# CORRELATION BETWEEN VARIABLES WITHIN HIGH SCHOOL STUDENTS: COMPARATION OF CONDUCTED RESERCH AND SECONDARY ANALYSIS

## Milazim KAMBERI, Shpresa MEMISHI, Adriatik KAMBERI

**Abstract**

Anthropometry is the general tool for defining overweight and obesity with body mass index (BMI) as the most common variable. Although BMI is widely used to identify overweight, the accuracy of BMI in predicting overweight and obesity varies with the degree of obesity, i.e., high accuracy in obese children and less for weak children.

According to the above, it is concluded that the annual increases in BMI during childhood are attributed to the increase in lean mass more than to the increase in fat mass, but they vary depending on gender and age. Hence, changes in the percentage of BMI do not necessarily reflect changes in adipose tissue in children over time, especially not in children with lower BMI values.

This paper aims to show the correlation of body mass index (BMI) with anthropometric variables associated with being overweight at different ages in childhood, especially during adolescence.

Within the paper, a research framework of secondary data is presented that refers to a group of children up to 16 years of age, i.e., the impact and relationship of anthropometric variables, according to age.

To prove the research question, it is needed to refer to the body mass index (BMI) which correlates with a few anthropometric variables related to overweight during different ages of childhood, which contribute the most to variations in the BMI in body mass index during childhood.

This paper aims to point out the strong correlations between BMI and standardized anthropometric variables. The conclusion is that this correlation is the weakest for the youngest age group and the highest between 7 and 12 years, and at the same time in both genders.

The main arguments will be used for further recommendations for the target group of adolescents within Macedonian society.

*Keywords:* Anthropometry, variables, BMI, body mass index, adolescents

## Introduction

Physical education is an important segment of a person's psychosomatic status. In this context, the growth and development of the human body are pointed out, within which quantitative, qualitative anatomical, physiological and psychological changes, as well as the development of sensory and motor skills, are analyzed on the developmental trend of the human being.

The child, from the youngest age, to a greater or lesser extent, can perform a certain physical activity. It is about motor skills, which are led by the so-called locomotor apparatus, which gives directions for movement. The performance itself, in turn, depends on anthropometric (morphological) characteristics. Consequently, it would be impossible to neutralize some influence of the morphological structure itself on the motor activity of the body (Ahmad, Al Molook, 2005).

On the other hand, to analyze a certain relationship, it is necessary to take into account the morphological characteristics of a child, more specifically, factors that have a certain impact on the realization of various movements i.e., can stimulate or limit performance.

This above relation creates morphological and functional changes in the tissues of the child's body, in a way that creates special structures and functions of the organic system, which is equivalent to a certain functional process of maturation.

It is estimated that 15 to 20% of American children between the ages of 6 and 17 are overweight, which is

an alarming result. The worrying problem of obesity does not pass Europe either, with the European Union having an authentic European Day of Obesity, May 22, 2010, under the umbrella of EOD, also a pan-European independent initiative that unites all responsible factors for public awareness of the problems of obesity weight and recognizing obesity as a chronic disease (Bala, 2013).

Within this scientific paper, the main emphasis is placed on determining the relationship between existing morphological characteristics and motor skills at a younger age, all to emphasize the role of physical culture and certain sports activities during the growth process. Additionally, the main guide of the presented theoretical-research framework in this paper is that within children there are intense and pronounced changes that dictate this ratio, as a result of changes in their growth and development. Consequently, there is, justifiably, great variability of results.

It is important to point out the long-term effectiveness of the conclusions and recommendations of this scientific paper, especially in terms of the implementation of practical knowledge in schools, more precisely, in terms of the crucial importance of physical education and sports activities.

## Methodology and findings

Within this paper, an analysis of three conducted types of research is made, in a different time and spatial framework, to extract common relevant data for setting future recommendations.

One of the researches applied in the framework of this paper refers to a group of 302 school-age children in the region of Serbia. Anthropometric measures are obtained using conventional criteria and measurement procedures, widely applicable, ie: (1) Body height (BH); (2) Weight (BW); (3) Body Mass Index (BMI) (Barbosa et al., 2016).

The realization of measurability in this case is performed by throwing a medicine ball. The child throws the medical ball weighing 2 kg, from a standing position to a place as far away as possible and without offenses. The result is a measurable throw length, with an accuracy of 10 cm. The second test exercise is through the child's bent frame. The bar is grasped with the help of a hand handle (the palms are turned away from the body), with the hands shoulder-width apart. Measuring the timing to get a result starts when the child is released, during which the child needs to be kept in this position as long as possible. The timing stops when the child's chin falls below the level of the bar or the head is tilted back to allow the chin to stay level with the bar. The result of this test is the retention time, measured in tenths of a second. Another exercise is by bending forward on the bench (FBB) (Rodić, 2012). The child stands on the bench and bows as deeply as possible. There is a rectangular ruler that points down with the 40 cm mark on the child's feet, and 40 cm below it is next to him/her. The result is the depth of reach measured in cm. The next exercise for obtaining data and results is a standing jump (SLJ). The child jumps with both feet from the back, which is denoted in cm. The result is the length of the jump in cm. Exercise - Sprint at 20 m (R20). At the command "RUN" the child who is behind the starting line must run 20 m as fast as he can to the end of the track (20 m). During this exercise, children run in pairs. The result is expressed in terms of running time, measured in tenths of a second.

The total number of tests is divided to ensure a minimal impact of the applied test on the result of any other test. What is especially important to point out in this type of research framework is the selection of measuring instruments, and their classification, as well as criteria for "reading" the tests, to prevent an objective approach. Children were measured according to five situations and five tests, with a break, and given instructions (Baylor, A, 2010).

In another study, the association between anthropometric parameters and lipid levels in Taiwanese school children was analyzed and evaluated. In terms of the methodology used, the analysis is set in several stages, to have a certain level of proportionality. To make the analysis sound, 1500 school children from 10 schools in the city of Taipei were taken into account (Chu, et al., 1998). During the analysis, the children as a target group were measured with anthropometric parameters including:

     - body weight,
     - body height,
     - waist circumference,
     - hip circumference
     - skin folds.

Additionally, the following were measured: total serum cholesterol (CHOL); triglycerides (TG); high-density lipoprotein-cholesterol (HDL-C); apolipoprotein A1 and B (ApoA1 and ApoB) - measured by standard methods; Low-density lipoprotein-cholesterol (LDL-C) and CHOL / HDL-C ratio was calculated by the formula.

In a study conducted by Rad and collaborators, the main goal is to see the differences in the anthropometric characteristics of high school students and the trend of change between them. It is important to note that anthropometric traits are closely related to improving health, as well as motor skills, and psychological and sociological development (Rad et al., 2018).

Regarding the methodological framework applied in this research, anthropometric parameters are presented, which include weight, height, and body mass index (BMI), the same measured in 60 students, male and female, aged $17 \pm 0.5$ years. Descriptive statistics and a t-independent test were used for data analysis.

## Results and Discission

One of the most stable and appropriate indicators for the growth and development of children is their height, which is considered the best indicator of the longitudinal dimension of the skeleton. Weight (BW) shows a moderate coefficient of variation in boys (CV = 14.7%), which indicates good homogeneity of results and representativeness of the arithmetic mean. All this confirms the fact that body weight as an indicator is a mixture of different types of tissue, due to which there is variation during growth and development, resulting in variable dimensions of volume and body weight due to the age and sex of children (Cole et al., 2010). In the context of this study, the mass index (BMI) has a mean coefficient of variation in boys (CV = 10.7%), which indicates very good homogeneity of the results.

One of the most widely used diagnostic tools for identifying children's weight problems is the assessment of healthy body weight based on the child's height. According to the research, the conclusion is as follows: according to the BMI data, in terms of gender and age of children, it is indicated that 2% of boys are underweight, 81% are healthy, overweight is 9% and 8% are fat boys. Comparing the results of research on motor variables, it could be concluded that there are only small differences between them. The differences relate mostly to the situation due to the vaguely stated age of children in available research, to numerical differences in results between the monthly chronological age of boys of the same age, and especially due to biological differences between boys (Djurašković et al., 2009).

The regression analysis of the first presented study shows that according to the existing morphological characteristics and motor abilities of the boys who are the target group, there are statistically significant relationships (p <0.01) that were affected by gender differences in boys. Additionally, it can be noticed that there is a positive influence of two morphological characteristics (body height and body weight) on the motor variable medicine throwing the ball, but also a negative impact on the variable standing jump in boys (Rodić, 2012).

The results of this research are compatible with a range of existing, relevant research conducted by other groups of authors. What is important to note and note as an inevitable result in this context is that there is a significant differentiation of motor skills, even in younger school-age children. Namely, the anthropometric characteristics of children in high school age and a little earlier, are especially important for the realization of motor constructions that represent a real biomechanical basis as factors that facilitate but also as factors that hinder the performance of motor tasks in physical education, as a compulsory school subject. The period of

younger school age is characterized by significant differences and undefined motor ability. The results of this research provide a solid basis for justifying the subject of physical education, especially from an early age in children, and according to the set plan, program, and organization, adapted to the age of children and their abilities and needs (Lu et al., 2013).

Regarding the results of the second study of Chu and the collaborators, according to the obtained results, the analysis included 1366 children (681 boys and 685 girls) with an average age of 13.3 g (from 12 to 16 years) and with valid anthropometric and biochemical parameters. Boys have higher body height (P <0.001) and higher body weight (P <0.05), waist circumference (P <0.01), and waist/hip ratio (WHR, P <0.001) than girls. As a difference between boys and girls, it is pointed out that girls, on the other hand, had larger skin folds than boys. After age adjustment, girls had higher total concentrations of CHOL, TG, HDL-C, LDL-C, ApoA1, and ApoB than boys. In general, TG was positively correlated with most anthropometric parameters (except body height); a similar negative correlation between HDL-C and anthropometric variables has also been observed (Chu, et al., 1998).

After controlling for age, smoking, alcohol, and puberty, lower body height was the strongest predictor of total CHOL, LDL-C, and ApoB concentrations in boys. In addition, although body mass index (BMI) was noted as a particularly important positive predictor (P <0.01) of the CHOL / HDL-C ratio, skin fold measurements were found to be the strongest anthropometric predictors of most concentrations of lipids in boys. In girls, WHR and BMI were found to be the strongest positive predictors of TG levels, but skin fold measurements were best for predicting HDL-C, LDL-C, ApoA1, and CHOL / HDL-C ratios (Chu, et al., 1998).

The main conclusion in the domain of this study of high school children, where was found that anthropometric parameters, such as body height, BMI, or WHR, are appropriate predictors of blood lipid levels; however, measurements of skin folds are generally more strongly associated with lipid levels in both sexes.

Regarding the third presented research, based on the obtained results, it is concluded that there are statistically significant differences in height (t = 7.40; P <0.000) and body weight (t = 3.62; P <0.001) of male and female students, while no significant difference was found in the BMI values in the two groups (t = -0.33, P> 0.001). In addition, it is found that 68% of male and female high school students with an average BMI of 25 and 13, respectively, have a normal dietary status; 14.6% of male and 10.5% of female students were malnourished; 21% of female students and 17% of male students had excessive malnutrition (Rad et al., 2018)

Obesity is one of the most serious health problems in Europe. The fight against this condition is especially difficult, and it is influenced by several factors. In the framework of the above-mentioned research, a target group of adolescents was included, within which differences in the final results were noticed, which refer to their somatic status, and above all to gender. More specifically, the target group of respondents sees a trend of changes in the psychosomatic status of the body with an emphasis on changes in physical status.

This research is used as a signal to note that overeating in children and adolescents is a complex disorder whose incidence has increased significantly in recent years, which is slowly but surely becoming a major health problem.

The main conclusion that should be paid special attention to is that obesity occurs as a result of insufficient physical activity in children, which becomes more important than any other genetic factor and predisposition to the disease.

The main assumption from this paper is that low physical activity has a major negative impact on the psychomotor and psychosomatic characteristics of students, equally in both sexes. Moreover, the greater the index exceeds the normal value range, the greater the risk of developing various heart diseases, diabetes, and high blood pressure (Katić et al., 2005).

Regarding the results of the research, it is concluded that both sexes of the respondents, in addition to the differences in physical status, had a normal diet, while some of them had the status of malnutrition. The result is supported by a six-year follow-up study in 300 subjects aged 10-16 years (20 references). It is suggested that a high BMI at age 10 predicts obesity at age 16.

According to the final results, it is noticed that there are significant differences in terms of body height and body mass between male and female students. As a second indicator, the nutritional status of children and adults is discussed, to prevent the tendency for hypertension, diabetes, increased blood fats, and metabolic syndrome, compared to those with normal waist circumference. However, heredity also plays a role in this domain (Martın-Espinosa et al., 2017).

Finally, according to the authors of this study, it is concluded that weight and obesity are under strong genetic control and that the environment in which a person grows up has a relatively small impact. Therefore, special attention should be paid to a healthy lifestyle as a means of preventing obesity, as an integral part of the modern lifestyle (Rodić, 2011).

As the main conclusion regarding this research, it is initially pointed out that, as technology advances and technological development, there needs to be a serious revision of lifestyle, especially in the area of dietary status and physical activity. In this context, special attention is paid to the liquid food that is consumed to solid food, which dictates the lifestyle of the student, but also to different age groups, which further reflects on the health benefits.

## Conclusion

The prevalence of obesity in children is increasing globally, which is a public health problem. The main reason for all this is the accelerated rate of unhealthy diets and reduced or insufficient movement. The consequences of this entire are most often associated with the usual chronic and metabolic disease and often occur more in the elderly than in the younger school ages.

Diagnosing the status of obesity and obesity at a younger age is becoming of particular interest among researchers to gain insight into the current status of growth and development potentials in any community. It is important to note that in the younger population, physical activity, even without reducing calorie intake, is a very effective method of reducing the risk of chronic disease, regardless of the degree of obesity. Many studies report that the health-related risk factors of obese people who engage in regular physical activity are no greater than sedentary people with ideal body weight. In addition, in a PubMed article, a review study suggested that grade 2 and 3 obesity was significantly higher in all-cause mortality compared with grade 1 and overweight (8).

This paper will present a secondary framework with research facilities for different areas of research, with a target group of young students and adolescents. The analysis is performed from the aspect of insight into the impact of anthropometric variables in students - high school, to set meaningfulanalyses and future recommendations for action.

# Reference

[1]. Ahmad S. Khazaen Al-Molook (2005). Anthropometric variables – high school cases. Tehran: Research Institute for Islamic and Complementary Medicine

[2]. Bala, G., Krneta, Ž., &Katić, R. (2013). Effects of Kindergarten Period on School Readiness and Motor Abilities. Collegium Antropologicum, 34(1), 61-67.

[3]. Barbosa VC Filho, Campos W, Fagundes RR, Lopes AS, Souza EA. (2016). Isolated and combined presence of elevated anthropometric indices in children: prevalence and sociodemographic correlates. Ci SaúdeColetiva. 21(1):213-224

[4]. Baylor, A. College of Medicine (2010). BMI Graph. Houston: USDA/ARS Nutrition Research Center.

[5]. Cole, T.J., Bellizzi, M.C., Flegal, K.M., & Dietz, W.H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. British Medical Journal, 320(7244), 1240-1243.

[6]. Chu, NF., Rimm, E., Wang, DJ. et al. (1998). Relationship between anthropometric variables and lipid levels among school children: The Taipei Children Heart Study. Int J Obes 22, 66–72

[7]. Djurašković, R., Kostić, R., Pantelić, S., Živković, D., Uzunović, S., Purenović, T., &Živković, M. (2009). A comparative analysis of the anthropometric parameters of seven-year-old children. Facta universitatis. Series: Physical Education and Sport, 7(1), 79-90.

[8]. Katić, R, Srhoj, L., &Pažanin, R. (2005). Integration of Coordination into the Morphological-Motor System in Male Children Aged 7–11 Years. Collegium Antropologicum, 29(2), 711-716.

[9]. Lu XI, Shi P, Luo CY, Zhou YF, Yu HT, Guo CY, et al. (2013). Prevalence of hypertension in overweight and obese children from a large school-based population in Shanghai, China. BMC Public Health.13:24.

[10]. Milanese, C., Bartolami, O., Bertucco, M., Verlato, G., &Zancanaro, C. (2010). Anthropometry and motor fitness in children aged 6-12 year. Journal of Human Sport &Exercize, 5(2), 265-279.

[11]. Martın-Espinosa N, Dıez-Fernandez A, Sanchez-Lopez M, Rivero-Merino I, Lucas-De La Cruz L, Solera-Martınez M, et al. (2017). Prevalence of high blood pressure and association with obesity in Spanish schoolchildren aged 4–6 years old.Plos ONE.

[12]. Rodić, N. (2004). Uticajmorfološkihkarakteristikanamotoričkesposobnostiučenikanižihrazredaosnovneškole. Nastavaivaspitanje, 53(1), 82-92.

[13]. Rodić, N. (2010). Uticaj 'sportskeigraonice' namotoričkesposobnostidecepredškolskogdoba. Pedagogija, 65(1), 148-158.

[14]. Rodić, N. (2011). Teorijafizičkogvaspitanja. Sombor: Pedagoškifakultet.

[15]. Rad, M., Torkamannejad, M Sabzevari, S., Rastaghi, Z. Dehnavi, M. (2018). The relationship between anthropometric index and primary dysmenorehea in female high school students, Journal of Education and Health Promotion 7(1), March 2018

[16]. Rodić, N. (2012). Relationship between anthropometric characteristics and motor abilities of boys in the first grade of elementary school. Sport Science 5(2):24-27