

## Secular changes of height and body mass of children and youth in the Bydgoszcz region

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**ABSTRACT** The secular changes of height and body mass of girls and boys in the Bydgoszcz region in the period between 1935 and 1991 have been presented in this paper. Over the period of 56 years changes of the traits under investigation showed periodical diversification. Between 1935-1946 a regress was observed, between 1952 and 1971 the greatest average secular changes took place, the years from 1972 to 1979 were characterized by a slowdown in the changes, and in the period from 1979 through 1991 there was a set back in the secular trend of the investigated traits. This is probably due to the fluctuation in the standard of living of the Polish society. The maximum intensification of the secular changes occurs in age groups 13.5 years, 14.5 years, and 15.5 years. Analysis of the research results indicates that the changes are more conspicuous among boys than among girls.

**KEY WORDS** secular changes, physical development, children of Bydgoszcz region

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### Introduction

Physical anthropologists', physicians' and educators' interest in the problems of secular changes in humans, initiated about a 100 years ago, is still very strong. Many researchers believe (see e.g., MALINOWSKI [1977]) that the process of secular changes intensified by the end of the 19th century in the developing countries, and then weakened in the highly developed societies. MILICER [1966] reports that in the period between 1880-1960 the body height of boys (aged

between 7 and 14) increased by 15.5 cm (11.6%) and of girls by 13.3 cm (10%), and their body mass grew by 8.8 kg (27.4%) and 9.1 kg (28.3%), respectively.

The research on the tendencies in developmental changes in boys and girls in relation to living conditions, taking into consideration both World Wars and the children's background was carried out by WOLAŃSKI [1977]. PANEK [1970] apart from the height and body mass investigated also the variability of breadth dimensions and studied the process of tooth

eruption. On the basis of the comparative materials from the period between 1956 and 1966 the author ascertained that the change tendencies were more distinct in rural than in urban areas.

A profound picture of the changes taking place over a long period of time (1880-1972) in children and youth of Poznań was presented by MALINOWSKI [1976]. The results of his study showed that over almost 100 years body height in this population increased on the average by 9.5%, chest circumference by approximately 9%, and head circumference by almost 3%. A very interesting characterization of the secular changes of body height and body mass in children and youth that took place over a period of 65 years in Łódź was presented by STOLARCZYK & MALINOWSKI [1996].

Extensive material documenting secular changes of morphological traits among children and youth in Kraków was gathered by BOCHEŃSKA [1978]. She ascertained that in the course of 36 years body height of boys increased on the average by 2.02 cm (1.6% per decade) and in the course of 51 years body height of girls grew by 1.3 cm (1%). In the course of 26 years body mass of boys increased by 0.7 kg (4.5%) in a decade, but the increase in girls was smaller, amounting only to 0.55 kg (1.5%) per decade. Secular changes in the physical development of children and youth in Bydgoszcz were analyzed by NOWICKI [1996].

The authors of the above-mentioned studies concerning secular changes in the physical development of children and youth generally agree that this change trend had a positive character and that it continued roughly till the end of the nineteen seventies.

## Materials

The secular changes taking place in the process of growth and increase of the body mass of children and youth aged from 7.5 to 18.5 years were presented in this paper on the basis of research results representative for the Bydgoszcz region (former provinces of Bydgoszcz, Toruń, Włocławek and the present Kujawsko-Pomorskie province). These studies were carried out in:

- 1935 [ĆWIRKO-GODYCKI 1937] on schoolboys from Bydgoszcz primary schools;
- 1946 [TRZEŚNIEWSKI 1963] on 2099 girls and 2049 boys from small towns and villages, and 2004 girls and 1102 boys from big cities;
- 1951 [TRZEŚNIEWSKI 1961] on girls and boys from villages (30.7%), small towns (38.5%), and the big cities (30.8%) of the Bydgoszcz region;
- 1971, 1979 and 1991 [NOWICKI 1996] on children and youth from the big cities (about 1/3 of a total number of individuals), small towns (about 33%) and villages (about 33%).

## Results and discussion

Secular changes that occurred between 1935- 1991 in the height and body mass of girls and boys aged 7.5 to 18.5 years are illustrated by the data included in Tables 1 and 2.

Changes of body height of girls in the course of 11 years between the research series from 1935 and 1946 are not unequivocal. Certain age categories (9.5 years, 10.5 years, 14.5 years) show increase while others (11.5 years, 12.5 years, 13.5 years) exhibit regress in the development of the trait. Total values of

the height of girls investigated in 1946, that is directly after the Second World War, are on average lower by 1.1 cm per decade than the values obtained for the girls examined in 1935 (Table 1).

A similar phenomenon was observed in that period with regard to the body mass of boys (Table 1), and the regress in the development of this trait was 0.7 cm per decade on the average. The phenomenon can be explained with a considerable deterioration of the population's social and living conditions during the war and in the early years after its end.

The greatest secular changes of the body height that occurred during the period of the 56 years took place between 1946 and 1951. The data concerning girls examined in 1951 show, that they were taller than the girls of the same age investigated in 1946 (a 3.2 cm increase per decade). The temporal changes of the body height of boys at that time were even greater and amounted to 5 cm per decade on the average. An exception to this trend were, however, older girls (16.5 - 18.5 years) and older boys (17.5 - 18.5) whose body height did not reach the stature of their peers investigated in 1946. This can be explained with the fact that the early years of their physical development had fallen in the war period, which might have had negative effect on the growth.

Between 1951 and 1971 (20 years) the trait exhibited further increase of 5.3 cm on the average in the group of girls (2.6 cm per decade) and 5.9 cm in the group of boys (3 cm per decade). Different character of the secular changes might be observed between the series from 1971 and 1979. In that period the increase of the body height of boys was very small (only 0.5 cm on the average, with 0.6 cm per decade) in comparison to

girls who exhibited the average growth of 2 cm (2.5 per decade).

Between 1979-1991 a further slow-down (arrest) of the secular changes was observed both in girls and in boys (0.2 cm per decade). It was probably connected with the economic crisis in Poland and the resultant sudden deterioration of the living conditions of the population.

The secular changes concern also body mass of children and youth in the Bydgoszcz region. The pertinent data are shown in Table 2.

In the first period between the 1935 and 1946 series we have to do with a downward tendency in body mass change. It means that the girls examined in 1946 had average body mass lower by 1.3 kg (1.1 kg per decade) than the girls examined in 1935, while in boys from those series the decrease was 0.9 kg (0.82 kg per decade). This concerned mainly individuals of both sexes of older ages starting from 11.5 years. The average differences between body mass of the subjects investigated in 1946 and 1951 are the biggest compared to other research series and amount to 1.7 kg (3.4 per decade) and 2.4 kg (4.8 kg per decade) for girls and boys, respectively.

Between 1951-1971 body mass of the investigated individuals aged 7.5 to 18.5 years was higher by 4.7 kg (2.4 kg per decade) for girls and 5.8 kg (2.9 kg per decade) for boys. In the next period of time (1971-1979) the secular changes of the body mass of boys were also big and amounted to 2.3 kg (2.9 kg per decade) but for girls they were slightly smaller at 0.3 kg (0.4 kg per decade). In the final period (1979-1991) the average body mass of boys decreased by 0.4 kg (0.3 per decade), while girls' body mass increased by 0.1 kg (0.08 kg per decade).

This suggests that the pace of secular changes in body mass slowed down, similarly to the changes in body height. In the entire period under investigation (1935-1991) the average body height of girls increased by 7.9 cm (1.4 cm per decade) and by 8.4 cm (1.5 cm per decade) for boys.

The value of the secular trend in body mass between 1935-1991 was 5.5 kg (1.0 kg per decade) for girls and 9.2 kg (1.6 per decade) for boys. On the average the biggest secular changes of height and body mass per decade were observed at the age of 13.5-15.5 years for both boys and girls. Similar results were presented by STOLARCZYK & MALINOWSKI [1996] in reference to children and youth from the Łódź region. In the studies on the reasons of secular changes among a variety of factors, social and economic conditions [TANNER 1963; SALZLER 1968; MILICER 1968; BOCHEŃSKA 1978; BIELICKI & CHRZANOWSKI 1977; BIELICKI *et al.* 1981] depending on the level of economic development are often mentioned. Due to its relatively fast pace of economic development after World War II, the Bydgoszcz region was an important element in Poland's economic structure. As a result the living standard of this region's population were improving:

We can distinguish four stages of development in the period from 1945 to 1991:

1. Stage of quantitative growth of consumption (1945-1960)
2. Stage of qualitative coverage of basic needs (1961-1970)
3. Stage of choice – the scope of freedom in the directions of consumption (1971-1974)
4. Stage of regress and a deep economic and social crisis (1975-1989).

The above stages of development of consumption in the population match the secular change direction of the investigated bodily traits. We can observe that the period between 1946-1971, being the period of the greatest secular change in the height and body mass, coincides in time with the first, second and third stages of the population's consumption development. The fourth stage (regress and social and economic crisis) can be associated with the slowdown in temporal changes of height and body mass in both girls and boys.

The phenomenon of the slowdown and regress in the physical development of children and youth in Poland (in the 1980s) is discussed by STOLARCZYK & MALINOWSKI [1996], GOŁĄB [1994], HULANICKA *et al.* [1990], and CHARZEWSKI *et al.* [1991].

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## Streszczenie

W pracy przedstawiono zmiany sekularne wysokości i masy ciała u dziewcząt i chłopców regionu bydgoskiego w okresie od 1935 do 1991 roku. W czasie 56 lat zmiany w rozwoju badanych cech wykazują okresowe zróżnicowanie. W latach 1935–1946 ma miejsce regres, w latach 1952–1971 zmiany sekularne są przeciętnie największe, lata 1972–1979 charakteryzują się ich spowolnieniem, a w ostatnim okresie 1979–1991 widoczne jest zahamowanie trendu sekularnego badanych cech. Można przypuszczać, że ma to związek z wahaniem poziomu życia społeczeństwa polskiego. Maksymalne natężenie zmian międzypokoleniowych występuje w wieku od 13,5 do 15,5 lat. Analiza wyników badań wskazuje, że zaznaczają się one bardziej u chłopców niż u dziewcząt.

**Table 1.** Secular changes of the body height of girls and boys from the Bydgoszcz region (cm)

Age	Year of the investigation / Author																	
	1935 Ćwirko-Godycki			1946 Trześniowski			1951 Trześniowski			1971 Nowicki			1979 Nowicki			1991 Nowicki		
	<i>N</i>	<i>X</i>	<i>SD</i>	<i>N</i>	<i>X</i>	<i>SD</i>	<i>N</i>	<i>X</i>	<i>SD</i>	<i>N</i>	<i>X</i>	<i>SD</i>	<i>N</i>	<i>X</i>	<i>SD</i>	<i>N</i>	<i>X</i>	<i>SD</i>
<b>GIRLS</b>																		
7.5	114	116.0	4.92	-	-	-	-	-	-	1835	123.4	5.69	100	125.4	7.56	364	125.6	6.82
8.5	131	121.5	5.27	-	-	-	-	-	-	1783	128.8	5.79	100	130.3	7.27	359	130.7	6.99
9.5	129	126.7	5.54	463	128.4	6.72	-	-	-	1813	133.7	6.13	100	135.2	7.36	372	135.5	7.21
10.5	145	131.2	6.38	465	131.5	6.79	123	135.8	6.28	1875	139.4	6.92	100	140.8	7.83	426	140.7	7.56
11.5	147	138.8	6.93	533	135.6	7.67	130	138.5	6.63	2277	145.4	7.23	100	147.1	7.82	417	147.3	7.49
12.5	118	145.8	6.79	519	140.4	7.14	129	143.2	7.12	2236	151.5	7.12	100	152.7	7.74	421	152.8	7.84
13.5	136	148.5	6.67	440	146.2	6.45	131	151.2	7.18	2285	155.8	6.33	100	156.9	7.35	446	157.0	7.80
14.5	132	149.6	6.85	397	151.1	5.91	117	152.4	7.04	2206	159.0	5.77	100	161.3	7.24	416	161.4	7.15
15.5	-	-	-	301	154.7	4.93	116	155.5	6.63	1629	160.7	5.52	100	163.1	7.39	420	163.4	6.98
16.5	-	-	-	546	157.1	4.76	120	156.9	5.80	1358	161.3	5.15	100	163.9	7.40	384	164.3	7.14
17.5	-	-	-	154	159.2	5.69	119	157.0	5.63	1034	161.7	5.32	100	164.7	7.18	365	165.1	6.99
18.5	-	-	-	285	158.9	5.31	108	158.8	5.49	617	161.9	5.31	100	165.0	7.24	341	165.2	7.04
<b>BOYS</b>																		
7.5	112	116.7	5.06	-	-	-	-	-	-	1867	124.5	5.68	100	124.9	4.34	356	125.1	5.42
8.5	136	122.4	5.74	-	-	-	-	-	-	1789	130.2	5.87	100	131.0	5.13	369	131.3	5.20
9.5	129	127.6	6.09	212	128.9	6.19	-	-	-	1814	134.9	6.28	100	135.6	5.09	354	136.0	5.12
10.5	149	131.5	5.28	443	131.9	6.08	129	132.7	6.09	1905	139.8	6.43	100	140.8	5.10	406	141.1	5.26
11.5	138	136.4	6.59	514	135.3	6.75	126	139.8	6.54	2050	144.8	6.76	100	145.3	5.19	428	145.6	5.40
12.5	151	142.6	6.94	490	139.7	7.36	130	143.7	6.72	2124	149.9	7.67	100	149.9	5.81	415	150.0	6.04
13.5	132	147.0	7.99	453	144.9	8.35	121	148.4	8.01	2063	156.6	8.16	100	156.8	5.90	405	156.9	6.12
14.5	121	150.0	8.35	461	149.8	8.92	148	154.7	8.53	2057	163.9	8.26	100	163.9	6.63	431	163.8	7.15
15.5	-	-	-	256	156.8	8.43	126	160.9	7.98	1748	168.9	7.21	100	169.0	6.54	399	169.2	7.02
16.5	-	-	-	152	163.0	7.25	130	166.6	7.47	1483	171.7	6.61	100	172.0	6.67	391	172.8	6.90
17.5	-	-	-	100	168.8	5.76	131	167.2	6.51	1253	173.6	6.27	100	175.9	6.47	373	175.8	6.78
18.5	-	-	-	70	169.6	6.31	132	168.6	5.87	341	176.1	5.63	100	176.3	6.44	350	176.5	6.61

**Table 2.** Secular changes of the body mass of girls and boys from the Bydgoszcz region (kg)

Age	Year of the investigation / Author																	
	1935			1946			1951			1971			1979			1991		
	Ćwirko-Godycki			Trzeźniowski			Trzeźniowski			Nowicki			Nowicki			Nowicki		
	N	X	SD	N	X	SD	N	X	SD	N	X	SD	N	X	SD	N	X	SD
<b>GIRLS</b>																		
7.5	114	20.5	2.85	-	-	-	-	-	-	1835	24.3	3.83	100	25.0	5.94	364	25.2	4.90
8.5	131	22.8	2.93	-	-	-	-	-	-	1783	27.1	4.61	100	27.5	5.54	359	26.9	5.08
9.5	129	25.4	3.33	463	26.1	3.92	-	-	-	1813	29.8	5.02	100	30.3	5.83	372	30.6	5.92
10.5	145	27.5	3.75	465	27.9	3.63	123	27.9	4.84	1875	33.0	5.78	100	33.5	4.96	426	33.5	5.90
11.5	147	32.3	4.95	533	29.9	4.37	130	32.5	5.51	2277	37.1	6.57	100	37.3	5.04	417	37.5	6.12
12.5	118	37.4	6.30	519	33.2	5.78	129	35.6	6.08	2236	42.2	7.48	100	42.4	5.28	421	42.5	6.21
13.5	136	40.2	6.35	440	37.5	7.08	131	40.9	6.73	2285	46.7	7.48	100	47.4	5.16	446	47.6	5.84
14.5	132	40.9	6.20	397	41.5	7.15	117	43.9	6.99	2206	50.7	7.08	100	50.9	5.23	416	50.8	5.70
15.5	-	-	-	301	46.1	7.59	116	49.0	6.61	1629	53.2	6.27	100	53.4	5.16	420	53.2	6.03
16.5	-	-	-	546	49.3	6.24	120	50.4	6.21	1358	54.4	6.14	100	54.7	5.18	384	54.8	5.87
17.5	-	-	-	154	52.7	5.96	119	53.0	6.04	1034	55.5	6.11	100	55.9	5.18	365	56.3	5.32
18.5	-	-	-	285	52.8	5.76	108	53.0	6.26	617	56.0	6.01	100	56.3	5.15	341	56.6	5.64
<b>BOYS</b>																		
7.5	112	21.1	2.32	-	-	-	-	-	-	1867	25.2	3.79	100	27.0	6.33	356	26.9	5.52
8.5	136	23.9	2.71	-	-	-	-	-	-	1789	28.0	4.20	100	31.2	6.50	369	30.9	5.91
9.5	129	26.4	3.12	212	27.6	3.43	-	-	-	1814	30.6	4.60	100	33.2	6.53	354	33.3	6.14
10.5	149	28.6	3.41	443	28.7	3.61	129	29.9	4.41	1905	33.7	5.16	100	35.4	5.47	406	34.9	5.84
11.5	138	31.8	3.31	514	30.7	4.19	126	32.8	4.99	2050	37.0	6.19	100	43.9	4.42	428	42.8	5.12
12.5	151	35.2	5.02	490	32.9	5.65	130	34.9	5.51	2124	40.5	7.15	100	45.3	4.51	415	44.9	5.36
13.5	132	38.5	5.89	453	36.5	6.58	121	39.2	6.40	2063	45.9	7.83	100	47.7	4.73	405	47.2	5.47
14.5	121	40.9	6.29	461	40.4	7.50	148	44.8	7.56	2057	52.7	8.29	100	55.2	4.83	431	54.0	5.24
15.5	-	-	-	256	46.1	7.80	126	50.6	7.92	1748	57.9	8.04	100	58.9	5.57	399	58.0	5.15
16.5	-	-	-	152	52.1	6.85	130	54.8	7.48	1483	61.3	7.41	100	62.6	5.55	391	62.1	5.62
17.5	-	-	-	100	57.1	6.41	131	57.4	6.99	1253	64.2	6.87	100	65.4	5.25	373	65.5	5.38
18.5	-	-	-	70	60.7	6.36	132	62.8	6.60	341	66.1	6.65	100	66.6	5.28	350	66.7	5.51