

THE LEVEL OF GENERAL PHYSICAL PERFORMANCE AND PHYSICAL DEVELOPMENT OF 14-YEAR-OLD PUPILS

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Original scientific paper

Abstract

The aim of this contribution is to find out the level of general physical performance and the level of physical development of the 14-year-old pupils in Banská Bystrica and then, to compare it with previous researches in Slovakia. The following indicators of general physical performance were monitored: sit-and-reach, standing long jump, sit-ups, flexed arm hang, shuttle run 4 x 10 m, and endurance shuttle run. Also basic somatic indicators such as body height, body weight and BMI were found out. We tested ninth grade pupils of primary schools in the number of 301 pupils, 164 boys and 137 girls. The girls achieved on average better level of trunk flexibility. Contrary, in boys we recorded better average level in 5 tests, statistically significant in four of them. Referring to the level of maximum and minimum performance, differences in monitored tests are not as clear as in the average values. In comparison with the previous researches in Slovakia, we noted a lower level of general physical performance but a higher level of indicators of physical development of boys and girls from Banská Bystrica.

Key words: primary schools, physical education, school age, physical fitness, somatic characteristics

Introduction

In general, there has been stated the low level of general physical performance, growth in the number of overweight and obese children, deterioration of health, a greater number of children with muscle imbalances and weaknesses, bad posture and last but not least, lower children's interest in physical activity, sport and physical education. Nevertheless, we have noted different opinions. E.g. Welk and Blair (2002) concluded that there is little objective data to support these claims. In Slovakia, there has been realized numerous studies dealing with physical development and general physical performance of pupils e.g. Sýkora (1968); Šemetka (1982); Havlíček (1987); Moravec (1990); Moravec, Sedláček, & Kampmiller, et al. (1996); Kasa (1997); Turek (1999); Jančoková, et al. (2002); Zapletalová (2002); Ružbarská & Turek (2007); PHA SR(2013) and others. The results are different, as well as test batteries, abundance and representativeness of samples. In recent years, studies by authors confirm the reducing level of general physical performance and the increasing level of indicators of physical development when comparing them with the previous researches. This is also confirmed by results on the group of 492 pupils of the first grade (Čillík et al., 2014) and on the group of 433 pupils of the fourth grade (Čillík et al., 2015). Pubescence period (11-15 years) is in terms of physical development the most turbulent phase of the transformation of a child into an adult. In particular, typical is an uneven development of individuals, gender differences (girls mature earlier) and individual differences in the biological development (3 - year differences were found out in the biological development). Around the age of fifteenth, the individual growth disparities balance and there is an accentuation of male and female anatomical features.

This is reflected in differences in motor performance between boys and girls that are much significant than at earlier age. In particular, there is increasing difference in power, speed-power and endurance abilities in favor of boys. Generally girls, regardless of age, are better than boys in joint flexibility. According to the authors Moravec, Sedláček and Kampmiller, et al. (1996) the girls reach the highest joint flexibility at the age of 15. The performance of girls since 12-13 years in most indicators of general physical performance has been stagnating or has had a very faint dynamics. Overall, the coordination skills are getting worse in pubescence period. However, it is true that moderate physical activity can significantly reduce negative impacts and on the other hand, it has a positive effect on indicators of general physical performance. For evaluation of physical performance of the school population were used standardized test batteries e.g. EUROFIT (EUROFIT, 1988), UNIFIT (Měkota, & Kovář, et al. 1995); Chytráček (2002), FITNESSGRAM (Cooper Institute, 1999), ACTIVITYGRAM (Cooper Institute, 2004). There also exist test batteries for the selection of talented individuals in sport Brown, (2001). These mentioned test batteries are, by their nature and normative way of assessment the test results, focused on the performance component of physical fitness. The aim of this contribution is to find out the level of general physical performance and the level of physical development of the 14-year-old pupils in Banská Bystrica and then, to compare it with previous researches in Slovakia.

Methods

This project is an agreement of cooperation between the town Banská Bystrica and Matej Bel University.

The project was organized by Department of Physical Education and Sport at Matej Bel University, Faculty of Arts.

Characteristics of the group

Overall, of the total number of 14-year-old pupils 515 were tested 58.5 % (301 pupils). The other 7.2% (37 pupils) were not included in this research because they were attending sport classes. Remaining 34.3 % were not tested because of the absence on teaching process or they could not exercise mainly because of the health reasons. There are 12 public schools in Banská Bystrica. One of the school is without a gym, therefore, these pupils were not tested as well. The pupils were tested in the number of 164 boys and 137 girls. The average age of tested boys was 14.88 ± 0.39 decimal years during the measuring and the average age of tested girls was 14.76 ± 0.39 decimal years. So, the group of tested boys was older about 0.12 years.

Realization of measurements

Measurements were made by teachers and Ph.D. students, Master and Bachelor students during October-December, 2014. Testing of pupils was the part of a teaching process, usually implemented during Physical Education lessons. The diagnostic of the level general physical performance was always implemented after the same pre-prepared warm-up and stretching of pupils in the gym. Measurements were made in accordance with daily biorhythms (Jančoková, 2000) always in the morning from 8 to 12 o'clock under the standard conditions of the gym at school, which pupils had attended. As a rule, one class was tested during one lesson. After arriving to the gym, pupils received race numbers and they became familiar with the aim of the research. Basic identification data (name and date of birth) were provided by classroom teachers. We found out the involvement of pupils in organized physical and sport activities during testing. Measuring of the level of physical development: body height, body weight. BMI was calculated on the basis of this. Measurement of body height was performed according to the methodology of the authors Moravec, Sedláček and Kampmiller et al. (1996) to the nearest 0.5 cm. Measurement of body weight was performed using a digital weight according to the methodology of the authors Moravec, Sedláček and Kampmiller et al. (1996) to the nearest 0.1 kg. Warming-up (3 min) and stretching (5 min). When selecting tests, we relied on 2 test batteries – EUROFIT and UNIFIT. We used the following tests to find out general physical performance: sit-and-reach test, standing long jump, sit-ups in 30s, flexed arm hang, shuttle run 4 x 10 m, endurance shuttle run. We applied a set of tests that cover the full range of general physical performance, but by reducing the number of test items in comparing with the mentioned test batteries. All the tests, sit-and-reach test, standing long jump, sit-ups, flexed arm hang and endurance shuttle run test, were performed according to the methodology of Moravec, Sedláček and Kampmiller et al. (1996).

Shuttle run 4 x 10 m was performed according to the methodology (Čillik et al., 2014). The task was to cross the opposite or starting line with both feet. The time needed to overcome 4 x 10 m was recorded to the nearest 0.1s. The order of tests was not strictly followed due to time, but endurance shuttle run was always performed as the last one.

Statistical analysis

We used the chi-square goodness of a fit test to verify the representativeness of the subjects by sex. The representativeness was verified for standard use 5 % significance level ($\alpha = 0.05$). The representativeness of gender selection was not rejected ($P = 0.606$). We used a T-test for independent subjects to verify the difference in the performance of boys and girls. Statistically significant difference in performance was tested in: - the level of general physical performance (in all implemented tests) between boys and girls; - the level of physical development (body height, body weight, BMI) between boys and girls. Statistical analysis was realized by using the software IBM SPSS Statistic 19.0.0. We also used the following basic statistical characteristics of central tendency and dispersion when evaluating the results: arithmetic average (M), standard deviation (SD), minimum measured values (min) and maximum measured values (max). We used basic logical methods to evaluate and interpret the results.

Results

Results show a different level of monitored parameters in boys and girls (Tables 1 and 2). The girls achieve on average better level of trunk flexibility which was determined through a sit-and-reach test. Contrary, in boys, we recorded better average values in explosive power of lower limbs (standing long jump), dynamic endurance strength of abdominal and hip-thigh muscles (sit-ups), static and endurance strength of muscles of upper limbs (flexed arm hang), running speed with changes of direction (shuttle run 4 x 10 m) and running endurance capacity (endurance shuttle run). We recorded statistically significant difference in the following tests: standing long jump, flexed arm hang, shuttle run 4 x 10 m and endurance shuttle run in favor of boys and in the sit-and-reach test in favor of girls. Referring to the level of maximum performance, differences in monitored tests are not as clear as in the average values. The girls achieved the best performance in the sit-and-reach test and flexed arm hang.

The boys achieved the best performance in the following tests: standing long jump, shuttle run 4 x 10 m and endurance shuttle run. The girls and boys achieved the same best performance in the sit-up test. Even in the worse performance level, the differences in monitored tests are not as clear as in the average values. The girls achieved the worst result in tests: standing long jump and endurance shuttle run. The boys achieved the worst result in tests: sit-and-reach test, sit-ups and shuttle run 4 x 10 m.

Table 1 Monitored indicators of general physical performance in a group of 14-year-old boys (B)

B	AGE	SRT	SLJ	SUT	FAH	4 x 10	ESR	BH	BW	BMI
		(cm)	(cm)	(n)	(s)	(s)	(n)	(cm)	(kg)	(i)
M	14.88	16.05	185.5*	22.65	40.87*	11.63*	49.54*	174.71*	66.15*	21.61
SD	0.39	8.66	28.3	5.36	25.16	1.14	21.49	7.36	13.39	3.81
min	14.14	14	123	7	0	9.8	13	153	42.8	14.73
max	17.1	39	254	35	105	16.8	125	198	114.4	38.99

Notes: SRT: sit-and-reach test; SLJ: standing long jump; SUT: sit-ups; FAH: flexed arm hang; 4 x 10: the shuttle run 4 x 10 m; ESR: endurance shuttle run; BH: body height; BW: body weight; BMI: body mass index. *statistically significant difference in favour of tested boys (P-value < 0.05).

Table 2 Monitored indicators of general physical performance in a group of 14-year-old girls (G)

G	AGE	SRT	SLJ	SUT	FAH	4 x 10	ESR	BH	BW	BMI
		(cm)	(cm)	(n)	(s)	(s)	(n)	(cm)	(kg)	(i)
M	14.76	24.90*	161.4	21.31	26.29	12.48	32.70	165.86	56.5	20.53
SD	0.39	7.94	23.13	4.57	19.64	1.03	13.10	6.07	10.51	3.58
min	14.00	4	107	9	0	10.1	9	151	37.7	13.96
max	16.36	42	210	35	117	16.0	90	186	98	36.0

Notes: SRT: sit-and-reach test; SLJ: standing long jump; SUT: sit-ups; FAH: flexed arm hang; 4 x 10: the shuttle run 4 x 10 m; ESR: endurance shuttle run; BH: body height; BW: body weight; BMI: body mass index. *statistically significant difference in favour of tested girls (P-value < 0.05).

Table 3 Comparison of average results of our group with other researches - boys (B)

B	AGE	SRT	SLJ	SUT	FAH	4 x 10	ESR	BH	BW	BMI
		(cm)	(cm)	(n)	(s)	(s)	(n)	(cm)	(kg)	(i)
BB (2014) n = 164	14.88	16.05	185.5	22.65	40.87	11.63	49.54	174.71	66.15	21.61
SR (1993) n = 530	14.50	21.70	200.11	26.82	29.49		60.52	170.24	57.31	
BB region (2001) n = 347	14.43							168.08	56.09	19.73
SR (2011) n = 707	14							170.86	61.02	20.81

Notes: SRT: sit-and-reach test; SLJ: standing long jump; SUT: sit-ups; FAH: flexed arm hang; 4 x 10: the shuttle run 4 x 10 m; ESR: endurance shuttle run; BH: body height; BW: body weight; BMI: body mass index.

Table 4 Comparison of average results of our group with other researches - girls (G)

G	AGE	SRT	SLJ	SUP	FAH	4 x 10	ESR	BH	BW	BMI
		(cm)	(cm)	(n)	(s)	(s)	(n)	(cm)	(kg)	(i)
BB (2014) n = 137	14.76	24.90	161.4	21.31	26.29	12.48	32.70	165.86	56.5	20.53
SR (1993) n = 554	14.54	26.11	173.8	23.25	14.53		37.48	164.05	53.30	
BB region (2001) n = 290	14.41							162.95	52.21	19.61
SR (2011) n = 706	14							162.91	55.64	20.93

Notes: SRT: sit-and-reach test; SLJ: standing long jump; SUT: sit-ups; FAH: flexed arm hang; 4 x 10: the shuttle run 4 x 10 m; ESR: endurance shuttle run; BH: body height; BW: body weight; BMI: body mass index.

There is one test in which the girls and boys achieved the same worst performance: flexed arm hang test. In the flexed arm hang test, we recorded zero values. It means that in both groups there were individuals who did not last in flexed arm hang even for 1 second. In the group of boys, we also recorded higher average values of somatic indicators - body height (boys were on average higher by 8.85 cm), body weight (boys were on average heavier by 9.35 kg) and BMI was higher by 1.08. Statistically significant difference was found in body height and body weight in favor of boys.

Discussion

When comparing our group of boys and girls, we conclude that the 14-year-old boys achieve better level in these five tests of general physical performance: standing long jump, sit-ups, flexed arm hang, shuttle run 4 x 10 m and endurance shuttle run. The differences are statistically significant in four of them. The girls achieve statistically better level in trunk flexibility.

Boys exceed the girls especially in tests in which power, speed-strength and endurance capabilities are decisive. The results are similar with those of the author Moravec (1990), who mentions that the results of boys in the tests of general physical performance according to EUROFIT are significantly higher than the results of girls, except flexibility. When comparing the performance of the group of boys with the group from Slovakia (Moravec, Sedláček, & Kampmiller, et al., 1996), we conclude lower level in all the tests, except the flexed arm hang test (Table 3). The boys from Banská Bystrica mostly lag behind in explosive power of lower limbs, dynamic and endurance strength of abdominal and hip-thigh muscles and in running endurance capacity. All differences are statistically significant. When comparing the group of girls from Banská Bystrica with those from Slovakia (1993), results are in favor of girls from Slovakia in these four indicators: sit-and-reach test, standing long jump, sit-ups and endurance shuttle run (Table 4). The girls from Banská Bystrica are better in flexed arm hang. All differences are statistically significant except the test sit-and-reach.

When comparing with the group from Slovakia 1993 (Moravec, Sedláček, & Kampmiller, et al., 1996), BB region 2001 (Jančoková, et al., 2002) and with those from Slovakia 2011 (PHA SR, 2013), we have recorded significantly higher level of physical development in our group of boys BMI (Table 3). All differences are statistically significant except BMI. When comparing the group of girls from Slovakia 1993 (Moravec, Sedláček, & Kampmiller, et al., 1996), BB region 2001 (Jančoková, et al., 2002) and with those from Slovakia 2011 (PHA SR, 2013), we have recorded higher level of all values in our group, except BMI in the group from Slovakia 2011 (PHA SR, 2013) (Table 4). Statistically significant differences are in body height. We used two test batteries in this contribution – EUROFIT and UNIFIT. Our aim was to simplify testing of children of middle school age. Therefore, we wanted to apply a battery that would cover the whole range of general physical performance, but through reducing the number of test items. We have omitted the test “flamingo” because of its lack of validity and questionable implementation in school-age as stated by Turek (1999). Whereas speed capabilities were investigated using another test (shuttle run 4 × 10 m), we omitted plate tapping which is used to measure the frequency speed of upper limbs. We also omitted a hand dynamometer because we used the flexed arm hang test to find out a static strength of upper limbs. Instead of shuttle run 10 × 5 m, we used shuttle run 4 × 10 m, considering its duration and easier implementation. Although, the test 4 × 10 m can be found in the battery UNIFIT, we simplified it considering the age of children.

Our test battery, which we used in testing, is nearly identical to the Brown’s test battery for sports talent identification (Brown, 2001).

Conclusions

The results that we noted in 14-year-old population of pupils in Banská Bystrica are similar as the results of most Slovak testing, which says that boys are better than girls in the tests of general physical performance, except flexibility. In the indicators of physical development, we noted higher values in favor of boys. All differences are statistically significant except the test sit-ups. When comparing with the subjects of the Slovak Republic, we state a lower level of general physical performance, except the test of flexed arm hang, but we state a higher level of physical development of tested boys and girls from Banská Bystrica (2014). Given the different selection of the subjects, our subjects were only the children from the town; the subjects of the Slovak Republic 1993 (Moravec, Sedláček, & Kampmiller, et al., 1996), BB region 2001 (Jančoková, et al., 2002) and from Slovakia 2011 (PHA SR, 2013) were the children both from the town and the village, we want to implement the testing on more representative subjects that would have affected the entire population of children. The set of tests which we used affects the full range of general physical performance. When there is a sufficient number of examiners (6-8) in one class (20-25 students), it can be implemented in one lesson. It is not challenging the spatial and material support because it does not require special devices that are not in primary schools.

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RAZINA OPĆE TJELESNE IZVEDBE I TJELESNOG RAZVOJA 14-GODIŠNJIH UĆENIKA

Sažetak

Cilj ovog doprinosa je saznati razinu opće fizičke performanse i razinu fizičke razvoja 14-year-old učenika u Banskog Bystrici, a zatim, kako bi ga usporediti s prijašnjim istraživanjima u Slovačkoj. Praćeni su slijedeći pokazatelji opće fizičke izvedbe: sit-and-dosegnuti, stoji skok u dalj, trbušnjaka, savinuta ruka visi, shuttle run 4 x 10 m, a izdržljivosti shuttle trčanje. Također, osnovni tjelesni pokazatelji kao što su tjelesne visine, tjelesne težine i BMI su otkrili. Testirali smo devetom učenike razreda osnovnih škola u broju 301 učenika, 164 dječaka i 137 djevojčica. Ostvareni prosječno višu razinu fleksibilnosti debela djevojke. Suprotno, kod dječaka zabilježen bolju prosječnu razinu u 5 testova, statistički značajna u četiri od njih. Pozivajući se na razini maksimalne i minimalne performanse, razlike u nadziranih ispitivanja nisu tako jasno kao u prosječnim vrijednostima. U usporedbi s prethodnim istraživanjima u Slovačkoj, istaknuo smo nižu razinu opće fizičke performanse, ali višu razinu pokazatelja tjelesnog razvoja dječaka i djevojčica iz Banskog Bystrica

Ključne riječi: osnovna škola, tjelesni odgoj, školski uzrast, tjelesni fitness, somatske značajke

Received: July 10, 2015

Accepted: September 10, 2015

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Acknowledgments

This contribution was written with the support of grant project KEGA 039UMB-4/2014 The innovation of tests of general physical performance of the school population between 6-15 years in region Banská Bystrica.