

SELECTED FACTORS OF PHYSICAL PERFORMANCE IN THE HUNGARIAN YOUTH

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Abstract: The author presents a brief report on the study that was initiated as a part of a nation-wide, cross-sectional project to determine the mental, social, biological and physical performance abilities of Hungarian school-children from 3 to 18 years of age. The author's sample size was approximately 28000, boys and girls, aged 6-18 years. The random sample was representative of all types of settlements and all types of schools. The investigation was connected functionally to Eiben's study of „The Hungarian National Growth Standards”. These two investigations were carried out simultaneously on the same sample. The functional examinations consist of the testing of the motor performance capacity (strength, speed, endurance). The boys performed better than the girls in the strength tests. In the younger girls' muscular endurance is similar to boys; a difference occurs with the change of ages. The greatest difference between boys and girls occurs in cardio-vascular endurance.

Key words: Physical performance, Hand grip strength, Medicine ball push, Standing broad jump, Sit-up Test, Burpee-test, 60 m dash, 12 minutes endurance run.

Introduction

Biological development manifests itself in the physical structure and physical performance. These factors affect each other mutually but not to the same extent. Numerous studies relating to biological development and physical performance have been published recently (Hebbelinck-Borms 1978, Ostyn 1980, Kemper 1985). Besides the standardized tests of biological development we utilized several kinds of „national test-batterie”. There were well-developed, recommended test-batteries of fundamental motion-forms like jumping, running and throwing. In order to make some comparison of the results of the motor tests, it was necessary to evaluate motor fitness (Simons-Renson 1982). The majority of Hungarian studies are characterised by an anthropometrical approach in which some motor performance tests were also used. The present research dealing with physical performance was justified because in the former studies – on the physical performance of Hungarian youth – there were some inadequacies of data collection, in other cases the sample was not large enough or representative of the whole population.

The purpose of the study was to describe the level of physical fitness of the Hungarian youth. It was also aimed to give suggestions on the basis of the comprehensive study on the biological and motor development of the youth and its relation to social structures. The major aims of the study were to

- find out precisely how sexual dimorphism and biological development determine the performance scores that may reflect different trends of physical abilities;
- display the performance scores of different groups categorised by sex, age, size of settlements and type of schools, and to analyse the differences;
- determine the relationship of the school-children's social background to their physical performance.

Material and Methods

A diagnosis of the general state and condition of Hungarian school-children between 6 and 18 was set up in the nation-wide, cross sectional, human biological study. This examination was started under the name of „Youth-research” by the Institute of Social Sciences and by the Council of Physical Education and Sport Sciences.

The size of the examined sample is 27430, 14758 boys and 12672 girls. The random sample is representative of all types of settlements and all types of schools (Eiben-Pantó 1981). The representation is 1.5 percent.

The performance tests used were the following: hand grip strength, two hand medicine ball push, standing broad jump, 30 sec. sit-up test, 30 sec. Burpee test, 60 meters dash, 12 minutes endurance run (Haag-Dassel 1975, Hebbelinck-Borms 1978, Mathews 1973, Ostyn et al. 1980, Simons-Renson 1982, Kemper (1985).

Results and Discussion

The age- and sex-specific means of the motor tests are grafically illustrated and given in tables.

Figure 1 and Table 1 show the *hand grip strength* of the boys and girls right and left hand, respectively. The curves of the right and left hand are similar in both sexes. The difference between the values increases by age and by greater strength values. At each age the boys' grip strength is greater than that of the girls'. The girls' performance approaches that of the boys' best at the age of 12, but the differences are still significant (at 0.001 level). The girls' greatest increase in strength occurs between 11-12 years, after that the increase in development levels off. The boys' greatest strength increase occurs between the ages of 14 and 15. There is also a steady increase in strength thereafter.

Our results show that the tendencies are similar to other international results. There is a marked difference in comparison with the Belgian result (Hebbelinck-Borms 1978) in which the girls' score is higher than the boys' at the age of 12.

Boys and girls follow a similar pattern in explosive strength up to 13 years of age, as demonstrated by the *medicine ball push* (Fig. 2, Table 2). The boys' scores are significantly higher than the girls', there is a levelling off for girls, while boys progressively increase in performance.

In the *standing broad jump*, that is a measure of explosive strength of the legs, a similar trend is obvious (Fig. 3, Table 3). Hebbelinck didn't find differences between the boys and the girls of early ages (6 and 7 years), and the stagnation appeared with the girls after 13 years, moreover, even decreases of the scores occurred (Kemper 1985).

In the *sit-up test* (Fig. 4, Table 4) which measures muscular endurance, there is no significant difference between the boys' and girls' performance at the age of 6, 7 and 8. At the age of 9 the boys' performance continues to increase till the age of 16, while the girls' performance levels off. The tendencies and the curves are similar in other investigations; differences can be seen in comparison with Hebbelinck's results. The girls are better than boys at the age of 6, 7, 8 and after 13 the girls' scores decrease. In our sample there is no decrease, only stagnation in the girls' case.

Boys show a steady and significant increase in performance in the *Burpee-test* from the age of 6 to 18 (Fig. 5, Table 5). There is no significant difference at the age of 6, 7 and 8 between boys and girls. The girls' performance tends to level off from the age of 12 and 13.

Boys are significantly faster than girls in the *60 meters' dash* at every age-level (Fig. 6, Table 6). In Hebbelinck-Borms's case (1978) the girls are faster. At the age of 14 the girls no longer improve while the boys' running times continue to decrease.

Boys show a steady and significant increase in the *12 minutes endurance run* in every age group (Fig. 7, Table 7). The girls' performance increases from the age of 6 to 12, but is significantly lower than the boys'. The girls' performance scores show no futher increase beyond the age of 12. We didn't find any decrease of the girls' scores as Kemper (1985) did.

Table 1. Number of the subjects investigated and means of hand grip strength in boys and girls (right and left hand)

Age (year)		Hand grip strength (kp)			
		Boys N	\bar{x}	N	Girls \bar{x}
6	Right	200	11.2	209	9.1
	Left		10.9		8.4
7	Right	1066	12.3	950	10.1
	Left		11.7		9.5
8	Right	1168	14.7	1151	12.2
	Left		14.1		11.4
9	Right	1262	17.0	1151	14.5
	Left		17.0		13.8
10	Right	1160	20.3	1099	17.5
	Left		19.1		16.4
11	Right	1176	23.0	1079	20.8
	Left		21.6		19.6
12	Right	1107	26.6	1055	24.3
	Left		24.9		22.9
13	Right	1165	30.6	1079	27.8
	Left		28.9		26.1
14	Right	1164	35.8	1069	30.5
	Left		33.8		28.6
15	Right	1551	42.1	1224	32.0
	Left		39.9		30.0
16	Reight	1577	46.6	1074	33.4
	Left		43.8		31.3
17	Right	1328	49.4	936	33.3
	Left		46.2		31.0
18	Right	737	51.5	537	33.8
	Left		48.5		31.5
over 18	Right	97	49.8	59	33.2
	Left		47.5		32.1

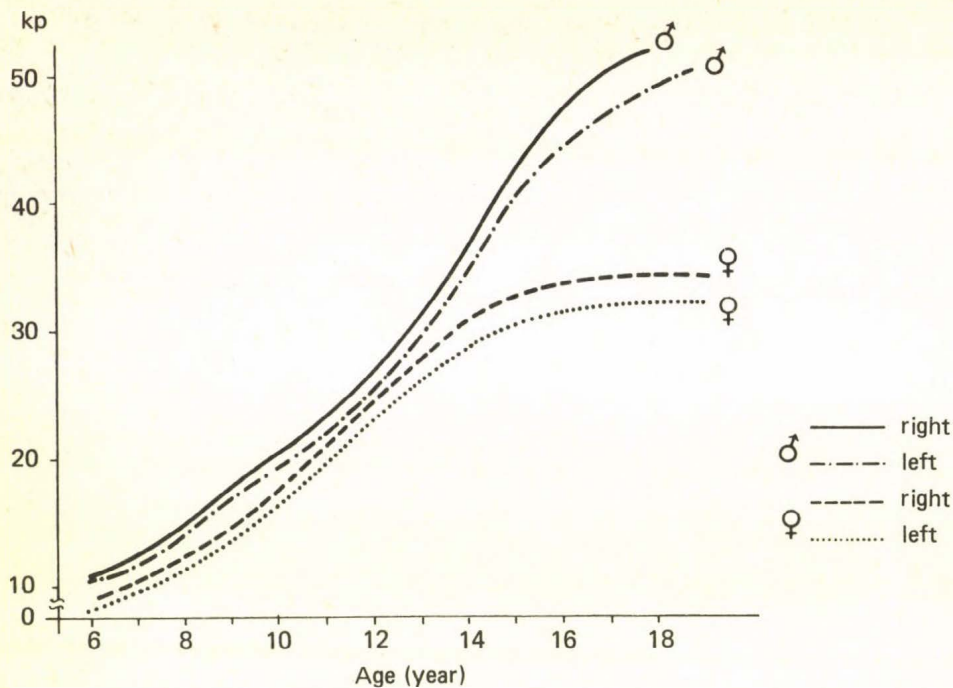


Fig. 1: Means of the hand grip strength in Hungarian boys and girls between 6 and 18 years of age

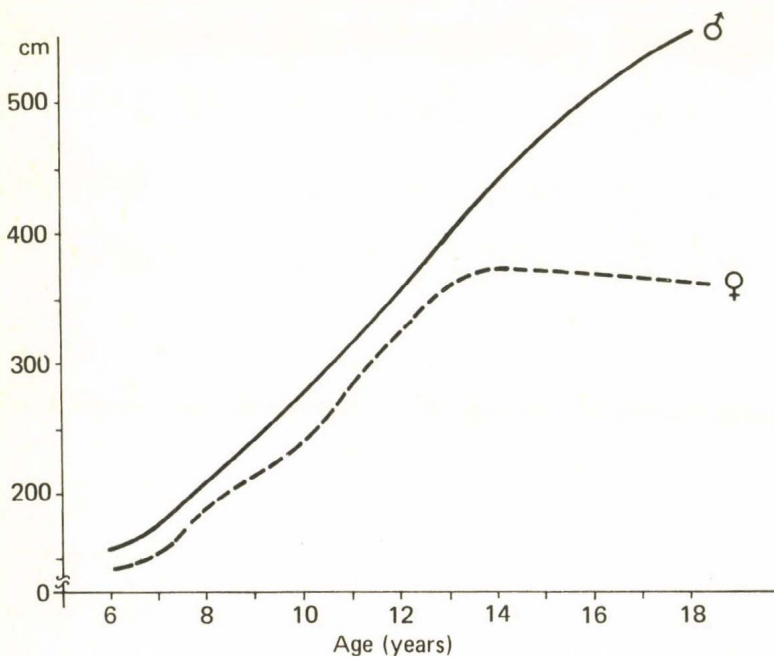


Fig. 2: Means of the medicine ball push in Hungarian boys and girls between 6 and 18 years of age

Table 2. Means and standard deviations of medicine ball push in boys and girls

Age (year)	Medicine ball push (cm)					
	Boys			Girls		
	\bar{x}	SD	\bar{x}	SD		SD
6	159	28.9	142	34.5		
7	176	32.7	154	26.8		
8	210	38.7	182	34.0		
9	242	43.7	207	38.7		
10	276	50.2	237	43.1		
11	311	54.5	281	53.5		
12	352	64.3	322	56.2		
13	402	78.3	363	58.9		
14	455	85.3	374	58.6		
15	465	81.4	355	52.5		
16	506	84.2	362	54.4		
17	530	84.4	363	56.6		
18	556	86.0	372	64.5		

Table 3. Means and standard deviations of standing broad jump in boys and girls

Age (year)	Standing broad jump (cm)					
	Boys			Girls		
	\bar{x}	SD	\bar{x}	SD		SD
6	100	19.1	96	18.4		
7	108	19.2	101	19.7		
8	119	20.4	114	18.6		
9	130	20.1	124	19.8		
10	137	19.4	130	19.5		
11	143	17.6	138	18.1		
12	150	19.4	145	20.6		
13	160	21.7	150	20.2		
14	172	23.5	154	20.1		
15	185	25.2	155	20.0		
16	192	24.7	155	20.0		
17	198	25.5	157	19.9		
18	206	24.8	160	19.6		

Table 4. Means and standard deviations of sit-up test in boys and girls

Age (year)	Sit-up test (N/30 sec)					
	Boys			Girls		
	\bar{x}	SD	\bar{x}	SD		SD
6	11.1	3.6	10.5	3.3		
7	11.4	3.7	11.1	3.4		
8	12.8	3.9	12.5	3.6		
9	14.0	3.7	13.4	3.5		
10	15.2	3.8	14.2	3.6		
11	16.0	3.9	15.1	3.3		
12	17.2	3.6	15.8	3.3		
13	18.1	3.7	15.5	3.2		
14	18.8	3.5	16.5	3.1		
15	19.4	3.4	16.1	2.9		
16	20.0	3.5	16.1	3.0		
17	19.9	3.5	16.0	3.0		
18	20.1	3.5	16.3	2.7		

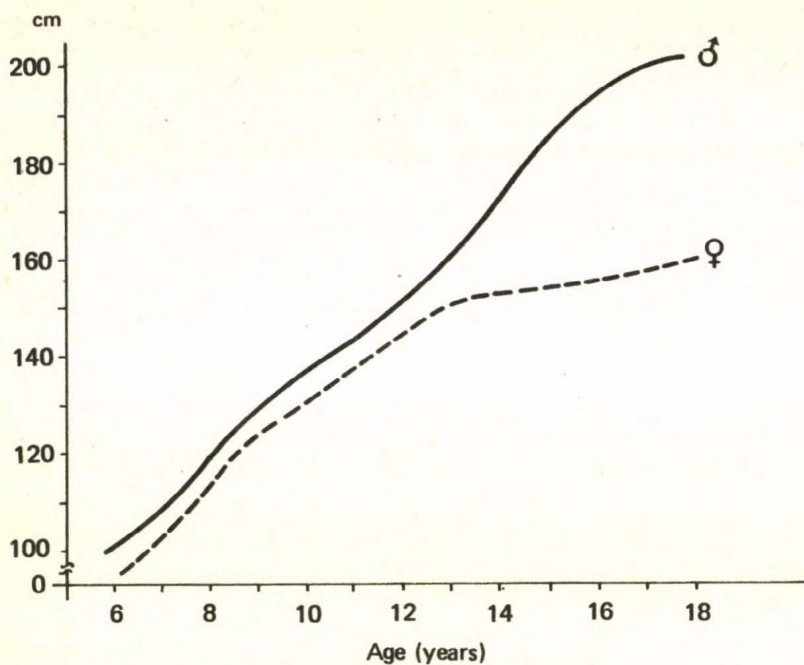


Fig. 3: Means of the standing broad jump in Hungarian boys and girls between 6 and 18 years of age

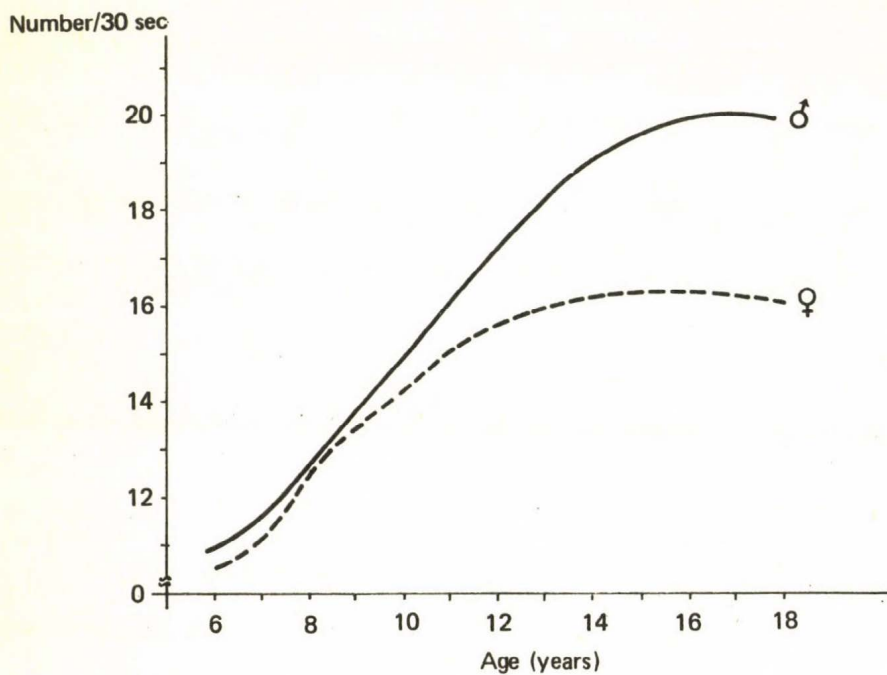


Fig. 4: Means of the sit-up test in Hungarian boys and girls between 6 and 18 years of age

Table 5. Means and standard deviations of Burpee test in boys and girls

Age (year)	Burpee-test (N/30 sec)			
	Boys		Girls	
	\bar{x}	SD	\bar{x}	SD
6	12.7	2.9	12.8	2.4
7	13.5	3.0	13.5	2.4
8	14.3	3.1	14.1	2.8
9	15.0	3.1	14.6	2.8
10	15.6	3.1	14.9	2.8
11	16.1	3.3	14.9	2.9
12	16.7	3.4	15.4	3.0
13	17.2	3.5	15.6	2.9
14	17.3	3.3	15.5	2.7
15	17.8	3.1	15.6	2.5
16	18.6	3.8	15.6	2.6
17	18.5	3.4	15.4	2.5
18	19.0	3.5	15.8	2.3

Table 6. Means and standard deviations of 60 m dash of boys and girls

Age (year)	60 meter dash (sec)			
	Boys		Girls	
	\bar{x}	SD	\bar{x}	SD
6	13.85	1.45	14.44	1.30
7	13.18	1.32	13.82	1.34
8	12.44	1.21	12.98	1.24
9	11.91	1.12	12.42	1.18
10	11.47	1.06	12.06	1.27
11	11.13	1.09	11.57	1.13
12	10.75	0.94	11.16	0.99
13	10.35	0.97	10.85	0.93
14	9.88	0.97	10.60	0.88
15	9.34	0.83	10.51	0.92
16	9.08	0.97	10.50	0.91
17	8.89	0.76	10.39	0.84
18	8.71	0.69	10.47	0.88

Table 7. Means and standard deviations of 12 min. endurance run of boys and girls

Age (year)	12 minutes endurance run (meter)			
	Boys		Girls	
	\bar{x}	SD	\bar{x}	SD
6	1597	330	1459	314
7	1681	315	1524	282
8	1797	339	1647	305
9	1958	367	1738	315
10	2056	374	1823	321
11	2151	368	1922	310
12	2257	353	1981	309
13	2305	358	2010	311
14	2387	365	2002	323
15	2469	361	1978	287
16	2532	365	1996	316
17	2539	367	2000	309
18	2625	356	2041	313

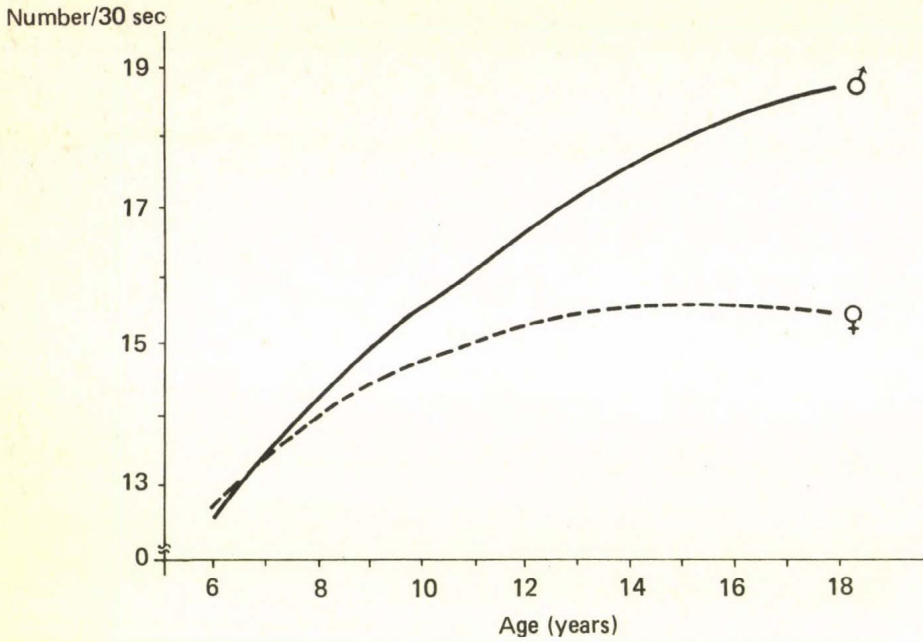


Fig. 5: Means of the Burpee test in Hungarian boys and girls between 6 and 18 years of age

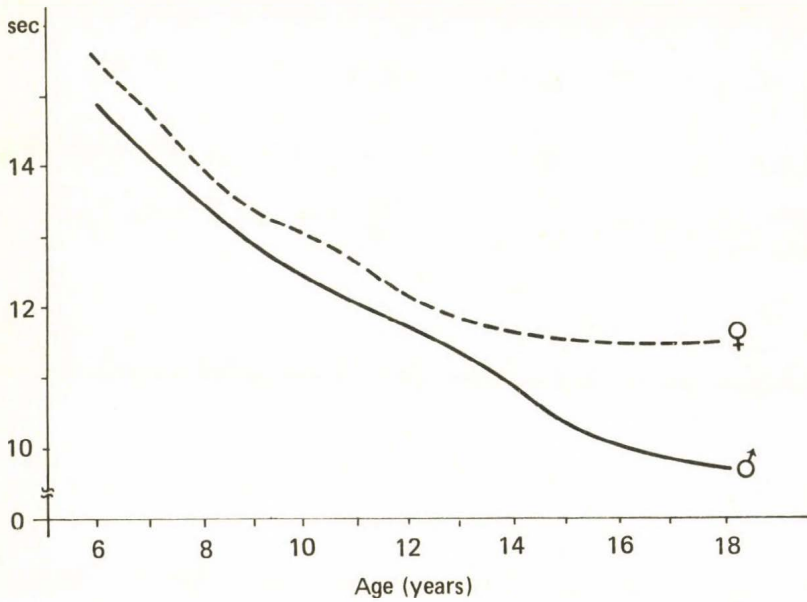


Fig. 6: Means of the 60 m dash test in Hungarian boys and girls between 6 and 18 years of age

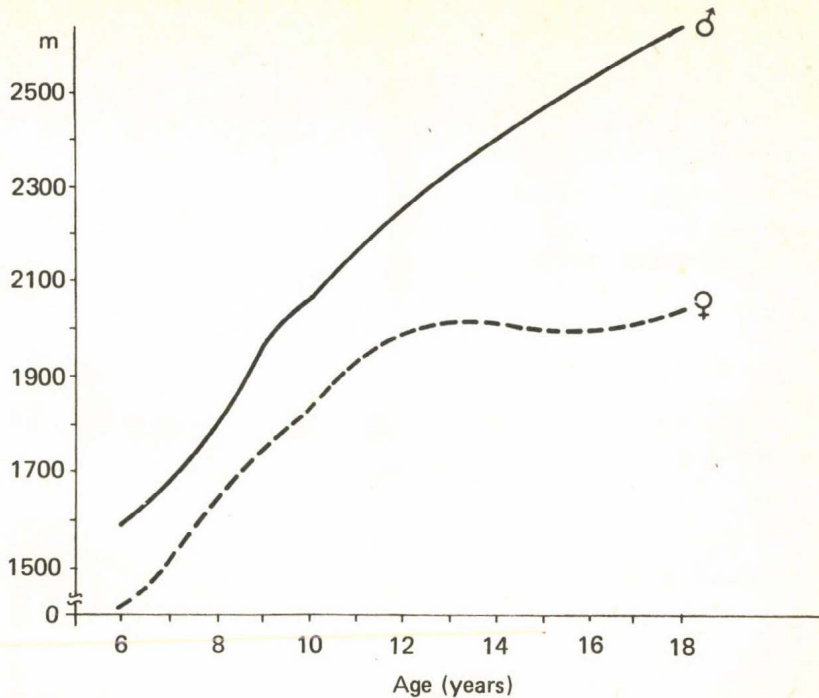


Fig. 7: Means of the 12 minutes endurance run test in Hungarian boys and girls between 6 and 18 years of age

Conclusions

Without going into details concerning the problem of differences of international results of physical performances, we may state that the strength of boys is greater than that of girls at every age level. The boys' explosive strength of the arm and leg extension is greater. The muscular endurance of boys as determined by the sit-up and Burpee tests increase at each age level. The muscular endurance of girls is similar to boys in younger years and increases slightly till the age 12 and than shows no further increase. The greatest difference between boys and girls occurs in cardio-vascular endurance, where the boys show a consequent steady improvement year to year, while the girls stabilize at a relatively early age and at a lower level. In a later paper, a deeper and more complex analysis will be given to explain the factors effecting these differences of the physical abilities of school-children.

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