem antropometrijskih karakteristika (težina, opseg trbuha, opsega nadlaktice, kožni nabor nadlaktice, kožni nabor trbuha) i funkcionalne sposobnosti po izmijenjenom Harvard testa prema Bergmanu. Primjenom regresijske analize utvrđeno je da sustav prediktorskih varijabli nema značajnu predikciju kriterija P indeksa za procjenu funkcionalne sposobnosti, te da ni jedna od prediktorskih varijabli nema statistički značajan učinak na iskazivanje funkcionalne sposobnosti djece spomenutog uzrasta, ali sve prediktorske varijable su u negativno značajnom odnosu s kriterijem.

Ključne riječi: aerobne sposobnosti, Harvard test, odnosi, voluminoznost

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