

## THE INFLUENCE OF BODY MASS ON CERTAIN MOTOR DIMENSIONS IN 1ST GRADE STUDENTS FROM SKOPJE

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(Original scientific paper)

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### Abstract

*Physical activity and maintenance of optimal body weight in children from an early chronological age is the foundation for further healthy living, prevention of chronological diseases and maintenance of optimal metabolic function. The population from which the sample was derived is defined as a stratified random sample, which consists of 1st grade students from the territory of the city of Skopje (100 respondents - 50 male and 50 female). The subject of this research is the determination of the influence of body mass on certain motor dimensions among students from 1st grade from Skopje. The objectives of this research are: determination of the body mass of students from the 1st grade, determination of correlations of the applied variables, determination of BMI (body mass index), determination of the height of the students, examination of biomotor abilities: 1. strength (static on upper extremity, explosive leg strength and abdominal repetitive strength), 2. speed (general and repetitive on upper extremity). In this research we used the following variables: morphological variables: body mass weight (TT), body height (TV), middle abdominal circumference (OSTO), upper arm circumference – extended (NADL), thigh circumference (NATK), mean chest girth (OGRA), biomotor variables: raising the upper body from the floor (PODI), tapping with the preferred hand (TAPI), standing long jump (SKOK), hang with straight elbows (ZGIB), running 5x10m. (T5x10) (TRC). For each applied variable, the following central and dispersion statistical parameters are calculated: arithmetic mean (AS), standard deviation (SD), estimation of the distribution of the results is tested with skewness (Sk), homogeneity of the results is tested with kurtosis (Ku), minimal score (Min), maximal score (Max), BMI determination, partial correlation analysis. All statistical procedures are calculated with modern statistical packages.*

**Key words:** *Physical activity, body mass index, skewness, kurtosis.*

### Introduction

The physical and health education in primary schools is an integral part of the overall upbringing and education. The aim of the teaching is to meet the students' needs for movement, increasing adaptive and creative abilities, developing positive psychological traits as well as forming health habits for a hygienic life. Physical and health education teachers in primary schools should encourage, motivate and strive the students to take care of their body weight and insist that they would be as active as possible during the day. Obesity and overweight in children is associated with lack of coordination and may cause inferior motor performance (Barros, W. M. A., Silva, K. G. D., Silva, R. K. P. et al., 2022). Research that was obtained showed that overweight subjects performed worse on locomotor and object tasks than subjects of normal weight (Morano, M., Colella, D., & Caroli, M. 2011). Those who possess higher motor competence in early childhood will tend to develop better motor competence in adolescence (Morrison, K. M., Cairney, J. A. et. al., 2018). Research on obesity has shown to lead to reduced physical activity in children (Metcalf, B. S., Hosking, J. et. al. 2011). The results of a review study showed that obesity may increase the likelihood of postural deformities in children (Paulis, W. D., Silva, S. et. al. 2014). Most of the postural deformities begin in childhood and their harmful effects can continue into adulthood (Brianezi, L., Cajazeiro, D. C., & Maifrino, L. B. M. 2017). The presence of genu valgum and flatfoot is higher in overweight/obese children (Shapouri, J., Aghaali, M. et. al. 2019). Chronic non-specific musculoskeletal pain in obese children has been reported to be common (El-Metwally, A., Salminen, J. J. et. al. 2004). (Tanamas, S. K., Wluka, A. et.

al.2012) found that an increase in adipose tissue and fat distribution throughout the body was associated with foot pain, yet this relationship was not evident with an increase in muscle mass.

### Method of work

The population from which the sample was derived is defined as a stratified random sample, which consists of 1st grade students from the territory of the city of Skopje (100 respondents - 50 male and 50 female). The subject of this research is the determination of the influence of body mass on certain motor dimensions among students from 1st grade from Skopje. The objectives of this research are: determination of the body mass of students from the 1st grade, determination of correlations of the applied variables, determination of BMI (body mass index), determination of the height of the students, examination of biomotor abilities: 1. strength (static on upper extremity, explosive leg strength and abdominal repetitive strength), 2. speed (general and repetitive on upper extremity). In this research we used the following variables: morphological variables: body mass weight (TT), body height (TV), middle abdominal circumference (OSTO), upper arm circumference – extended (NADL), thigh circumference (NATK), mean chest girth (OGRA), biomotor variables: raising the upper body from the floor (PODI), tapping with the preferred hand (TAPI), standing long jump (SKOK), hang with straight elbows (ZGIB), running 5x10m. (T5x10) (TRC). Before the beginning of the tests, it was explained to the students why this research is being carried out, they were given detailed instructions for the realization of the set tasks, and all the tasks were also demonstrated. The measurements were carried out in the morning hours, in the school halls. For each applied variable, the following central and dispersion statistical parameters are calculated: arithmetic mean (AS), standard deviation (SD), estimation of the distribution of the results is tested with skewness (Sk), homogeneity of the results is tested with kurtosis (Ku), minimal score (Min), maximal score (Max), BMI determination, partial correlation analysis. All statistical procedures are calculated with modern statistical packages.

### Results and discussion

Central and dispersive parameters of the morphological and biomotor variables among male students of the 1st grade are presented in table no. 1

Table 1. 1st grade male students

	AS	SD	Skw	Kurt	Min	Max
TT	25.83	7.40	2.6	8.44	19	53.8
TV	123	0.04	0.26	-0.94	116	134
OSTO	62.2	9.82	2.52	7.63	51	98
NADL	20.75	3.94	1.23	0.85	16	30
NATK	35.58	4.16	0.94	1.44	30	47
OGRA	65.16	8.44	2.91	10.03	57	98
SKOK	106.58	17.36	-0.44	-0.82	72	130
PODI	11.29	3.53	0.07	0.07	4	18
TRC	19.49	2.22	0.38	-0.67	16	24
ZGIB	14.25	9.79	0.76	-0.35	2	35
TAPI	18.7	2.19	-1.12	2.77	12	22

Table 2. 1st grade female students

	AS	SD	Skw	Kurt	Min	Max
TT	24,25	4,33	1,87	4,33	20	34
TV	120,69	6,03	0,58	0,07	110	134
OSTO	60,91	8,84	2,17	5,94	52	92
NADL	20,41	3,09	1,21	1,63	16	29
NATK	37	4,92	1,32	1,52	31	51
OGRA	63,29	7,50	1,91	4,25	55	88
SKOK	89,37	13,04	-0,34	-0,37	60	110
PODI	10,83	3,19	0,69	0,03	7	19
TRC	19	1,89	0,85	0,41	17	23
ZGIB	12,70	7,79	0,50	-0,37	1	30
TAPI	18,16	2,49	0,43	0,59	13	24

Central and dispersive parameters of the morphological and biomotor variables among female students of the 1st grade are presented in table no. 2.

### Determinatin of BMI

The reference values of the body mass index were analyzed according to the categorization by “Centers for Disease Control and Prevention”.

Table no. 3

BMI	Under weight (BMI<14,8)	Healthy body mass (14,8≤BMI<21,8)	Overweight (21,8≤BMI<25,2)	Obese (BMI≥25.2)
Male		17.10		
Female		16.84		

### Interpretation of the obtained results - motor skills and morphological characteristics of the students

Analyzing the data from the treated motor variables in the students, as well as their basic longitudinal and transversal dimensions, as well as weight data, we note that the average weight of the students is 25.04 kg. According to the Skw values, a moderate asymmetry of the data is observed, with leptokurtic, that is, narrow homogeneity of the results. The average body height of students of this age is 123 cm, while for female students it is 120.69 cm. The biggest differences between the minimum and maximum results appear among schoolgirls, that is, the minimum result is 110 cm, while the largest is 136 cm. These asymmetry results suggest moderate asymmetry, with leptokurtic homogeneity. 62.2 cm. is the average stomach circumference for male students, while for female students it is slightly smaller, i.e. 60.91 cm. In general, all results are of moderate symmetry and closehomogeneity. The circumference of the upper arm in the subjects is 23.16 cm, in the students AS=20.75, while in the schoolgirls AS=20.41, and the other parameters have a tendency to overlap with the stomach circumference variable. In contrast to the previous two variables, where the boys had relatively higher results, in the variable NATK - thigh circumference, higher AS values are shown by female students, i.e. 37 cm. while for boys that value is 35.8 cm. the dispersion of the results ranges within the expected results.

In the variable OGRA - chest circumference, the results of male students have relatively higher values (AS 65.16) than the values of female respondents (63.29), in relation to the total values of AS 63.29. The arithmetic mean of the long jump variable - SKOK, for boys AS is 106.58, while for girls it is somewhat lower and is 89.37 cm AS, with greater homogeneity of the results for schoolgirls. Asymmetry points to a moderate asymmetry of the obtained results. Analyzing the data from the PODI variable - indicates that boys had a higher AS 11.29, than girls with AS 10.83, where the SD values of 3.19 in girls are higher than the standard deviation values in boys. Results for both genders are almost identical, (inverse test). Arithmetic mean of the variable TRC running 5x10m. , differs by only 0.5 sec. The variable hanging with flexion in the elbow joint VIS, in both genders, indicates a deviation from the values of the results, which is observed from the data obtained with SD. TAPI tapping with the better hand is the last variable treated. The arithmetic mean for female students is 18.16, where boys have values of AS 18.7. Seen as a whole, and in the context of the nature of the research, we can accept that the applied variables for the assessment of the morphological and biomotoric dimensions of the students of the 1st grade, and based on the obtained results, an acceptable distribution of the individual results is present. Although a larger number of variables deviate from the normal distribution, we need to emphasize that this deviation does not produce side effects on the final results in data processing in this research, because these variables in the multidimensional space, together with the other factors, have a multivariate normal distribution. Analyzing the variables related to the morphological dimensionality of the students, we can notice that the students of the specified age (males) have higher values in the variables that determine the longitudinal and transversal dimensionality of the locomotor system, except for the variables that determine the circumference of the upper leg where female students have higher results. Variable 1 (body weight) has 4 statistically significant, large and positive correlation coefficients with variables 3, 4, 5 and 6 that determine abdominal circumference, upper arm circumference and chest circumference, there is a negative and large correlation with var. 8 (lifting the upper body from the ground). Variable 1 has a relatively medium and negative correlation with variable 10, that is, with the variable that determines the strength of the arms and shoulder girdle (flexion height). We notice that female students with a higher body weight show poorer results in the

variables that treat the strength of the arms and shoulder girdle, as well as the strength of the abdominal muscles. Body weight among male students has 5 statistically significant, large and positive correlation coefficients with variables 2, 3, 4, 5 and 6 that determine body height, abdominal circumference, upper arm circumference and chest circumference, as well as with var. 5 (thigh circumference). Variable 1 has a relatively medium and positive relationship with variable 9, that is, with the variable that determines running or general speed. From the stated results, it can be observed that students with a relatively higher body weight also have a larger muscle mass of the lower limbs, which enables better results in general speed.

## Conclusion

Bearing in mind the main subject of the research - determining the influence of body mass on certain motoric dimensions among students from the 1st grade from Skopje, this research was carried out, which was realized through 11 variables that determine the morphological and biomotoric status of the students who are 6 years old. For this purpose, through scientifically formatted, valid, reliable measuring instruments and motor tests, students of the specified age were tested in relation to the subject of research.

Based on the obtained results of data from the basic statistics that refer to the morphological and biomotoric status of the 1st grade students from Skopje, the following conclusions can be drawn: boys are heavier and taller than girls, female students have a larger thigh circumference than boys. All students have a healthy body mass according to BMI, boys have more explosive leg strength, stronger abdominal muscles, as well as more upper limb strength, and girls have better upper limb segmental speed and better general speed.

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