Original Article

Study regarding the level of physical and functional development of children from primary school level

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Abstract:

The research followed the idea of observing and assessing the level of physical and functional development of children from the primary school level. The experiment sample was formed from 46 students from 2nd and 3rd grade from Gymnasium School "Unirea" from Târgu Mureș, with aged between 8.00 ± 0.3086 , 22 males and 24 females. The study used mostly experimental methods of investigation, such as measuring the weight and height, calculating body mass index and statistical and mathematical methods for interpretation like descriptive statistics elements (frequency, mean, median, standard deviation) and analyzed with specific statistical test (the D'Agostino & Pearson test, t-Student test, Mann-Whitney test, the Chi-square test) all measured with the GraphPad Prism program. The results showed that we identified two children in 2nd grade (18.18%) who are overweight and three children in 3rd grade (27%) who fall into the overweight and obese category. The conclusions of the study indicate that prevention measures for overweight/obese children should begin in early childhood, before the age of 5–7 years. However, since increased BMI in childhood is only a moderate predictor of overweight or obesity later in life, general prevention efforts targeting all children are the most important. The anthropometric examination regarding the harmonious growth and development of young schoolchildren is a fundamental action because by this we can analyze whether the studied subject falls within the normal limits, exceeds or is below the level of development specific to gender and age.

KeyWords: *anthropometric measurements, body mass index, obesity, health through sports.*

Introduction

Contemporary educational organizations point out that children's experiences in sports and physical education contribute to mental acuity, skills, and harmonious motor development, which are important for fulfilling lifelong challenges. The perceived importance of physical education and its contribution to children's academic success vary considerably in the modern educational system (Joseph et al., 2016).

Physical activity, as stated by the World Health Organization (WHO) and confirmed by numerous studies, offers numerous health benefits, influencing the prevention of chronic diseases, balancing the daily energy consumption and maintaining adequate body weight. Overweight and obesity in children is a growing public health problem, and overweight in childhood years negatively affects anthropometric-functional development and health in adulthood. Physical activity, especially with healthy eating, can be a way of addressing this problem (Phillip et al., 2017).

Children are distinguished from adults by an essential element which is the complex process of growth and development, extremely dynamic, which starts from the moment of conception and then continues intrauterine throughout childhood and adolescence (Georgescu and Anca, 2015).

Middle-aged childhood, from 6 to 12 years old, is often referred to as the "forgotten years" of development, because most research focuses on early childhood development or adolescent growth. However, middle childhood is rich in potential for cognitive, social, emotional and physical progress. During this period, the brain is actively subjected to synaptic cutting and, as such, becomes more and more refined, a process that largely depends on the environment of a child. This discovery opens the door to optimizing the experiences a child has to provide a solid foundation for maturity (Kandice and Lee, 2012).

The self-esteem gained in sports can also enhance academic performance. However, this is not the only mechanism by which sport and school performance are connected. Studies have shown that physical activity produces growth factors and proteins that protect and stimulate the brain and improve memory, concentration, and attention. This finding is supported by research from the University of Illinois (Illinois, USA), which shows

that younger children in the same socioeconomic environment and with the same body mass index performed better on attention and memory assessment of complex tests (Chaddock et al., 2010a).

Active children also have significantly larger basal ganglia and hippocampus, areas responsible for maintaining attention, coordination and memory. In Sweden, a study of samples of 18-year-old boys in the army found that fitness correlated with higher IQs and satisfactory careers, even among identical twins. This supports the fact that childhood exercise can contribute to brain structure and function, thus enhancing future neuro-cognition. The impact of physical education on brain development, intelligence and mental health, in addition to general physical health, underlines the importance of encouraging physical education during middle childhood (Chaddock et al., 2010b; Aberga et al., 2009; Hillman et al., 2008).

Growth can be monitored by measuring weight, length, perimeters and other indicators that are determined at periodic and balanced assessments. The data obtained are compared with the normal values of healthy children, of the same age, sex and from the same geographical area, graphically represented by a bell-shaped Gaussian curve. From the standard values, the average is at the tip of the curve and the exceptions are expressed by the percentiles and standard deviations. Bone age is the most appropriate parameter for growth assessment, which is established by comparing the epiphyseal ossification centers of patients with standard radiographic clichés (Iordache, 2011).

The overweight/obesity rate is particularly high among young people with disabilities. For example, the use of data from the National Health and Nutrition Examination Study (NHANES) 1999 and 2010, Kim et al. (2013) found that adolescents (aged between 12 and 15 years) with disabilities have higher rates of obesity than peers of the same age without disabilities (20.9% vs. 14.2%). Overweight/obesity status was identified as a key factor in influencing self-assessment of overall health status (Haegele, 2018).

Physical education is a basic aspect of education, which influences the harmonious and normal development of the body, maintains health and helps to develop the physical qualities necessary for adult life. It is an important part of education that exerts its influence on the body and which provides the necessary conditions for the maturation of normal functions and development under favorable conditions of human personality (Ungureanu, 2010).

Physical education is a complex and multilateral activity, meant to help solve disorders, which refer to the health of children, optimizing the physiological functions of the body, increasing the work capacity, harmonious development of the body, and training of motor skills: skill, speed, strength, and resistance. A basic aspect of physical education is also the formation of a correct attitude (Kenareva, 2013).

Food rules for preschoolers and schoolchildren: it is indicated and represents the right age to introduce a whole cow's milk into the child's menu. The child's diet should be more and more similar to that of his family. Children need to have 3 main meals and 2 snacks between them (Săvescu, 2007).

Nutrition is very important for harmonious development and for the health of the child. By receiving the necessary nutrients, the child will develop at a normal rate, both physically and cognitively. In addition, the quality of the food should prevail, the child fed with healthy food will have fewer health problems both in childhood and in adulthood. Healthy eating will echo in his adult life, with a much lower risk of developing diseases such as diabetes, obesity and various forms of cancer (Epuran and Horghidan, 2009).

One of the fundamental objectives of physical education (PE) classes is for the students to adopt healthy lifestyle habits, as well as to participate in physical activity (PA) during their free time (Metzler, 2017).

However, only 20% of adolescents around the world practice PA, despite the multiple physical benefits (decreased obesity, prevention of heart disease, etc.) and psychological benefits (prevention of stress, depression, and body image disorder, etc.) which daily practice provides (Ekelund et al., 2016). To this effect, PE classes during primary and, especially, secondary education have been recognized as an ideal context in which to promote healthy physical-play activities during free time (Hagger et al., 2009; Trigueros et al., 2019a), in addition to improving physical abilities, and a wide range of competencies, such as cognitive and affective processes, motivation, and personal, social and emotional development (Trigueros, 2019b).

The role of the teacher during PE classes and his/her teaching style has been a very important element in various studies (Aelterman, 2014; Bartholomew, 2018) as teachers play a relevant role that needs to be evaluated in order to measure the effectiveness and quality of the teaching and learning processes; this will result in student effectiveness and effort, which could lead to an improvement in the quality of the educational experience and in the students being motivated (Garzon and Noguera, 2016; McKenzie and Lounsbury, 2014). A considerable amount of research has been developed that has analyzed the educational relationships between the teacher and his/her students based on a multitude of motivational theories. Promoting personal initiative, self-regulation, self-concept, offering relevant objectives, and the use of minimum contingencies, will encourage support for student autonomy. On the other hand, a controlling style refers to the teacher's use of external pressures, the use of coercive means, impositions, etc., which are perceived by students as the origin of their behavior, undermining their own initiative, effort, and personal self-knowledge (Hein et al., 2018). In the educational field, emotions are a very important element in student academic performance since they are a highly significant motivational element, acting as triggers for the motivational processes inherent in the students (Trigueros et al., 2019).

Objective of the research

The objective of the study is to analyze and compare the data obtained on the anthropometric indices monitored, respectively height, weight, and BMI, to determine the influence of external factors and the level of growth and development of the children involved in our study.

Hypothesis of the research

In our study, we started from the hypothesis that following the comparison of the anthropometric indices of the male students from the general school, where the research was carried out, we will be able to monitor the physiological or pathological evolution of the anthropometric-functional growth and development of the children in the primary cycle.

Material & methods

The study was conducted on a number of 46 children (22 males and 24 females) with an average age of 8.00 ± 0.3086 , from 2nd grade (22 children) and 3rd grade (24 children), from the primary level of School "DACIA" from TârguMureș. We monitored anthropometric indices like height and weight for all study participants, and calculated the body mass index for all of them with the purpose of finding their level of health. For the measurements, we used an electronic weighing scale and for height, we used a ruler. We also retained demographic data of our subjects like age and gender.

The study carried out by us investigates both the reference values regarding the height, weight, age and the number of training of children practicing a sport, as well as the rest period and the use of phones/computers. We tried to focus on male subjects, in order to compare the anthropometric indices of those who practice physical activity and those who do not.

The period in which the research was conducted was between 05.02.2018 and 05.03.2018.

This investigation was overseen in accordance with the Declaration of Helsinki (2013) and approved by the Ethics Committee before the beginning of the study. It also met the ethical standards for Sport and Exercise Science Research. Due to the fact that the General data protection regulation entered into the appliance on 25 May 2018 (Regulation (EU) 2016/679).

Results

The first step in conducting the study was the selection of a group of 46 children (22 males and 24 females), from 2nd grade (22 children) and 3rd grade (24 children), from a primary school. Each individual was measured and weighed separately. Through these methods we were informed about the level of bodily development of each individual. The results were noted and compared within 4 weeks.

Statistical analysis included descriptive statistics elements (frequency, mean, median, standard deviation) and inferential statistics. The D'Agostino & Pearson test was applied to determine the distribution of the analyzed data series. For comparison of means and medians, the t-Student test, parametric test for unpaired data, respectively Mann-Whitney test, non-parametric test for unpaired data was applied. To determine the association between the qualitative variables, the Chi-square test was applied. The significance threshold chosen for the p-value was 0.05. Statistical analysis was performed using the GraphPad Prism.

Table 1. Parameters of the sample of students

Parameters analyzed		Second grade (22) Mean $\pm$ SD (Median)	Third grade (24) Mean $\pm$ SD (Median)	Value of p
Age		8.00 $\pm$ 0.3086 (8.00)	8.917 $\pm$ 0.4082 (9.00)	*<0.0001
Height		133.6 $\pm$ 5.949 (134.0)	136.9 $\pm$ 5.828 (137.0)	0.0707
Weight		29.68 $\pm$ 7.894 (28.50)	34.25 $\pm$ 7.583 (31.50)	*0.0021
Gender	Female	11	13	0.7775
	Male	11	11	

Mann-Whitney test, $p < 0.05$, there is a statistically significant difference between the median age values for the 2 groups.

The t-Student test, $p > 0.05$, there is no statistically significant difference between the mean values of the height in the 2 groups.

Mann-Whitney test, $p < 0.05$, there is a statistically significant difference between the mean values of weight in the 2 groups.

Chi square test, $p > 0.05$, there is no statistically significant association between sex and class type.

Fig. 1. Statistical interpretation of parameters age, height and weight

Fig. 2. Graphical representation of measurements at the 2nd grade
 Table 2. Anthropometrical indices of children from 2nd grade

No.	Grade				Subjects	Age	Gender		Height	Weight
	I	II A	III	IV			Male	Female		
1		1			S.A	8		1	135	30
2		1			B.C	8	1		134	26
3		1			B.A	8	1		135	26
4		1			B.C	8		1	134	27
5		1			C.C	8		1	133	30
6		1			D.A	8		1	133	25
7		1			J.A	8	1		138	28
8		1			M.S	8	1		129	27
9		1			M.M	8	1		134	29
10		1			M.D	8	1		125	20
11		1			N.A	8		1	132	30
12		1			S.R	8	1		128	30
13		1			S.A	8		1	134	29
14		1			V.R	8		1	148	58
15		1			V.C	7		1	142	31
16		1			O.A	8	1		132	26
17		1			N.R	8	1		123	28
18		1			N.M	8		1	125	22
19		1			S.F	8	1		141	34
20		1			M.S	8		1	136	30
21		1			T.M	9		1	140	44
22		1			S.I	8	1		129	23

Fig. 2. Graphical representation of measurements at the 3rd grade

Table 3. Anthropometrical indices of children from 3rd grade

No.	Grade				Subjects	Age	Gender		Height	Weight
	I	II	III A,B	IV			Male	Female		
1			1		G.A	9		1	149	34
2			1		C.A	9		1	147	42
3			1		B.E	9		1	140	43
4			1		P.R	9		1	138	30
5			1		E.I	8		1	128	26
6			1		R.C	9		1	130	32
7			1		C.I	9		1	139	32
8			1		A.B	9		1	142	31
9			1		A.D	9		1	134	30
10			1		B.C	9		1	147	59
11			1		B.G	8		1	133	28
12			1		G.A	9		1	131	31
13			1		G.T	10		1	138	47
14			1		T.C	9	1		136,5	30
15			1		M.A	9	1		138,5	38
16			1		M.C	9	1		137	31
17			1		C.I	8	1		137	41
18			1		I.A	9	1		140	37
19			1		A.X	9	1		138	29
20			1		R.C	9	1		136	33
21			1		B.M	9	1		132	29
22			1		N.E	9	1		131	26
23			1		F.I	9	1		125,5	32
24			1		T.B	9	1		137	31

During this period the sleeping hours of each child were recorded, the nutrition and the level of physical effort they put into them were monitored. Following these results, we found that:

- Boys who slept at least 8 hours a night, had a proper diet and had moderate physical exertion during these 4 weeks, also increased in height, in some cases even surprising.

Fig. 3. Graphical representation of the comparison between classes II and III

Following the study, we concluded that the development of a child depends on both genetic and external factors, and failure to comply with the rules of healthy behavior could slow the normal growth rate of the individual.

Discussion

Following the study, we identified two children in 2nd grade (18.18%) who are overweight and three children in 3rd grade (27%) who fall into the overweight and obese category. This indicates to us that obesity prevention measures must be implemented from an early age. Our result is supported by a study by Evensen E. et

al. in 2016 in Norway, 532 children were followed from early childhood to adolescence. This study shows that 6 out of 10 children who were overweight or obese at the age of 5–7 years were classified in the same category at 15–17 years.

Also other studies discovered that overweight BMI and obesity conducts to flattening of the thoracic kyphosis and increasing lumbar lordosis (Grabara&Pstragowska, 2008). Thus lordosis was observed to develop in numerous cases of overweight or obese people due to the protruding stomach. As can be observed, the spine keeps the body strait and through this it develops arch at the lower back to hold the body strait (Wyszyńska et al., 2016).

It has been suggested that fat mass may be the cause of the outward appearance of a “flat” foot in obese individuals (Wearing et al., 2012).

As we can observe other studies focused their attention on varum knee deficiencies proving that BMI is a big factor causing this dysfunction affirming that nowadays, the effect of high levels of BMI on knee alignment has been tested on youth population, and the bigger the valgum dysfunction was observed among obese youth in late puberty (Boye et al., 2002; Taylor et al., 2006).

Conclusions

Prevention measures for overweight/obese children should begin in early childhood, before the age of 5–7 years. However, since increased BMI in childhood is only a moderate predictor of overweight or obesity later in life, general prevention efforts targeting all children are the most important.

The anthropometric examination regarding the harmonious growth and development of young school children is a fundamental action because by this we can analyze whether the studied subject falls within the normal limits, exceeds or is below the level of development specific to gender and age.

This study shows that the growth and physiological development of children can be traced using anthropometric indices. The height, weight, and BMI measured by us helped us to identify the subjects who do not fit within the normal limits corresponding to their age and sex, namely, we identified 4 overweight and one obese child after BMI.

Research in the field of somatometry is a large area and of particular importance in assessing the growth and physical development of students in primary education. This is a morphological study that appreciates the external human form. The use of these methods helps us to define the normal and abnormal physical limits and to determine the constitutional types.

Practicing physical education helps children acquire the necessary movement skills in every day life. Sport helps the permanent formation of new and new conditioned reflexes that are fixed but also improves the activity and structure of all the organs of the body. Moreover, the lack of adequate physical activity of the children in the family, in the preschool and school institutions influences the occurrence of disorders of the locomotor system (scoliosis, flatfoot, etc.) that can persist through out their life only being improved by treatment.

Introducing into the educational process the functional and motor training of students in the primary education cycle could have a positive impact on the level of motor training and health fortification, but also on the formation and acquisition of cognitive skills through the development of basic psychic processes (attention, memory, thought, perception and imagination), these being necessary for the harmonious development and integration of the student in the society.

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