# THE RELATIONS BETWEEN MORPHOLOGICAL CHARACTERISTICS AND SPEED AND STRENGTH WITH BOYS OF PREPARATORY GROUP

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***Abstract***

*The period of preschool age and lower grades of elementary school is a period of the most tempestuous changes of anthropological status of the organism. Exactly in this period, the human body is showing the greatest ability to adapt to environmental influences, under which physical activity is meant from the kinesiological standpoint. The aim of this study was to determine the relations between morphological characteristics and speed and strength with boys of preparatory group. Sample consisted of 40 boys 5-6 years old (+6 months). For the purposes of this research there were measuring instruments for evaluation of morphological characteristics: body height TVIS, body weight TMAS and siiting height SEDVIS; for speed evaluation: hand tapping TAPR, foot tapping TAPN, hand circling KRUR, Shuttle run test (STAF), speed of body extension BURP and 20m running speed TR20; for strength evaluation: hand dinamometry DINS, the standing long jump SKDA, throwing a medicine ball BMED, jumping on one leg for 7 meters 7MS, two foot jumping for 7 meters 7SNS and height pull up VISZG. Canonical correlation and regression analysis were used in data processing. Conclusion of this study shows a statistically significant relationship of morphological characteristics with both dimensions of motor abilities (speed and power), as well as some specific tests.*

***Keywords****: morphological characteristics, speed, strength, boys of preparatory group*

## Introduction

Most of the motor skills and habits are being developed and gained only during childhood and can be beneficially affected in pre-school age (4-7 years old) or in younger school period ( 7-11 years old). Speed is a trait, characterized by the ability to perform movement or movements with maximum possible speed for the given conditions, where it is assumed that the external resistance is not large and that the activity does not last long, in order not to fatigue. For speed, it is usually said that it is genetically determined by a high ratio of over 90% and it depends on the development of central nervous system and the mass of white muscle fibers, which indicates limited development opportunities. Modern researches have shown that the speed can be improved to a great extent by adequate resources of training, although it is largely genetically defined (by Sudarov, 2007). The speed is impacted by other more factors, such as the development of the musculoskeletal system, movement techniques, training level, strength, endurance, coordination and other internal and external factors. Speed also depends on fast and flexible strength, flexibility, motivation, concentration, inter and intra muscular coordination and others. Based on researches by some theory of training authors (Mero, Komi & Gregor, 1992; Dintiman, Ward & Tellez, 1997; Brown, Ferring & Santana, 2000) it have been separated the following types of speed: speed of reaction, the starting speed (acceleration), speed of stopping (deceleration), maximum speed, speed endurance and agility. Given the frequency of researches of strength, there are number of definitions, like "strength in the sport' is body ability and particular muscle ability (within movement activity) to substantially and effectively withstand to higher resistance" (Kurelić, 1967, 122). Strength can be divided into: Static strength - reflected in the ability of long-term maintenance of the maximum isometric tension-type, where there is no movement in order to prevent distortion of the current position; Dynamic strength (two types): Explosive strength - the ability to manifest the maximum strength for maximum short time (various jumps, running at 100m, 200m, sports games, martial arts kicks). Genetically conditioned by about 80%. The best results are achieved from 18-22 years, while in 28 it begins to decline. Repetitive (repeating) strength - muscles ability of exerting strength in a cyclic regime of work. For this kind of strength, alternation of tension and relaxation of muscles is characterized (push-ups, chin-ups, raising troops, squats). The aim of this study was to determine the relations between morphological characteristics and speed and strength with boys of preparatory group.

## Methods

In terms of temporal specificity, this study belongs to transversal researches and it consists of a single measurement of appropriate motor ability indicators (speed and strength) and some morphological characteristic indicators. The sample consisted of 40 boys, 5-6 years old (+6 months). Determining the level of morphological characteristics, speed and strength was realized in the preparatory group of *Kole Rasic* school in Nis. For the purposes of this research, measuring instruments for the assessment of morphological characteristics have been applied.

Those are: body height (TVIS), body weight (TMAS) and sitting height (SEDVIS); for the assessment of speed: hand tapping (TAPR), foot tapping (TAPN), hand circling (KRUR), Shuttle run test (STAF), speed of body extension (BURP) and 20m running speed (TR20); for the assessment of strength: hand dynamometry (DINS), the standing long jump (SKDA), throwing a medicine ball (BMED), jumping on one leg for 7meters (7MS), two foot jumping for 7 meters (7SNS) and height pull up (VISZG). Canonical correlation analysis and regression analysis were used for data processing.

## Results

*Relations between morphological characteristics and speed analyzed by correlation analysis*

Table 1 Canonical correlation analysis of morphological characteristics and speed

| | Can.R | Can.$R^2$ | Chi-sqr. | df | p | Lambda |
|---|---|---|---|---|---|---|
| 0 | .76 | .58 | 37.54 | 18 | .004 | .332 |

From Table 1 the result of testing the level of correlation between predictor system of morphological characteristics and speed as criteria system can be seen. There is a single significant canonical correlation of these systems at the level of p <.01. Canonical correlation of predictor and criteria system is explained by the size of the canonical correlation coefficient (Can.R = .76), which turned into a significant function amounts to p = .004. The coefficient of determination (Can.R2 = .58) explains the percentage connection between the two sets, so the impact of morphological characteristics on the speed is 58%.

Table 2 Canonical factors of morphological characteristics and speed

| | Root 1 | | Root 1 |
|---|---|---|---|
| TVIS | -0.87 | TAPR | 0.15 |
| TMAS | -0.95 | TAPN | -0.11 |
| SEDVIS | -0.32 | KRUR | 0.90 |
| | | STAF | -0.10 |
| | | BURP | -0.33 |
| | | TR20 | -0.39 |

Table 3 Crosscorelation matrix of morphological characteristics and speed

| Kros-korelacija | TVIS | TMAS | SEDVIS |
|---|---|---|---|
| TAPR | -0.06 | -0.14 | -0.04 |
| TAPN | 0.06 | 0.07 | -0.02 |
| KRUR | -0.64 | -0.62 | 0 |
| STAF | -0.01 | 0.17 | 0.25 |
| BURP | 0.19 | 0.23 | -0.07 |
| TR20 | 0.24 | 0.25 | -0.19 |

Canonical factor structure (Table 2) on the side of morphological characteristics indicates that the definition of the factor is most affected by body mass (TMAS -. 95) and body height (TVIS -. 87), while sitting height (SEDVIS -. 32) has much smaller contribution on defining the factor. Speed tests which have the greatest impact on defining the factor is hand circling (KRUR .90), speed of body extension (BURP -.39) and 20m running speed (TR20 -.39).

In the case of connection between predictor system of morphological characteristics and speed as criteria system, one general factor can be defined. Crosscorelation matrix of morphological characteristics and performance in tests of speed (Table 3) is characterized by coefficients of medium and low intensity. The most significant correlation can be seen in hand circling with body height and body mass (KRUR/TVIS -. 64; KRUR/TMAS -. 62).

*Relations between morphological characteristics and strength analyzed by correlation analysis*

Table 4 Canonical correlation analysis of morphological characteristics and strength

| | Can.R | Can.$R^2$ | Chi-sqr. | df | p | Lambda |
|---|---|---|---|---|---|---|
| 0 | .73 | .53 | 32.78 | 18 | .018 | .381 |

In the case of connection between predictor system of morphological characteristics and strength as criteria system (Table 4) significant canonical correlation of these systems is also established a at the level of p <.05. The size of the canonical correlation coefficient is Can.R = .73, which turned into a significant function amounts to p = .018. The coefficient of determination (Can.R2 = .53) explains the percentage connection between the two sets, and the influence of morphological characteristics on the strength is 53%. Looking at the structure of the canonical factors (Table 5) it can be seen that on the side of morphological characteristics, body height (TVIS -. 84) has the biggest influence on factor defining, while slightly less intensity of factor can be seen in body mass (TMAS -. 69) and sitting height (SEDVIS .42). In the canonical factor structure of the strength side, statistically significant defining belongs to throwing a medicine ball (BMED -. 43) and hand dynamometry (DINS .42).

In the case of connection between predictor system of morphological characteristics and strength as criteria system, one general factor can be defined. Crosscorelation matrix of morphological characteristics and performance in tests of strength (Table 6) shows the contribution of anthropometric measures of success in a specific motor skills at the individual level. Crosscorelation matrix coefficients are characterized by low intensity. The highest correlation can be seen at throwing a medicine ball with body weight and body height (BMED / TMAS .29; BMED / TVIS .26).

Table 5 Canonical factors of morphological characteristics and strength

| | Root 1 | | Root 1 |
|---|---|---|---|
| TVIS | -.82 | DINŠ | .38 |
| TMAS | -.69 | SKDA | .26 |
| SEDVIS | .42 | BMED | -.48 |
| | | 7MS | -.15 |
| | | 7SNS | -.16 |
| | | VISZG | .01 |

Table 6 Crosscorelation matrix of morphological characteristics and strength

| Kros-korelacija | TVIS | TMAS | SEDVIS |
|---|---|---|---|
| DINŠ | -0.2 | -0.18 | 0.15 |
| SKDA | -0.18 | -0.13 | 0.05 |
| BMED | 0.26 | 0.29 | -0.14 |
| 7MS | 0.2 | 0.1 | 0.09 |
| 7SNS | 0.1 | 0.02 | -0.08 |
| VISZG | 0.11 | -0.09 | 0.07 |

*Relations between morphological characteristics with speed and strength analyzed by regression analysis*

The results indicate a statistically significant impact on the morphological characteristics on the speed tests of hand circling (KRUR .000), speed of body extension (BURP .014) and 20m running speed (TR20, 000). At the individual level, anthropometric measures of body height (TVIS) and body weight (TMAS) have a significant impact on the hand circling (KRUR .031; .041) and 20m running speed (TR20 .029; .033). The influence of morphological characteristics on strength is observed in hands dynamometry (DINS .003) and throwing a medicine ball (BMED .001). At the individual level, body height (TVIS) has a significant impact on the hand dynamometry(DINS .004) and throwing a medicine ball (BMED .005) and body weight (TMAS) on the throwing a medicine ball (.019 BMED).

## Discussion

Physical education with adequate facilities stimulatively effects on the development of organic, functional and anthropomotoric abilities. Previous foreign and domestic studies of the school population point out the disproportion in the physical development and development of antropomotoric skills (Višnjić et al, 2004). A prerequisite for solving the other tasks of physical education is to establish a balance between physical development and physical abilities, with strictly respecting the age and individual psycho-physical characteristics in each stage of growth and development (Grandić, 1997). Children's organism in this period is characterized by a significant correlation between motor, cognitive and conative sphere, which is represented by well-known theory of integral development by Ismail. In other words, children of this age respond to physical activity with all theirs intellectual and conative capacities, so it is possible to affect the entire personality by physical exercise during this period. Children's motoric functioning is generally determined (Ismail & Gruber, 1971; Bala, 1981), which means that there are no differentiated motor skills at that age (children respond with their whole body and overall motor skills). An important characteristic of preschool and younger school age, is striking and emphasizing integrity of development, where the domains of child development (physical, motor, cognitive, etc..) are closely connected. Motor skills, or rather, general motor skills are being steadily improved during the preschool and early primary school period, but not always in a linear manner (Kulić, 2005; Popović, Cvetković & Grujičić, 2006; Cvetković, Popović & Jakšić, 2007). Changes in motor status are closely associated with changes in body constitution. Observation of the causal connections between these two areas is of great importance for the proper development of children's physical abilities, and successful selection for various sports. However, the age of preschool children is very ungrateful for researcing because of the frequent mistakes made by the respondents, especially for more complicated tests. In addition, it is possible that the results are due to a badly learnt and performed tests, and not the current level of motor skills, especially as the preschool period is yet undefined motor status (Bala, 1981). Therefore, any investigation should be taken into account, but with a certain amount of caution. Researches with similar epilogue as this study also indicate a significant relations of these two very important anthropological fields. In some works, these important relations are related to individual tests (Krsmanović, 1980), while other researchers point out the significance in the multivariate level of morphological and motor sphere (Matić, 2006; Turek, 2006; Veselinović et al., 2009).

## Conclusion

The conclusion of this study showed a statistically significant relations of morphological characteristics with both dimensions of motor abilities (speed and strength), as well as some individual tests. The speed significance is occurred in the hand circling (KRUR .000), speed of body extension (BURP .014) and 20m running speed (TR20 .000). The strength is represented by hand dynamometry (DINS .003) and throwing a medicine ball (BMED .001)

Table 7 Regression analysis of morphological characteristics with speed and strength

| Varijables | TAPR (q) | TAPN (q) | KRUR (q) | STAF (q) | BURP (q) | TR20 (q) |
|---|---|---|---|---|---|---|
| TVIS | 0.21 | 0.23 | 0.03 | 0.28 | 0.18 | 0.03 |
| TMAS | 0.40 | 0.78 | 0.04 | 0.19 | 0.33 | 0.03 |
| SEDVIS | 0.19 | 0.21 | 0.32 | 0.20 | 0.17 | 0.11 |
| Q | 0.13 | 0.17 | 0.00 | 0.25 | 0.01 | 0.00 |
| Varijables | DINŠ (q) | SKDA (q) | BMED (q) | 7MS (q) | 7SNS (q) | VISZG (q) |
| TVIS | 0.00 | 0.16 | 0.01 | 0.27 | 0.09 | 0.13 |
| TMAS | 0.13 | 0.12 | 0.02 | 0.17 | 0.25 | 0.13 |
| SEDVIS | 0.06 | 0.16 | 0.07 | 0.21 | 0.13 | 0.11 |
| Q | 0.00 | 0.09 | 0.00 | 0.11 | 0.12 | 0.10 |

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## RELACIJE MORFOLOŠKIH ZNAČAJKI I BRZINE I SNAGE KOD DJEČAKA U PRIPREMNOJ GRUPI


**Sažetak**

*Razdoblje predškolskog uzrasta i nižih razreda osnove škole predstavlja razdoblje najburnijih promjena antropološkog statusa organizma. Upravo tada ljudski organizam pokazuje najveću sposobnost adaptacije na utjecaje vanjske sredine, pod kojima se sa stanovišta kineziologije pre svega podrazumijeva fizička aktivnost. Cilj ovog istraživanja bio je utvrđivanje relacija između morfoloških karakteristika i brzine i snage kod dječaka pripremne grupe. Uzorak ispitanika činilo je 40 dječaka, uzrasta od 5-6 godina (+/-6 mjeseci). Za potrebe istraživanja primjenjeni su mjerni instrumenti za procjenu morfoloških karakteristika: tjelesna visina TVIS, tjelesna masa TMAS i sjedeća visina SEDVIS; za procjenu brzine: taping rukom TAPR, taping nogom TAPN, kruženje rukom KRUR, Shuttle run test (STAF), brzina opružanja tijela BURP i brzina trčanja na 20m TR20; za procjenu snage: dinamometrija šake DINŠ, skok udalj s mjesta SKDA, bacanje medicinke BMED, skokovi na jednoj nozi 7 metara 7MS, sunožni skokovi 7 metara 7SNS i vis u zgibu VISZG. Za obradu podataka korištene su kanonička korelacijska i regresijska analiza. Zaključak: ovo istraživanja pokazuje statistički značajne relacije morfoloških karakteristika sa obje dimenzije motoričkog prostora (brzina i snaga), kao i sa nekim pojedinačnim testovima.*



***Ključne riječi:*** *morfološke karakteristike, brzina, snaga, dječaci pripremne grupe*

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