

DEVELOPMENTAL TRENDS IN GROWTH OF CZECH YOUTH IN 1967

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In 1951 the first nation-wide investigation of the basic physical characters of school-children was performed. Since it furnished a number of interesting findings, it was decided to repeat it within the scope of the National Research Plan after ten years, i.e. in 1961 as part of the project "Sound Development of the New Generation".

The results of investigation of school-children represent comprehensive material from which generally valid conclusions can be drawn that enjoy the attention of pediatricists, pedagogues, anthropologists, and gymnastic instructors. They are also of importance for industry and by their consequences they also touch upon the spheres of sociology and economy. They give objective criteria of the physical condition of the contemporary population and the development of youth in changing living conditions (Fetter, Prokopec, Suchý, Šobová 1963, Fetter, Prokopec, Suchý 1965, Fetter, Suchý 1966, Suchý 1967).

In 1951 and in 1961, teachers played an outstanding role in the realization of this research project in schools, because the teachers were commissioned with the cardinal work of the entire project, i.e. the collection of documentary material. The teachers regularly measured and measure the height and weight of school-children, but the obtained data, as a rule, are not centrally treated and remain archival material of the respective school. On the other hand, in research campaigns the material is concentrated for treatment and for scientific evaluation. The campaigns are carried out only at certain schools or in certain classes that have been selected into a representative set and the teachers are instructed personally and in writing so that all use the same methods.

The author of this communication worked out in 1966 a research project, the realization of which he began with the consent of the Ministry of Education in 1967.

Project of long-term observation of physical development of school-children:

1. Since a ten-year interval between the individual investigations represents a very long time, during which the development of youth cannot be checked

ed on a larger scale, the existing system of cross-section campaigns will be enhanced through the system of semi-longitudinal observation.

2. In this system the network of schools from cross-sectional research will be used so that the same children can be repeatedly observed and their development compared with the developmental norms, obtained in 1961.
3. In this way the developmental norm will not only be continuously checked, but the possibility of its sensitive correction will also be given.
4. The results will be partly of scientific importance (verification of the validity of the biological laws of evolution), partly of practical importance, because they can, in concrete cases, signal the need for corrective measures.
5. Research will include three basic physical characteristics (height, weight, and girth of chest) found during cross-sectional nation-wide investigation in 1961.

These characters are established either by specially instructed teachers or research workers sent to the schools. Measurements will be performed in agreement with the headmasters of the schools so that the normal run of lessons is not disturbed. As a rule, only part of the pupils will be measured, so that the selected schools will practically not be handicapped by the research project.

DOCUMENTARY MATERIAL

In 1967 boy and girl pupils were measured at 116 schools in Bohemia and in Moravia. The schools had been random selected out of 439 schools where research had been carried out in 1961. Thus the present set is a reduced representative set of Czech youth for 1967. Each school was told in what month the investigation would take place. At each school, all the children who were born in that month in which the measurements were made and all the children whom half a year had elapsed from their birth in this month were measured. The investigations were held in the months of June, September, October and November. Several schools

TAB. 1
Boys — Height (in cm)

Age	1961		SD ₁	1967			Difference		SD
	\bar{x}_1	s_1		\bar{x}	s	n	$\bar{x} - \bar{x}_1$	i	
6	115,6	4,8	1,0	117,7	5,25	13	2,1		
6 1/2				120,2	5,61	81			
7	121,5	5,6	0,8	122,0	5,22	100	0,5	0,1	0,2
7 1/2				125,5	5,88	118			
8	127,5	5,8	0,7	128,8	6,24	89	1,3	0,3	1,5
8 1/2				130,9	5,94	111			
9	132,6	6,0	1,0	133,9	5,49	87	1,3	0,2	1,3
9 1/2				136,0	6,21	138			
10	137,7	6,4	1,4	138,6	5,91	157	0,9	0,2	0,3
10 1/2				141,0	7,05	130			
11	142,5	6,8	-0,6	143,1	6,87	178	0,6	0,1	-1,9
11 1/2				146,5	6,57	237			
12	147,7	7,2	-1,3	148,7	7,44	246	1,0	0,2	-2,5
12 1/2				151,6	7,11	267			
13	154,0	7,9	-0,6	153,7	7,62	237	-0,3	0	-2,3
13 1/2				158,7	8,49	236			
14	160,4	8,7	2,0	163,6	9,54	249	3,2	0,4	4,2
14 1/2				165,8	8,28	240			
15	167,2	8,4	6,3	167,3	8,34	245	0,1	0	6,0
15 1/2				170,5	6,60	42			
16	171,0	7,4	9,0	172,2	8,64	17	1,2	0,1	8,9
16 1/2				175,6	6,54	23			
17	172,9	6,7	10,7	175,9	5,04	27	3,0	0,5	12,8
17 1/2				175,6	7,02	28			
18	174,3	6,5	12,2	178,0	5,19	6	3,7	0,6	
18 1/2				172		1			
Total						3 303			

Explanatory notes to Tables:

\bar{x}_1 = mean (1961)

\bar{x} = mean (1967)

s_1 = standard deviation (1961)

s = standard deviation (1967)

n = number of persons

$i = (\bar{x} - \bar{x}_1) : s_1$

The age groups comprising fewer than 20 persons are marked by lying numbers.

SD₁ (1961) and SD (1967) are the sexual differences. The negative numbers in this column denote that the girls are taller or heavier than the boys.

that could not fulfil the assigned research task in the appointed month, held this campaign still in December. All in all, 3303 boys and 3403 girls were examined. The individual values recorded at the individual schools were concentrated in Prague and the basic characteristics of the particular age groups were calculated from them. The results were compared with those of 1961. Detailed numerical data are presented in the relevant Tables.

RESULTS

Height

In boys and girls there is a distinct increase of the mean values in all age groups between the measurements in 1961 and 1967. An exception is formed only by thirteen-year-old boys where the values of 1967 are insignificantly lower. If this negative difference is considered from the viewpoint of value i , it appears to be negligible. The values i

TAB. 2
Girls — Height (in cm)

Age	1961		1967			Difference	
	\bar{x}_1	s_1	\bar{x}	s	n	$\bar{x} - \bar{x}_1$	i
6	114,6	4,6	117,3	3,39	17	2,7	
6 1/2			118,9	4,86	105		
7	120,7	5,5	121,8	5,55	83	1,1	0,2
7 1/2			125,7	4,80	105		
8	126,8	5,8	127,3	6,15	93	0,5	0
8 1/2			131,2	7,32	104		
9	131,6	5,9	132,6	6,96	97	1,0	0,2
9 1/2			135,4	6,36	127		
10	136,3	6,6	138,3	7,65	138	2,0	0,3
10 1/2			142,5	6,39	149		
11	143,1	7,2	145,0	7,08	154	1,9	0,3
11 1/2			147,8	7,23	249		
12	149,0	7,2	151,2	7,47	256	2,2	0,3
12 1/2			153,6	6,78	233		
13	154,6	7,0	156,0	7,35	236	1,4	0,2
13 1/2			159,3	5,97	292		
14	158,4	6,1	159,4	4,12	266	1,0	0,1
14 1/2			160,0	6,51	257		
15	160,9	5,9	161,3	5,73	234	0,4	0
15 1/2			160,6	5,22	42		
16	162,0	5,8	163,3	6,18	35	1,3	0,2
16 1/2			163,3	5,49	40		
17	162,2	5,5	163,1	6,24	34	0,9	0,1
17 1/2			162,3	6,51	38		
18	162,1	5,1	162,6	5,49	19	0,5	0,2
Total						3 403	

are an indicator of the significance of differences, the standard deviation of 1961 being the criterion. These values confirm the general upward trend in

most age groups. When we establish the differences between boys and girls, we find that girls are taller at the age of 11–13 years.

Weight

In boys an upward trend over the values of 1961 can be found. The only negative difference was ascertained in the sixteen-year-old ones, but this age group contains too low a number of investigated cases. Our documentary material permits to derive weighty conclusions in the age groups of 7 to 15 years.

Of interest are the results in girls. An upward trend appears only till 14 years. An exception is formed by the group of ten-year-old girls. The problem of chance of this phenomenon will have to be solved by repeated investigation of the same group after one year and comparison with even-aged girls at other schools. Fifteen-year-old girls and also girls in the subsequent tested age groups are always lighter than the mean of 1961. Already that time a tendency to a more slender body structure began to display itself in girls. The mean value of eighteen-year-old girls made 0.5 kg less in 1961 than in 1951. It is probable that parallel to secular acceleration of pubertal development, the reconstruction of the somatotype proceeds more and more in the younger age groups. If this assumption is confirmed in further investigations, we can say that since the sixties of our century the type of body structure in young women has been changing.

TAB. 4
Girls — Weight (in kg)

Age	1961		1967			Difference	
	\bar{x}_1	s_1	\bar{x}	s	n	$\bar{x} - \bar{x}_1$	i
6	20,4	2,5	20,8	2,19	17	0,4	
6 1/2			22,2	4,02	105		
7	23,1	3,6	23,6	4,11	83	0,5	0,2
7 1/2			25,3	3,87	105		
8	26,1	4,4	26,6	4,41	93	0,5	0,2
8 1/2			28,8	5,64	104		
9	28,8	5,1	29,3	5,58	97	0,5	0
9 1/2			31,9	6,30	128		
10	32,5	6,0	31,5	6,99	138	-1,0	-0,2
10 1/2			35,5	6,21	148		
11	36,3	7,2	36,8	6,63	154	0,5	0,1
11 1/2			39,8	7,38	249		
12	41,3	8,1	42,7	8,13	243	1,4	0,2
12 1/2			44,8	7,92	233		
13	46,1	8,5	48,2	8,94	236	2,1	0,2
13 1/2			50,2	7,98	291		
14	51,1	8,4	52,0	8,82	262	0,9	0,1
14 1/2			51,5	8,49	257		
15	55,0	7,8	51,2	7,59	235	-3,8	-0,5
15 1/2			51,9	6,51	42		
16	57,3	7,9	55,2	5,67	35	-2,1	-0,3
16 1/2			56,8	1,91	40		
17	58,3	7,4	57,9	6,54	34	-0,4	0
17 1/2			58,3	5,55	38		
18	59,0	7,8	55,6	7,44	19	-3,4	-0,4

TAB. 3
Boys — Weight (in kg)

Age	1961		SD_1	1967			Difference		SD
	\bar{x}_1	s_1		\bar{x}	s	n	$\bar{x} - \bar{x}_1$	i	
6	20,9	3,0	0,5	21,4	2,88	13	0,5		
6 1/2				22,9	3,18	81			
7	23,5	3,4	0,4	23,7	3,54	100	0,2	0,1	0,1
7 1/2				25,3	3,99	118			
8	26,2	4,2	0,1	26,5	4,11	89	0,3	0,1	-0,1
8 1/2				28,2	4,62	111			
9	29,1	4,7	0,3	30,2	5,13	86	1,1	0,2	0,9
9 1/2				31,1	5,49	138			
10	32,2	5,5	-0,3	33,0	5,61	157	0,8	0,1	1,5
10 1/2				34,3	5,79	130			
11	35,3	6,3	-1,0	36,1	6,84	178	0,8	0,1	-0,7
11 1/2				37,4	5,97	237			
12	38,8	7,0	-2,5	39,5	7,02	246	0,7	0,1	-3,2
12 1/2				41,9	7,83	266			
13	43,8	8,1	-2,3	43,9	7,98	237	0,1	0	-4,3
13 1/2				47,7	8,85	237			
14	49,2	8,9	-1,9	50,1	9,84	249	0,9	0,1	-1,9
14 1/2				50,5	9,42	239			
15	56,1	9,4	1,1	56,2	9,72	245	0,1	0	5,0
15 1/2				58,1	9,78	42			
16	60,8	8,8	3,5	60,4	8,91	17	-0,4	0	5,2
16 1/2				66,3	8,76	22			
17	63,5	8,4	5,2	64,4	4,86	27	0,9	0,1	6,5
17 1/2				68,1	7,44	28			
18	65,5	8,0	6,5	72,0	5,73	6	6,5	0,8	
18 1/2				61		1			

TAB. 5.

Boys — Girth of Chest (circumference in cm)

Age	1961		SD ₁	1967			Difference	
	\bar{x}_1	s_1		\bar{x}	s	n	$\bar{x} - \bar{x}_1$	SD
6	57,5	3,0	1,3	60,5	3,09	13	3,0	
6 1/2				61,0	3,45	81		
7	60,0	3,4	0,9	61,1	3,99	100	1,1	0,9
7 1/2				63,1	4,53	118		
8	62,1	3,7	0,5	63,7	4,17	89	1,6	0,7
8 1/2				65,0	4,44	111		
9	64,4	4,5	0,5	66,9	5,82	86	2,5	1,5
9 1/2				67,7	4,89	128		
10	66,8	4,8	0	68,3	4,95	157	1,5	0,3
10 1/2				69,8	5,19	130		
11	69,0	5,1	-1,0	71,5	6,09	178	2,5	0,3
11 1/2				71,5	5,73	237		
12	71,2	5,5	-2,9	72,9	5,64	246	1,7	-3,0
12 1/2				74,6	6,42	266		
13	74,1	5,8	-3,6	75,5	6,12	235	1,4	-5,0
13 1/2				78,2	6,30	236		
14	77,1	6,2	-4,5	79,4	6,90	249	2,3	-4,8
14 1/2				81,8	6,48	240		
15	81,6	6,2	-2,8	83,2	6,63	245	1,6	-1,8
15 1/2				84,7	3,54	42		
16	84,8	6,0	-1,6	86,9	4,92	17	2,1	-0,7
16 1/2				89,2	5,37	22		
17	87,0	5,6	-0,4	88,4	4,47	27	1,4	1,5
17 1/2				90,3	5,19	28		
18	88,6	5,6	0,6	92,0	4,23	6	3,4	
18 1/2				86		1		

The comparison of the differences between boys and girls in 1961 and in 1967 bears out the former changes of the child's body into an adult one in both sexes. In 1961 the period in which the girls were heavier than the boys lasted from 10 to 14 years. Now this period is shortened in that it begins one year later. But the differences during this period are more marked in favour of the girls, while after termination of this period they are more marked in favour of the boys. The sexual differentiation more marked in 1967 than in 1961 can be regarded as another proof of secular development.

Girth of chest

The development tendencies found in body weight are also confirmed in the girth of chest. This criterion furnishes in boys of all age groups higher mean values than six years ago. In girls this phenomenon can be observed only till 15 years. The period in which girls surpassed boys lasted from 11 to 17 years. But now it begins one year later and ends one year earlier. The differences between the sexes are more marked.

DISCUSSION

In the determination of the development standard for the youth of a certain country it is not possible to take over into the standard the possible development irregularities of certain age groups as they may follow empirically according to documentary material. Such standards, as a rule, are derived from the empiric results of investigations with the aid of more or less complicated mathematical operations.

TAB. 6

Girls — Girth of Chest (circumference in cm)

Age	1961		1967			Difference
	\bar{x}_1	s_1	\bar{x}	s	n	$\bar{x} - \bar{x}_1$
6	56,2	3,0	58,9	3,00	17	2,7
6 1/2			60,0	3,63	105	
7	59,1	3,9	60,2	3,96	83	1,1
7 1/2			62,2	4,62	105	
8	61,6	4,4	63,0	4,53	93	1,4
8 1/2			64,9	5,25	104	
9	63,9	4,7	65,4	6,09	97	1,5
9 1/2			67,8	5,94	128	
10	66,8	5,6	68,0	6,39	138	1,2
10 1/2			70,6	5,73	149	
11	70,0	6,0	71,2	6,00	154	1,2
11 1/2			73,9	6,90	248	
12	74,1	6,7	75,9	7,05	255	1,8
12 1/2			78,1	6,71	233	
13	77,7	7,0	80,5	7,47	236	2,8
13 1/2			82,3	6,57	291	
14	81,6	6,6	84,2	6,87	266	2,6
14 1/2			84,8	6,39	257	
15	84,4	6,1	85,0	6,48	235	0,6
15 1/2			83,3	5,67	42	
16	86,4	5,7	86,2	4,74	35	-0,2
16 1/2			86,2	4,14	40	
17	87,4	5,7	86,9	3,63	34	-0,5
17 1/2			86,9	5,16	38	
18	88,0	5,8	87,0	4,80	19	-1,0

This is done for the reason that the standards are to be an aid for individual or group treatment of the development of children during a relatively long time. In Czechoslovakia a modification of standards is expected always after ten years, e.g. 1951—1961, etc. Our results of 1967 are direct empiric values. Therefore it is not possible, for the time being, to draw any conclusions from the fact that in two cases exceptions were found that do not agree with the generally known tendencies. This concerns the unexpectedly low height in 13-year-old boys and the low weight in 10-year-old girls. It is possible that specific characteristics of certain age groups are involved. It will be necessary to search for the causes of these peculiarities, if in the further stages of research the established phenomenon is confirmed. For a continuous check to be possible not only in generally manifesting tendencies, but also in slight exceptions, we leave the results without mathematical modifications. The present report on the results of research in 1967 is but the first stage that preliminarily indicates where at present the trend in the development of physical properties of school-children is leading to.

SUMMARY

In the ten-year interval of 1951—1961 significant secular changes in the development of Czech school-children were found. Therefore, in 1967 the author, on the basis of his own project, began with the continuous control of the developmental tendencies in three basic physical characteristics. A total of 6706 persons aged 6 to 18 years were examined. By

comparison of the results of development standards of 1961 it was found that the body height on the average had increased in boys and in girls. In boys the body weight, too, registered a general increase, while in girls the weight grew only in the age groups till 14 years. In girls of fifteen years, on the other hand, a clear tendency to slimming could be noticed. This is confirmed by the data on the chest circumference as well. In the pubertal acceleration of development more marked sexual differences manifest themselves, which testifies to the further shift of this phenomenon to the younger age groups.

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