# RELATIONS BETWEEN ANTHROPOMETRIC VARIABLES AND MOTOR TESTS USED AT 6 YEARS OLD MALE CHILDREN

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**Abstract**

This research was realized on a sample of 123 male, 6 years old children, with aim to determine the relations between morphologic and motor variables. These relations are estimated using 17 anthropometric measures that cover four-dimensional structure of morphologic space and 33 motor tests for estimation of 9 segments of motor space.Using canonic correlation analyses, 3 pairs of morphologic factors were isolated and point out of significant correlation between anthropometric variables and motor tests. The results analysis points out that smaller values of some anthropometric measures (circumferences, lean body mass, subcutaneous adipose tissue and longitudinal dimensions) results with better results in motoric tests for estimation of motor abilities depended from energetic and informational components. With increased values of measurements for body volume, it could be expected results improvement in certain motor tests for estimation of speed, preciseness with hand and balance, realized with certain body parts

**Key words:** *relations, 6 years old children, anthropometric variables, motor tests, motor abilities*

## INTRODUCTION

Interrelations between all segments of anthropologic status and their implications at motor behavior are very important for researches in kinesiology. Efficiency in motoric activities is highly related with anthropometric measures. Therefore, these two segments of anthropologic status – anthropometric characteristics and motor abilities and their relations are subject of analysis at this paper.

Relations between anthropometric characteristics and motor abilities are explored in many other researches. Mainly these researches are focused on sample of subjects in period of puberty and adolescences when many other developmental changes occurs (Malina et all, 2004; Jürimäe, T. & Jürimäe, J,2001). Beside many researches realized with students and adolescents, significantly smaller number of researches is realized with children. These types of researches are realized with children at early school age or a period between 7 and 10 years of age (Bala, 1981; Rausavljević, 1992; Bala, 2003; Pejćić & Malacko, 2005) and pre-school period or children from 3 to 6 years (Strel&Sturm, 1981;Дуковски, 1984; Videmšek, 1996; Perić, 1991; Planinšec, 2002; Bala, Sabo & Popović, 2005; Zurc, Pišot & Strojnik, 2005; Popeska, B, 2009). The analysis of the results from mentioned studies, points out at different age.

## METHOD OF WORK

This research was realized on a sample of 123 examinees, 6 years old male children (+/- 6 months), pupils in first grade with aim to determine the relations between morphologic and motor dimensions. In order to realize the proposed goal, 17 anthropometric variables for estimation of longitudinal dimensionality, transversal dimensionality, volume and body mass and variables for subcutaneous adipose tissue were used. Anthropometric measures used in this research were selected according the model for estimation of morphologic status, suggested by Momirovic et al (1969, 1970) and Kurelič et al (1975).

A total number of 33 motor tests were used in this research in order to estimate 9 motor abilities: coordination, running speed, frequency of movement, explosive strength, repetitive strength, static strength, flexibility, balance, preciseness with throwing and preciseness with leading. Relations

between the sets of variables for estimation of morphologic characteristics and variables for estimation of motor abilities are determined using canonic correlation analysis.

## RESULTS AND DISCUSSION

Based on the coefficients of correlations obtained in the set of anthropometric measures and set of motor tests, canonic correlation analysis was done and following parameters were calculated: canonic correlation (Can R) and coefficient of canonic determination (Can R²). The number of statistical significant canonic factors was determined using Bartlett's test which is tested using Chi – square test (Table 1) defined of 0.01 and 0.05 level of significance. According the more strict criteria (p?0.01), relations between morphologic dimensions and motor abilities at 6 years old children are defined with 3 pairs of canonic factors.

*Table (1).Canonic correlation analysis between anthropometric characteristics and motor variables used at 6 years old children*

|   | Can R | Can R-sqr. | Chi-sqr. | df | p |
|---|-------|-----------|----------|------|------|
| 1 | 0,86  | 0,75      | 789,22   | 561,00 | 0,00 |
| 2 | 0,81  | 0,65      | 657,19   | 512,00 | 0,00 |
| 3 | 0,79  | 0,62      | 555,81   | 465,00 | 0,00 |

The values of the coefficients of canonic correlations (Can R) are 0.86 for the first pair, 0.81 for the second pair and 0.79 for the third pair. This values points out on existence of significant, medium and high coefficient of relations between latent structures in morphologic and motor space at 6 years old children. The content in Table 2 shows the structure of canonic factors in the anthropometric system of variables, while the structure of canonic factors for the system of motor variables is shown in Table 3.

Significant projections of the first canonic pair in morphologic and motor space, point to the conclusion that 6 years old children with higher values for body height and body mass, higher values of anthropometric measures for circumferences and subcutaneous adipose tissue at arms and legs, but with smaller values of measures for transversal dimensionality on arms and legs, would achieve lower results at motor test used for estimation of

*Table (2) Structure of canonic factors in anthropometric systemof variables used at 6 years old children*

| Variables | CAN 1 | CAN 2 | CAN 3 |
|-----------|-------|-------|-------|
| AVIST     | 0,36  | 0,11  | 0,08  |
| ADOLR     | 0,14  | 0,04  | 0,05  |
| ADOLN     | 0,17  | -0,07 | 0,01  |
| ASIRA     | -0,11 | 0,26  | -0,05 |
| ASIKA     | 0,02  | 0,18  | -0,50 |
| ADILA     | -0,37 | 0,00  | -0,49 |
| ADIRZ     | -0,68 | -0,06 | -0,32 |
| ADIKO     | -0,44 | 0,39  | -0,53 |
| ADISZ     | -0,35 | 0,19  | -0,19 |
| AONDL     | 0,54  | 0,30  | -0,42 |
| AOPDL     | 0,54  | 0,58  | -0,20 |
| AOPTK     | 0,56  | 0,31  | -0,41 |
| AMASA     | 0,40  | 0,25  | -0,49 |
| ÀAKDNDL   | 0,37  | 0,19  | -0,69 |
| AKDGR     | 0,24  | 0,23  | -0,69 |
| AKDME     | 0,28  | 0,17  | -0,71 |
| AKDPTK    | 0,63  | 0,19  | -0,54 |

coordination (KOPAL, KOSL2), running speed (BT10LS, BT4x10), explosive strength (ES20VS), static strength (SSVZG), flexibility (FLPRK) or in all tests were passive mass has a greater influence on successful test realization. This children would achieve better results in tests for estimation of frequency of movement – arm tapping (SBBTAR) and preciseness with leg (PIVCN), where movements from the test are realized with certain body parts (leg or arm), or movements where the influence of the passive mass is smaller. This conclusion is based on positive or negative sign on significant coefficients of the first morphologic and motor canonic factors that points out on inverse relations on morphologic and motor variables (Bala, 1986).

When body moves during the realization of tests for coordination and speed, when speed of movement of all body or certain body parts need to be increase or decrease, or when all body should be hold in certain position, then increased body mass or body height, or increased values of subcutaneous adipose tissue have a negative influence on the performance of the movement. This is because for increased speed the body movement requires larger force, while subcutaneous adipose tissue makes muscles activation more difficult and indi-

*Table (3) Structure of canonic factors in system of motor variables used at 6 years old children*

| Variables | CAN 1 | CAN 2 | CAN 3 |
|---|---|---|---|
| KOPAL1 | 0,61 | 0,33 | 0,02 |
| KOPON1 | 0,11 | 0,25 | -0,60 |
| KOSL21 | 0,44 | -0,05 | -0,36 |
| KOTRT1 | 0,14 | -0,08 | -0,03 |
| BT10LS1 | 0,59 | 0,34 | 0,00 |
| BT4X101 | 0,51 | -0,13 | -0,22 |
| BTZMT1 | 0,23 | 0,32 | -0,19 |
| BSTAR1 | 0,39 | 0,05 | -0,16 |
| BSTAN1 | -0,06 | -0,14 | 0,22 |
| BSTNZ1 | -0,06 | 0,06 | 0,25 |
| ESSDM1 | -0,16 | 0,10 | 0,53 |
| ESFMST1 | 0,14 | 0,21 | 0,21 |
| ESFMG1 | 0,22 | -0,05 | 0,26 |
| ES20VS1 | 0,43 | 0,05 | -0,18 |
| RSSKL | -0,24 | -0,24 | 0,08 |
| RSPTR | -0,19 | -0,02 | 0,34 |
| RSITR | -0,23 | -0,01 | 0,22 |
| RSVKK | 0,28 | -0,25 | -0,50 |
| RSBZG | -0,31 | 0,25 | 0,48 |
| SSZLM | -0,03 | 0,01 | 0,21 |
| SSZLG | -0,18 | -0,37 | 0,07 |
| FLPRK1 | -0,55 | -0,03 | -0,12 |
| FLRLG1 | 0,05 | 0,04 | 0,29 |
| FLPRS1 | 0,27 | 0,09 | 0,19 |
| RAOSK1 | 0,29 | 0,13 | -0,04 |
| RASKS1 | -0,06 | 0,12 | 0,10 |
| RASKD1 | -0,14 | 0,33 | 0,27 |
| PIOBS1 | -0,01 | 0,11 | 0,29 |
| PITET1 | 0,06 | 0,03 | 0,09 |
| PITHC1 | -0,06 | -0,09 | 0,13 |
| PIVCN1 | 0,34 | 0,03 | -0,13 |
| PVGKS1 | 0,18 | -0,04 | 0,08 |
| PVG1DS1 | 0,23 | -0,32 | 0,12 |

rectly complicates and make difficulties in realization of the movement. On the other hand, increased values of circumferences have a positive influence in movements that are realized only with one arm or leg (preciseness with leg, arm tapping, balance on one leg) where the influence of passive mass decreases. Similar results are obtained in research realized by Bala, G., Jaksic, D. & Katic, R. (2009a) realized whit 6 and 7 years old male children.

According to the relations of the second canonic factor in the system of anthropometric measurements and equally in the system of motoric variables, children with higher values of circular dimensions manifested by the body volume, would achieved better results in the test for balance – standing on a bench in length (RASKD) and would achieve lower results in tests that defined the second canonic factor in motor space - test for estimation of coordination (KOPAL), running speed (BT10LS, BTZMT), static strength (SSZLG) and test for preciseness (PVGDS). Obtained results lead to conclusion that higher values for volume of upper arm, lower arm and lower leg as well as the diameter of arm ankle have a negative influence on tasks in motor tests for estimation of coordination, running speed, static strength on the trunk ad preciseness with leading and have a positive influence maintaining balance.  Enlarged volume of lower leg and increased diameter of the knee ankle generates larger force of lower leg muscles, which helps maintaining balance and results with achievement of better results in test for estimation of balance. According to development characteristics (Malina et all, 2004), 6 – years old children are not capable for maximal activation of arm muscles. Therefore, they need more strength to realize complex movements incorporated in tests for estimation of coordination, speed and strength.

According to the relations of the third canonic factor in the system of anthropometric measurements and equally in the system of motoric tests, examiners with lower values of transversal measurements, lower values of upper and lower arm volume, lower body mass and subcutaneous adipose tissue, would achieve better results in tests for estimation of coordination (KOPON, KOSL2), explosive strength (ESSDM), repetitive strength (RSPTR, RSVKK) and static strength (SSVZG), or movements where passive mass have a smaller influence in successful realization of the movements.

From results obtained in these and other similar researches (Grbovac, 2007; Malacko, 2007; Vlahovič et al, 2007; Dejanovic, & Zivkovic,D, 2008; Kostic et all 2009; Bala, 2009) it could be concluded that morphologic characteristics have a significant influence and impact in realization of many motor tasks. Morphologic and motoric spaces are highly connected and there is an obvious need of their simultaneously studying and

research. The size and direction of influence of anthropometric characteristics vary in different motor abilities. They facilitate or disrupt the performance of motor tasks when body and certain parts of the body is moved from one place to another, when certain posture needs to be maintained, independently whether is a motor task that requires strength, speed, flexibility, coordination or balance.

The results obtained in these research and referring to relations between morphologic and motor space, impact, influences and changes that occurs in both segments during the performance of body movements inn children in the early school age, will not resolve all problems and dilemmas for factors that define children's motor development, but we hope it would give a small contribution in clarification of these problems. Realization of other similar studies with larger numbers of examiners and variables will surely help to get a more precise information and clearer picture for relations between these two subspaces from the human anthropologic status.

## CONCLUSION

Based on analyzed results, obtained in this study using canonical correlation analysis, and the three isolated pairs of canonic factors, it could be concluded that 6 – years old male children that have a smaller values of body height and body mass, smaller values of the joints of the arms and legs, smaller values for volumes of the body and smaller skin folds, would achieve better results in motor tests used for estimation of coordination, running speed, explosive, repetitive and static strength. All these requires movements where body moves backward or it changes the direction of movement, when it is lifted up, it is dragged or maintains hanging position or movements in which the impact of passive mass is reduced, as well as the tests for estimation of balance, preciseness with leg or arm tapping.

According to the interpreted results obtained using canonic correlation analysis, 6 – years old male children with smaller values of anthropometric measures would perform better and achieved better results in most of the motor tests, while children with higher values of anthropometric measurements will achieve worst results in numerous motor tests except the tests for estimation of preciseness with arm, frequency of movement with arms and one leg balance, where they will achieve better results.

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# РЕЛАЦИИ МЕЃУ АНТРОПОМЕТРИСКИТЕ И МОТОРИЧКИТЕ ВАРИЈАБЛИ КАЈ ДЕЦА НА 6 ГОДИШНА ВОЗРАСТ

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*Абстракт*

*За остварување на целите на ова истражување спроведена е истражувачка постапка на примерок од 68 испитаници, студенти од машки пол од прва година од Факултетот за физичка култура во Скопје.Врз избраниот примерок на испитаници беа применети вкупно 20 манифесни моторички варијабли од кои дванаесет (12) за проценка на координација и осум (8) моторички тестови за проценка на експлозивна снага. Оценувањето на техничката изведба на гимнастичкиот елемент премет напред на прескок извршено е од страна на 4 квалификувани судии кои добро го познаваа предметот на оценување. Во регресивната анализа како предиктори се употребени тестовите за координација и експлозивна снага, а како критериум е земен гимнастичкиот елемент премет напред на прескок. Предикторите покажале статистички значајно влијание врз критериумот.*

*Клучни зборови: прескок, координација, експлозивна снага, регресивни анализи, значајно влијание.*