CHANGES IN THE MOTOR PERFORMANCE OF CHILDREN IN PRIMARY EDUCATION

[a]MARIÁN MERICA, [b]PETER PETRIKÁN, [c]MÁRIA BELEŠOVÁ, [d]RÓBERT OSAĎAN, [e]RUDOLF HORVÁTH

[a c d] Faculty of Education of the Comenius University in Bratislava, Račianska, 59, 813 34 Bratislava, Slovak Republic
[b e] Pedagogical Faculty of Prešov University in Prešov, 17 November Street, no. 15, 080 01 Prešov, Slovak Republic
email: [a]merica@fedu.uniba.sk, [b]peter.petrikan.p1p@gmail.com, [c]belesova@fedu.uniba.sk, [d]osadan@fedu.uniba.sk, [e]47rudolf.horvath@gmail.com

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Abstract: In the paper, the authors approach the issue of motor performance of children in primary education by tracing trends in the development of somatic and motor characteristics over a 20-year period. Our research involved 924 children of younger school age from primary schools in five towns of the Eastern Slovakia region. The aim of the paper is to identify the current status and level of somatic and motor characteristics of primary school children in the primary schools of the East-Slovak region in relation to age and gender. To determine the level of motor skills we used selected tests from the EUROFIT battery. We compared the achieved research results of all children of our research (File 2019) with the results of research (Turek 1999). By analyzing and comparing the results, we highlight developmental trends over a 20-year period and also present an analysis of the causes of possible changes.

Keywords: Diagnosis, somatic and motor characteristics, EUROFIT-test, movement skills, coordination skills, comparison, younger school age.

1 Introduction

Knowing the state of movement abilities of children of younger school age in primary education contributes significantly to its positive influence in terms of prevention and the goal of the set requirements for children. By looking for effective models for the development of movement skills in physical and sports education, we will help children discover the benefits of movement activities and the possibilities of enjoying them. Their development should be carried out taking into account and respecting the age and individuality of each child and adult. We cannot imagine life in our schools without adequate physical activity. The authors (Goodway, Ozmun & Gallahue, 2019) state that childhood, especially the period of younger school age, is a crucial period for movement development. Supporting physical activities and motor competence, especially at this developmental stage, is very beneficial for a healthy and active lifestyle. Research on children's physical activity and health began around 1980. Some long-term studies still exist until today, e.g. Amsterdam Growth and Health Study, Young Finns Study, Leuven Longitudinal Study, Danish Youth and Sports Study, Northern Ireland Young Hearts Study. Physical activity is important for everyone's health, and studies such as the European Youth Heart Study report a high prevalence of cardiovascular disease risk factors, low muscle strength and low bone mass in children who do little physical activity. Nevertheless, there is a large proportion of children with physically inactive lifestyle.

Stavridou, Kapsali, & Panagouli et al. (2021) report that in 2019, 38.2 million children under 5 years were overweight or obese (almost half of them living in Asia) and more than 340 million children and adolescents aged 5–19 years were overweight or obese in 2016. The prevalence of overweight and obesity among children and adolescents aged 5–19 years has increased significantly from only 4% in 1975 to more than 18% in 2016. Although obesity and overweight were considered as a problem in high-income countries, there is also a rapid increase in low-income and middle-income countries. In the United States (USA), nearly 18.5% (13.7 million) children aged 2–19 were obese in 2017–2018.

According to Ruopeng et al. (2020) during the COVID-19 pandemic, extended school closures were mandated to reduce infection rates. However, it was a measure that disrupted the daily routine of distance learning children, limiting their regular, physical, extracurricular and outdoor activities, as public places were closed. The resulting reduction in energy expenditure was a factor associated with an increased risk of childhood obesity. Nagata, Magid & Gabriel (2020) stated that in addition, children's excessive screen time was associated with sedentary behavior and snacking, which are also associated with obesity and high blood pressure. In a group of 432,302 US children and teenagers aged 2–19, the rate of increase in body mass index (BMI) during the pandemic roughly doubled compared to the period before it. The biggest increases were seen in children aged 6–11 and those who were already overweight before the pandemic. Before the pandemic, children who were at a healthy weight gained an average of 1.55 kg per year. It increased to 2.45 kg during the pandemic. For those who were already mildly obese, weight gain increased from 2.95 kg per year to 5.45 kg after the outbreak of the pandemic. In the severely obese, the average annual weight gain increased from 4 kg to 6.6 kg.

The child should be led to movement activities from a young age, because the first habits are already formed during this period. Children perceive their parents as role models, and when they notice that their parents are not interested in physical activity, we can assume that the child will also imitate their attitude. We believe that among the factors that influence the entire process of motivating children to physical education and sports are primarily the quality and quantity of comprehensible information in everyday life, the climate of school and home, the teacher, coach and family, but also the child himself. According to (Horváth et al., 2010), somatic and movement testing has a wide scope and at the same time affects the individual, school, region, education and health departments, their orientation, with important goals for a healthy lifestyle for the whole society. The author Šimonek (2018) is of the opinion that when determining children's talent for sports, not only the level of motor skills should be monitored, but also the level of motor competences manifested in basic locomotion walking, running, jumping, throwing, rolling a ball, jumping rope, jumping over an obstacle, etc. The state of gross motor skills usually reveals the quality of children's motor skills more than performance in tests of motor skills.

Several authors, e.g. Antala et al. (2018), Antala (2021), Horváth et al. (2016), Merica & Barnáková (2021), Belešová (2022), Merica & Belešová (2022), Severini, E., Kožík Lehotayová, B., & Kuruc, M. (2020), Severini, Kožuchová & Brezovská (2021), Koreňová, Severini & Čavojský (2023) emphasize that teachers significantly influence the development of the educational system, unbringing and education itself. the importance of the teaching profession affects all areas of society's life. According to the authors Gunčaga, Žilková & Partová et al. (2019), Gunčaga & Belešová (2023), Kostrub (2022), Horecký, J., & Koreňová (2023) the teacher influences the character and quality of the relationship with the students, conditions the atmosphere in the classroom, stimulates the students' interest - including their relationship to sports and active physical activity, experiencing life at school, developing their knowledge and whole personality. Other authors, e.g. Gregor (2013), Harsa, Kaplánová, & Gregor et al. (2023), Horváth (2001), Kampmiller & Vanderka et al. (2012), Macura et al. (2022), Petrikán (2021), Turek (1999) recommend physical activities as part of a healthy lifestyle and emphasize the need for regular exercise in children from the earliest school age.

2 Methodology

Diagnosing should be the teacher's basic activity. The student's development is constantly monitored by the teacher, who looks forth causes of possible problems (Porubčanová & Zapletal, 2022). Individualized diagnosis mainly monitors the progress of pupils over a given period of time.

Goal. The goal of the article is to find out and identify the state of the level of somatic and motor characteristics of children of younger school age from primary schools in five cities in the

East Slovak Region and to find out the trends of their development by comparing our research - File (2019) with research - Turek (1999) and on the basis of the comparison try to analyze the causes of development. To determine the level of motor skills, we used selected tests from the EUROFIT battery by Moravec et al. (2002).

Tasks. Based on the goal we set, we set ourselves the following tasks: Select primary schools in the East Slovak region where we will conduct our research, conduct teacher training and explain the methodology of testing children. Select test items from the EUROFIT-test battery that we will use during testing. To carry out planned testing of children of younger school age in primary schools in the East Slovak region, to compare the results of our research (File 2019) carried out on 924 children of the East Slovak region with the results of research (Turek 1999), which carried out research on 3590 children of the East Slovak region. Statistically process and evaluate the measured results.

Hypotheses. On the basis of the goal and tasks of the work, we made the following hypotheses (H0-1, H1-1, H0-2, H1-2, H03, H1-3):

H0-1: we assume that there will be no statistically significant differences in somatic characteristics between the results of the children from the research - Turek (1999) and the results of our research - File (2019).

H1-1: we assume that there will be statistically significant differences in somatic characteristics between the results of the children from the research - Turek (1999) and the results of our research – File (2019).

H0-2: we assume that there will be no statistically significant differences between the results of the children from the research - Turek (1999) and the results of our research - File (2019) in the tests of motor characteristics in individual test items.

H1-2: we assume that there will be statistically significant differences between the results of the children from the research - Turek (1999) and the results of our research - File (2019) in the tests of motor characteristics in individual test items.

H0-3: we assume that the results in motor characteristics of children from our research - File (2019) will be better than that of children from our research - Turek (1999).

H1-3: we assume that the results of the children's motor characteristics from our research - (File (2019) will be worse than the results of the children from the research - Turek (1999).

Characteristics of the research object: Our research was attended by 924 children of younger school age from elementary schools (ES) of the East-Slovak Region in the cities of Michalovce, Košice, Veľké Kapušany, Prešov and Trebišov. Of these, there were 448 boys and 476 girls. They were students of the first, second, third and fourth grades. In our research - File (2019) we included: 7, 8, 9 and 10-year-old children of younger school age, while for 7-year-olds we consider the decimal age 7.00-7.99, for 8-year-olds the decimal age 8.00-8, 99, for 9 years decimal age 9.00-9.99 and 10 years decimal age 10.00-10.99.

Data acquisition methods: We chose the following tests to determine the data we are tracking. For somatic characteristics, we chose: 1. BH (body height), 2. BW (body weight), 3. BMI (Body Mass Index). For motor characteristics, we selected the following items from the EUROFIT test:

1. Test (PRKL) – Forward bending with reaching while sitting. Factor: joint mobility and flexibility of the body of the sitting part of the body and the back of the legs.
2. Test (SKOK) - Long jump from a place. Factor: explosive power of the lower limbs.
3. Test (LS) – Sit up in 30s. Factor: dynamic and endurance strength of the abdominal, hip and thigh muscles.
4. Test (VZH) – Pull-up. Factor: static, endurance strength of the muscles of the upper body.
5. Test (CBEH) – Shuttle run 10 x 5m. Factor: running speed with changes of direction.
6. Test (VBEH) – Endurance shuttle run. Factor: running endurance.

Methods of processing and evaluating the results: We statistically processed and evaluated the measured data. We digitized the measured values recorded in the recording sheets as an input database, which we processed using the EXCEL program from the Microsoft Office package. The first step, before processing the research data, was the exclusion of extreme values (outliers). We evaluated somatic indicators using percentile charts. Since we want to test hypotheses about the statistical significance of file differences, we had to decide what type of test to use. When deciding between parametric and non-parametric tests, the deciding factor is the normality of the sets and whether the variances of the sets are not significantly different. We tested normality with the Shapiro-Wilk normality test, and variances were tested with the F test. Since normality was confirmed and the results of the F test did not show significant differences in the variances, we used the parametric T test, the so-called "one simple t test", to test the hypotheses. The formula that this t test is based on is

$$t = \left(\frac{x_{1999} - x_{2019}}{s}\right)\sqrt{n}$$

where x_{1999} and x_{2019} are the arithmetic means of the sets, s is the standard deviation, n is the number of probands in the set. We compared the calculated value of t at the assumed level of significance α=0.05 with the table value of the Student's distribution at n-1 degrees of freedom tcrit. If t>tcrit, we reject the null hypothesis H0 and accept the alternative hypothesis H1. The use of several statistical methods can also be found in the authors Hendl (2006), Tomšik (2017), Gunčaga, Zawadowski, Prodromou (2019) and others.

3 Results and discussion

We present the results obtained from the testing of somatic indicators and motor movement skills in children of younger school age (n=924) from elementary schools in five cities in the East Slovak Region in tables and graphs with a view to individual six hypotheses. There were (448) boys and (476) girls in the group we monitored. They were students of the first, second, third and fourth grades. In Tab. (1) we present the number and composition of our monitored file: File (2019) in the number of 924 children.

Tab. 1: Number and composition of sets of children of younger school age (n=924): File (2019)

	Boys					Girls					Summary
	7 years old	8 years old	9 years old	10 years old	Total	7 years old	8 years old	9 years old	10 years old	Total	
Elementary school in Michalovce	26	24	24	24	98	27	27	25	25	104	202
Elementary school in Košice	23	24	24	24	95	24	24	24	24	96	191
Elementary school in Veľké Kapušany	10	34	17	24	193	25	32	29	32	200	393
Elementary school in Prešov	13	15	14	14	56	17	15	15	15	62	118
Elementary school in Trebišov	30	30	27	27	114	21	24	25	26	96	210
Summary	102	127	106	113	448	114	122	118	122	476	924

3.1 Somatic characteristics of children of younger school age

In the following tables (Tab. 2, 3) we present the somatic characteristics of children of younger school age in our monitored set: File (2019) in number (n=924), which we also specified for the category: 7- and 8-year-old children and for the category: 9 and 10-year-old children.

Tab. 2: Somatic characteristics of children of younger school age (7 and 8 years old): File (2019)

Age			7						8					
			n	x	s	T	tcrit	T-test	n	x	s	T	tcrit	T-test
BH	B	1999	446	126,11	6,30				423	129,58	5,31			
		2019	102	128,96	12,5	2,937	1,993	**	127	132,02	7,12	2,89	1,993	**
	G	1999	452	125,02	5,19				403	131,41	5,98			
		2019	114	126,04	5,20	2,01	1,992	**	122	129,16	5,35	4,65	1,987	**
BW	B	1999	446	24,82	3,94				423	27,83	4,91			
		2019	102	26,65	5,06	7,69	1,993	**	127	29,74	6,86	2,37	1,993	**
	G	1999	452	20,78	3,10				403	27,83	3,00			
		2019	114	24,54	4,67	6,28	1,993	**	122	29,68	6,35	5,25	1,950	**
BMI	B	1999	446	15,20	9,56				423	15,93	1,91			
		2019	102	16,73	2,60	3,23	1,993	**	127	16,88	2,94	3,25	1,993	**
	G	1999	452	15,91	9,75				403	16,06	2,11			
		2019	114	16,8	2,31	2,01	1,992	**	122	16,93	3,12	2,51	1,992	**

Legend: BH (body height), BW (body weight), BMI (Body Mass Index), B (boys), G (girls), n (number of probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), tcrit (critical value of Student's distribution at n-2 degrees of freedom), ** (statistically significant difference of the T-test at the 0.05% level).

Tab. 3: Somatic characteristics of children of younger school age (9 and 10 years old): File (2019)

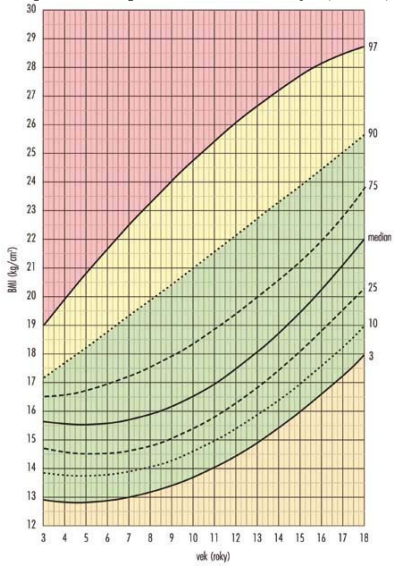
Age			9						10					
			n	x	s	T	tcrit	T-test		x	s	T	tcrit	T- test
BH	B	1999	424	135,95	5,80				528	141,14	6,43			
		2019	106	137,76	5,91	0,890	1,994	**	113	143,07	7,52	2,69	1,940	**
	G	1999	370	134,37	5,50				510	140,67	6,86			
		2019	118	136,05	5,57	2,34	1,993	**	122	139.85	8,40	2,77	1,990	**
BW	B	1999	424	32,85	5,19				528	33,58	6,93			
		2019	106	31,35	7,68	2,37	1,994	**	113	38,14	8,91	5,37	1,994	**
	G	1999	370	30,89	3,56				510	33,73	7,15			
		2019	118	32,87	7,37	2,96	1,993	**	122	37,35	8,27	5,05	1,990	**
BMI	B	1999	424	16,84	2,30				528	17,48	4,53			
		2019	106	17,20	3,08	2,47	1,994	**	113	18,56	3,47	3,37	1,954	**
	G	1999	370	16,76	2,30				510	19,49	10,37			
		2019	118	17,64	3,15	3,08	1,993	**	122	18,37	3,02	4,08	1,990	**

Legend: BH (body height), BW (body weight), BMI (Body Mass Index), B (boys), G (girls), n (number of probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), tcrit (critical value of Student's distribution at n-2 degrees of freedom), ** (statistically significant difference of the T-test at the 0.05% level).

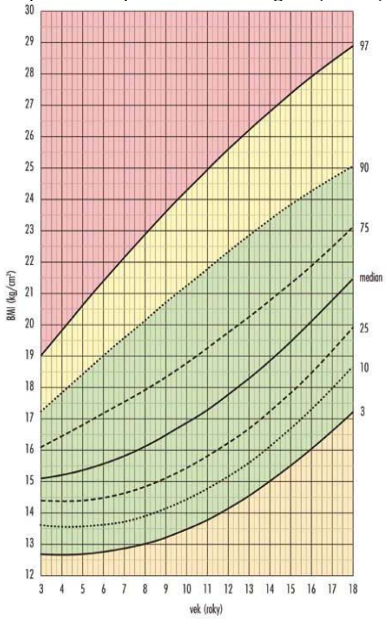
When analyzing the results of the T-test (Tab. 2, 3), we can state that in all age categories there are statistically significant changes in body height and body weight and thus also an increase in BMI. However, the increase in body weight is much higher than in height, as evidenced by the increase in BMI. Body weight gain increases with age. While for boys there is an increase of 7% for 7-year-olds, it is already 12.2% for 10-year-olds. In 7-year-old girls, the weight increase compared to the measurement of Turek (1999) is by 8%, but in 10-year-old girls by up to 11.2%. Of course, the BMI of 7-year-old boys and girls increases proportionally by 11% and 10-year-olds by 15%. From these figures, we can see that the weight of children of younger school age has been growing at a high rate for the last 20 years. If we consider that Turek (1999) already recorded an increase in weight in his research compared to the research of Moravec (1996), this fact is even more interesting.

In the following graphs (Graph 1, 2) we present the BMI percentile values for boys and girls.

Graph 1: BMI percentile chart - boys (n=448)



Graph 2: BMI percentile chart - girls (n=476)



Also on the BMI percentile graphs (Graph 1, 2,) we can see in both boys and girls that while in the research: Turek (1999) the average BMI values were below the median, in our measurement (File 2019) the average values are at the level of 65. up to the 75th percentile. We can therefore state that the hypothesis H0-1 was rejected and therefore we accept the alternative hypothesis H1-1, that there are statistically significant differences between the results of somatic indicators according to the research - Turek (1999) and our research – File (2019).

3.2 Evaluation of motor tests

In the following tables (Tab. 4, 5) we present the motor characteristics of children of younger school age of the group we monitored (n = 924) - File: (2019), which we also specify for children of younger school age (7 and 8 years old) and children younger of school age (9 and 10 years old).

Tab. 4: Motor characteristics of children of younger school age (7 and 8 years old): File (2019)

Motor characteristics of children of younger school age														
Age			7						8					
			n	x	s	T	tcrit	T Test	n	x	s	T	tcrit	T Test
PRKL	B	1999	446	20,56	5,77				423	21,10	5,67			
		2019	102	19,56	12,41	9,15	1,993	**	127	12,45	7,38	13,35	1,993	**
	G	1999	452	21,65	6,01				403	21,13	7,14			
		2019	114	12,49	7,33	13,39	1,992	**	122	14,10	7,24	10,75	1,980	**
SKOK	B	1999	446	115,13	18,15				423	130,31	13,89			
		2019	102	108,91	20,49	3,10	1,993	**	127	119,89	18,96	6,26	1,993	**
	G	1999	452	108,73	16,63				403	122,11	14,28			
		2019	114	101,61	19,03	4,011	1,992	**	122	113,52	20,92	4,53	1,980	**
LS	B	1999	446	15,66	5,311				423	17,07	4,37			
		2019	102	16,82	9,92	0,95	1,993		127	16,66	4,80	0,93	1,993	
	G	1999	452	14,59	4,99				403	15,80	4,07			
		2019	114	13,58	4,89	2,206	1,992	**	122	15,50	4,30	0,742	1,980	
VZH	B	1999	446	12,06	8,84				423	15,62	10,94			
		2019	102	7,22	9,08	6,11	1,993	**	127	12,25	11,84	3,20	1,993	**
	G	1999	452	10,12	7,75				403	10,75	9,42			
		2019	114	7,13	6,86	4,66	1,992	**	122	10,59	9,52	0,17	1,980	
CBEH	B	1999	446	26,56	7,61				423	24,47	0,35			
		2019	102	24,71	3,33	5,67	1,993	**	127	24,60	4,06	0,35	1,993	
	G	1999	452	26,54	3,66				403	25,67	2,52			
		2019	114	25,51	3,02	2,84	1,992	**	122	24,85	3,51	2,58	1,980	**
VBEH	B	1999	446	20,80	5,61				423	22,43	11,54			
		2019	102	18,72	9,05	3,65	1,992	**	127	21,36	9,03	2,34	1,993	**
	G	1999	452	18,91	9,45	4,03	1,992	**	403	19,04	8,64	0,69	1,980	

Legend: n (number of tested probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), tcrit (critical table value of Student's distribution at n-2 degrees of freedom), ** (statistically T-test significant difference at the 0.05% level).

The motor tests in the tables (Tab. 4, 5) and in the graphs (Graph 1 – 12) are indicated by abbreviations that mean: 1. Test (PRKL) - Forward bending with reaching while sitting. 2. Test (SKOK) - Long jump from a place. 3. Test (LS) – Sit up in 30s. 4. Test (VZH) – Pull up. 5. Test (CBEH) – Shuttle run 10 x 5m. 6. Test (VBEH) - Endurance shuttle run.

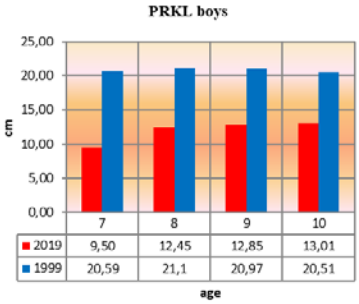
Tab. 5: Motor characteristics of children of younger school age (9 and 10 years old): File (2019)

Motor characteristics of children of younger school age														
Age			9						10					
			n	x	s	T	tcrit	T test	n	x	s	T	tcrit	T test
PRKL	B	1999	424	20,97	6,71				526	20,51	5,72			
		2019	106	12,85	7,18	8,49	1,995	**	113	13,01	7,42	5,25	1,993	**
	G	1999	370	22,32	5,66				510	21,78	6,16			
		2019	118	15,81	6,06	11,85	1,992	**	122	14,17	7,31	5,46	1,980	**
SKOK	B	1999	424	141,33	3,01				526	155,15	18,91			
		2019	106	135,81	20,49	8,49	1,993	**	113	135,42	22,55	5,25	1,993	**
	G	1999	370	131,76	15,63				510	142,28	18,55			
		2019	118	122,97	19,95	4,86	1,992	**	122	125,28	21,85	5,46	1,980	**
LS	B	1999	424	19,02	4,32				526	21,46	4,48			
		2019	106	19,91	5,101	1,84	1,993		113	19,03	5,00	5,25	1,993	**
	G	1999	370	17,11	4,37				510	19,64	5,62			
		2019	118	17,09	5,46	0,045	1,992		122	17,28	4,45	5,46	1,980	**
VZH	B	1999	424	16,94	12,36				526	19,53	15,42			
		2019	106	17,14	15,40	0,138	1,993		113	15,52	13,49	5,25	1,993	**
	G	1999	370	12,11	8,55				510	13,22	9,93			
		2019	118	10,69	8,64	1,71	1,992		122	12,81	11,40	5,46	1,980	**
CBEH	B	1999	424	24,03	4,48				526	22,45	2,52			
		2019	106	23,98	3,45	0,151	1,993		113	21,83	3,24	5,25	1,993	**
	G	1999	370	24,59	2,64				510	23,75	3,33			
		2019	118	24,34	4,55	0,665	1,992		122	24,11	3,49	5,46	1,980	**
VBEH	B	1999	424	29,95	13,66				526	31,87	13,50			
		2019	106	31,64	16,75	0,89	1,993		113	29,36	16,37	5,25	1,993	**
	G	1999	370	23,31	10,72				510	23,37	9,35			
		2019	118	22,86	11,77	0,70	1,992		122	24,48	11,38	5,46	1,980	**

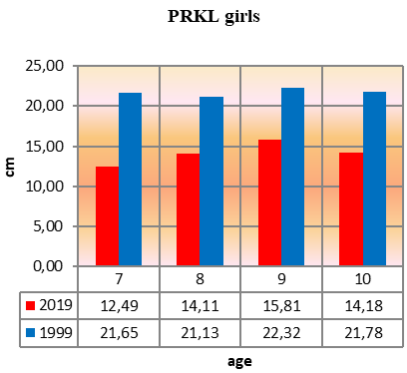
Legend: n (number of tested probands), x (arithmetic mean of values), s (standard deviation), T (calculated value from the T-test), tcrit (critical table value of Student's distribution at n-2 degrees of freedom), ** (statistically T-test significant difference at the 0.05% level).

In Tab. (4, 5) show arithmetic averages, standard deviations, and t-test results of measured values from individual items of the EUROFIT-test files (Turek 1999), which is a file from the research: Turek (1999) and from our research carried out in 2019: (File 2019).
In the next part (Graph 3 – 14) we present the results of individual motor tests, including the attitude towards individual hypotheses.

Graph 3: Forward bending with reaching while sitting (PRLK): boys: n=448 (factor: joint mobility of the trunk)



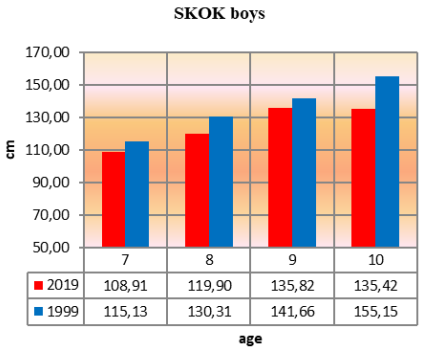
Graph 4: Forward bending with reaching while sitting (PRLK): girls: n=476



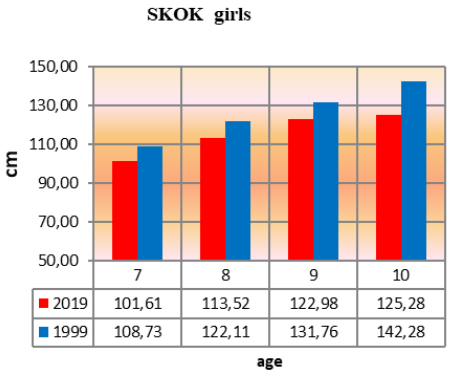
The test item (PRKL – Forward bending with reaching while sitting) represents the joint mobility of the trunk (Graph 3, 4). The achieved results show statistically significant differences between the children from the research - Turek (1999) and our

research - File (2019). The differences are in favor of the set (Turek 1999) and are better than the results of our research (File 2019). The results in the set of boys and girls change at least with age, even in the set of girls (File 2019) the results of 9-year-old girls are better than the results of 10-year-old girls. We can be inclined to believe that the worse results we observed in our research (File 2019) are related to a statistically significant increase in weight.

Graph 5: Long jump from a place (SKOK): boys (factor: explosive power of the lower limbs)

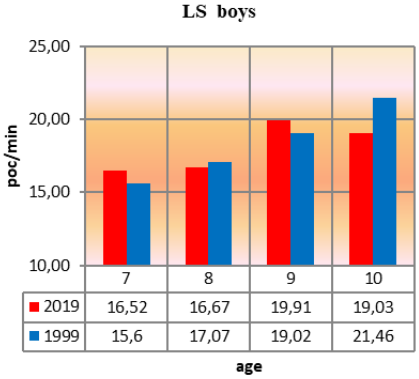


Graph 6: Long jump from a place (SKOK): girls

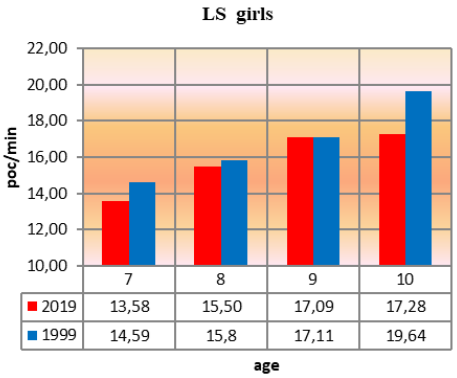


In the test item (SKOK - long jump from a place), which reflects the explosive power of the lower limbs (Graph 5, 6), it can be found that both in boys and in girls the results of the research - Turek (1999) are better than the results of our research - File (2019) in all age categories. We see the most striking differences in the age category of 10-year-old boys and girls. In the category of 10-year-old boys (Turek 1999), performances in the standing long jump are up to 14.5% better than in our research (File, 2019). For girls, this difference is 13.5% in favor of 10-year-old girls from the ensemble (Turek 1999).

Graph 7: Sit up (LS): Boys (factor: dynamic and endurance strength of the abdominal, hip and thigh muscles)

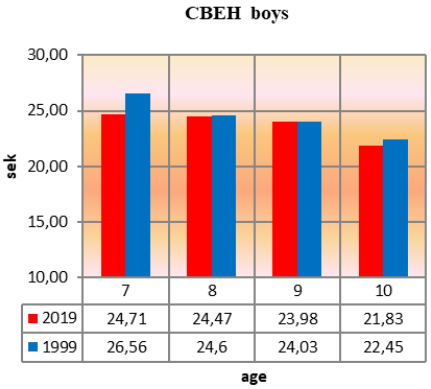


Graph 8: Sit up (LS): Girls

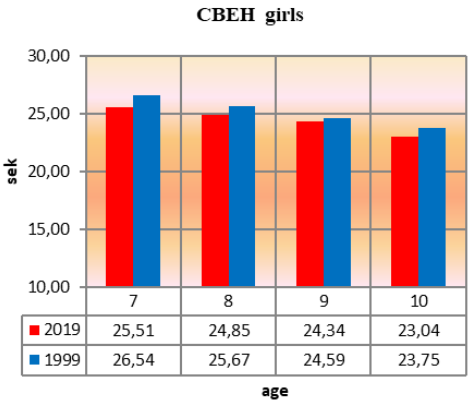


The evaluation of the test item (LS: Sit up), which determines the dynamic and endurance strength of the abdominal and hip-femoral muscles (Graph 7, 8) is not clear-cut. For boys, the research results (Turek 1999) are better only in the age category of 8 and 10 years, statistically significant only in 10-year-old boys. For girls, the results in all age categories are better in research (Turek 1999), but statistically significant only for 7 and 10-year-olds.

Graph 9: Pull-up (VZH): Boys (factor: static, endurance strength of the muscles of the upper body)

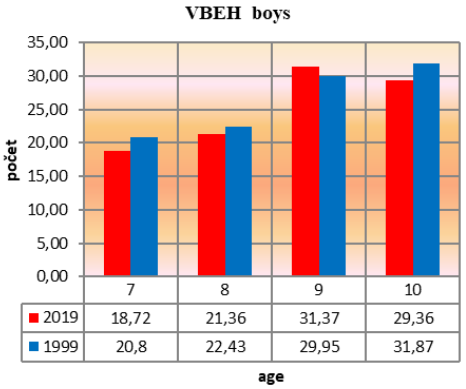


Graph 10: Pull-up (VZH): Girls

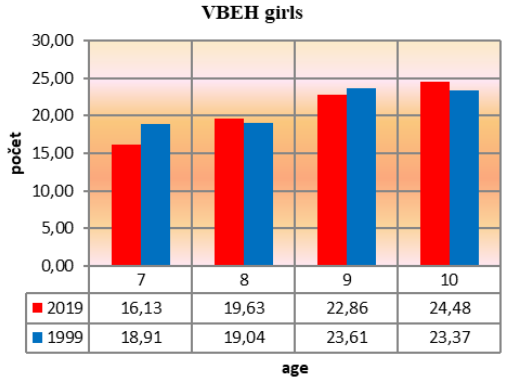


When analyzing the results of testing the item (VZH – Pull-up), which determines the static and endurance strength of the muscles of the upper limbs, we see (Graph 9, 10) that better results were achieved by boys (Turek 1999) in the age categories of 7, 8 and 10 years old, only in the age category of 9-year-old boys were better results in our research (File 2019), also not statistically significant. For girls, similarly better results were achieved in the set (Turek 1999) for 7, 9 and 10-year-old girls.

Graph 11: Endurance shuttle run (VBEH): boys (factor: running endurance)



Graph 12: Endurance shuttle run (VBEH): Girls



In the test item (VBEH - endurance shuttle run) the results are ambiguous (Graph 11, 12). For boys in the age categories of 7, 8 and 10 years, the results are better in the ensemble (Turek 1999). In 9-year-old boys, boys recorded better results (File 2019). The situation is similar for girls, in the age categories of 7 and 9-year-old girls, better results were recorded in the ensemble (Turek 1999), but in the categories of 8 and 10-year-old girls, the girls from our research had better results (File 2019).

3.3 Statement on hypotheses

The results of our research show the following: in the null hypothesis H0-1 where we assumed that there would be no statistically significant differences in somatic characteristics between the results of the somatic characteristics of children from the research of Turek (1999) and the results of our research (File 2019). We disproved this hypothesis with the t-test and the alternative hypothesis H1-1 is valid, that there are statistically significant differences in the somatic characteristics of the children from the research (Turek, 1999) and the results of our research (File 2019), which applies to all age categories and both boys and girls. Children of younger school age from our research (File 2019) have higher weight, body height and higher BMI (Body Mass Index) than the children from the research (Turek 1999).

In the null hypothesis H0-2, we assumed that there would be no statistically significant differences between the results of children from the research of Turek (1999) and the results of our research (File 2019) in the tests of motor characteristics in individual test items. This hypothesis was unambiguously refuted by the t test, and the alternative hypothesis H1-2 is valid, that there are statistically significant differences between the results of the children from the research of Turek (1999) and the results of our research (File 2019) in the tests of motor characteristics in the individual test items.

In hypothesis H0-3, we assumed that the results in the motor characteristics of the children from our 2019 research would be better than the results of the children from the research (Turek 1999). We unequivocally disproved this hypothesis only for test items (PRKL, SKOK and VZH), where the alternative hypothesis H1-3 is valid, that the results of the research children (Turek 1999) are statistically significantly better than the results of the children from our research (File 2019) for both boys and girls in all age categories.

In the other test items (LS, CBEH and VBEH), hypothesis H1-3 cannot be rejected for all age categories of boys and girls, however, it is also true that the results of the research children (Turek 1999) are better than the results of the children from our research (File 2019), but statistically insignificant.

In somatic characteristics, especially in body weight, our research showed that children of younger school age from our research (File 2019) have a statistically significantly higher weight for all age categories in both boys and girls than the probands from the research (Turek 1999). Since Turek (1999) in his research proved an increase in the weight of children of younger school age compared to research (Moravec 2002), we can conclude that the weight of children of younger school age has been continuously increasing since 1996.

The speed-strength and strength-endurance motor characteristics are in most age categories in both the boys and girls of our research at the level below average to weak according to standards (Moravec 2002) and statistically significantly worse than the results of the research (Turek (1999). The results obtained show a correlation between the increase in weight of the children from our research (File (2019) and the worse motor characteristics of these children.

Motor skills appear to have clinical relevance for school performance, as research by Ericsson and Karlsson (2012) reports that children with motor skill deficits at the beginning of school may struggle with academic performance. Therefore, it is important to identify children with impaired motor skills already at school and to start intervening in order to improve motor development. Scientific evidence of the relationship between motor coordination and academic performance was also provided by a Spanish study conducted by the Guillamón, Cantó and García team (2021). Their cross-sectional study included 163 Spanish schoolchildren aged 6–9 years. Motor coordination was measured with the GRAMI-2 test (motor coordination test for the assessment of elementary school children). Variables were calculated: motor coordination index and overall academic performance. The obtained results showed that schoolchildren with a better index of motor coordination had significantly better grades in language, mathematics, science and English (p between $< .01$ and $< .05$). After dividing the sample according to global academic performance, those with good academic performance showed better coordination performance in lateral jumps ($p = 0.021$) and a better motor coordination index ($p = 0.008$). These results indicate the existence of a positive relationship between motor coordination and academic performance.

4 Conclusion

In our article, we tried to approach the issue of motor performance of children of younger school age by following trends in the development of somatic and motor characteristics over a 20-year period. To determine the level of motor skills, we used selected tests from the EUROFIT battery. We compared the achieved research results of all children with the research results (Turek, 1999). By analyzing and comparing the results, we point out development trends after a 20-year period and at the same time provide an analysis of the causes of possible changes.

924 elementary school children from five towns in the East Slovak Region participated in our research. The goal of the article was to identify the current state and level of somatic and motor characteristics of children in primary education in primary schools of the East Slovak region in two selected groups: research (Turek, 1999) and our research (File, 2019) in relation

to age and gender. In the somatic characteristics, we observe an increase in the weight of the children of our research - File (2019) compared to the children of the research (Turek 1999).

The mentioned author (Turek, 1999) in his research reported an increase in the weight of children compared to the research - Moravec, Kampmiller and Sedláček (2002). We believe that the increase in the weight of children of younger school age has continued continuously since at least 1996. Of course, the increase in the Body Mass Index (BMI) also corresponds to this. According to Loz, Child and Doolittle (2023), a significant increase in normalized BMI (Body Mass Index) was already found during the pre-pandemic period in all age groups. This rate of change increased during the pandemic in patients with preexisting overweight or obesity who were in age 10 years. Changes in the rate of weight gain during the period of the COVID-19 pandemic raise the possibility that the effects of the pandemic may have worsened the rate of weight gain in children with pre-existing obesity or overweight.

We therefore ask ourselves the following questions: What is the cause of the increase in the weight of children of younger school age and the decrease in their motor characteristics? Is it a higher standard of living, bad eating habits or lack of exercise? We assume that it is a synergy of these three conditions.

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Primary Paper Section: A

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