

SECULAR CHANGES OF CHOSEN SOMATIC VARIABLES IN CHILDREN AGED 7 TO 15 FROM THE RURAL REGIONS OF ŻYWIEC BETWEEN 1964-1996

by

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The main objective of the paper was the determination of the secular trend of boys and girls from rural regions of Żywiec in the years of 1964-1996. The results indicate that time changes relate to chosen somatic variables as well as body proportions. The intensity of these changes vary depending on the variable. The greatest increment for both sexes were registered for body height and body mass (only average 1.3 cm and 1.1 kg per decade). This increase was higher in case of males and was lower in the rural population in comparison to others. During the years on 1980-1996 the rate of secular changes decreased significantly what reflects very difficult social and economical conditions of Polish rural populations during this period. Secular changes seem to confirm the thesis proposed by Polish antropologists which states that the level of physical development reflects in a very sensitive manner social changes in a given population.

Keywords: secular trend, rural population

Introduction

The role of social and economic factors in the physical development of men is well established this is confirmed by research on social variables (urbanization, social and economic conditions) and the secular trend. In Poland this observations were carried out on a large scale in army recruits and other subjects with the application of anthropological photos (Bielicki et al. 1981) arriving at a conclusion that a social gradient exists: better social conditions

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relate to greater physical development and a more intensive secular changes. This is especially visible in relation of city and country where a great number of factors effecting physical development combine.

As mentioned previously, there has been many research projects considering secular changes in Polish populations. Few of these projects consider rural populations and those that do are too short in time.

In south of Poland the best examined region is the Żywiec thanks to works of Jasicki et al. (1986). Having access to the data of Jasicki from the years of 1964-1967 (serie I), 1972-1974 (serie II), 1978-1980 (serie III) and own data from the years 1995-1996 (serie IV) an attempt was made to determine the secular trend in this region.

Many scientists attempt to evaluate in the same manner the secular trend in physical fitness (Przewęda, Trzeźniowski 1980-2000). One can not forget that physical fitness is to a large extent dependent on physical development. This is why the authors of this paper believe that the changes in body structure are primary in nature while those related to physical fitness are secondary. The evaluation of secular changes in physical fitness can not be consider without somatic changes. The dynamics of this changes in a Polish rural population over a period of 30 years is the main objective of this work.

Material and methods

The material includes results of cross-sectional research conducted on 588 boys and 517 girls between the age of 7 to 18 from the rural regions of Żywiec performed in 1995-1996 and those of Jasicki et al. (1986). The social structure of this region did not change significantly during the period of investigation (Jaworski 1998) and the migration of the people from this regions was also very low. For 90% of population most of the income comes from activities other than farming, while only 10% exists strictly from farming. The number of subject evaluated in relation to age and sex is presented in table 1.

Table 1

The number of evaluated children with relation to age and sex

Age	Boys	Girls
7	24	27
8	79	83
9	65	56
10	63	64
11	68	71
12	66	53
13	73	56
14	92	71
15	58	36
Total	588	517

The scope of this research included basic somatic variables, comparable to those evaluated earlier by Jasicki et al. (1986):

- ✓ body height (B-v)
- ✓ shoulder width (a-a)
- ✓ hip width (ic-ic)
- ✓ body mass
- ✓ Quetelet's index
- ✓ hip-shoulder index

Basic statistical methods were applied. To present results in a more objective manner the intensity of the trend was presented not only in absolute values but also in relative ones (%/10 years).

Results

As can be seen from fig. 1 during the analyzed 30 years a systematical increase in body height was observed in all age groups for both sexes. The lowest body height occurred in boys and girls of serie I while the highest values are registered in serie IV. The greatest intensity in the secular trend in boys was observed between the following series: I-II (1964/67-1972/74), those born in the 50's of the 20th century and between II-III (1972/74-1978/80) – 1.4 cm per decade. In girls the most intensive secular trend occurred between serie I and II and equaled 1.8 cm per decade. During the analyzed period, two distinct phases

of secular intensity occurred: the first one includes the years 1964-1980, while the second one in the years 1980-1996. Very characteristic is the decrease of the intensity of the secular trend (threefold) between serie III and IV (1980-1996). This is confirmed by data included in tables 2 and 3. During this period of time the intensity of secular trend is only 0.7 cm per decade for boys and 0.4 cm for girls. It seems that the maturity spurt is delayed to the age of 14-15 in this population.

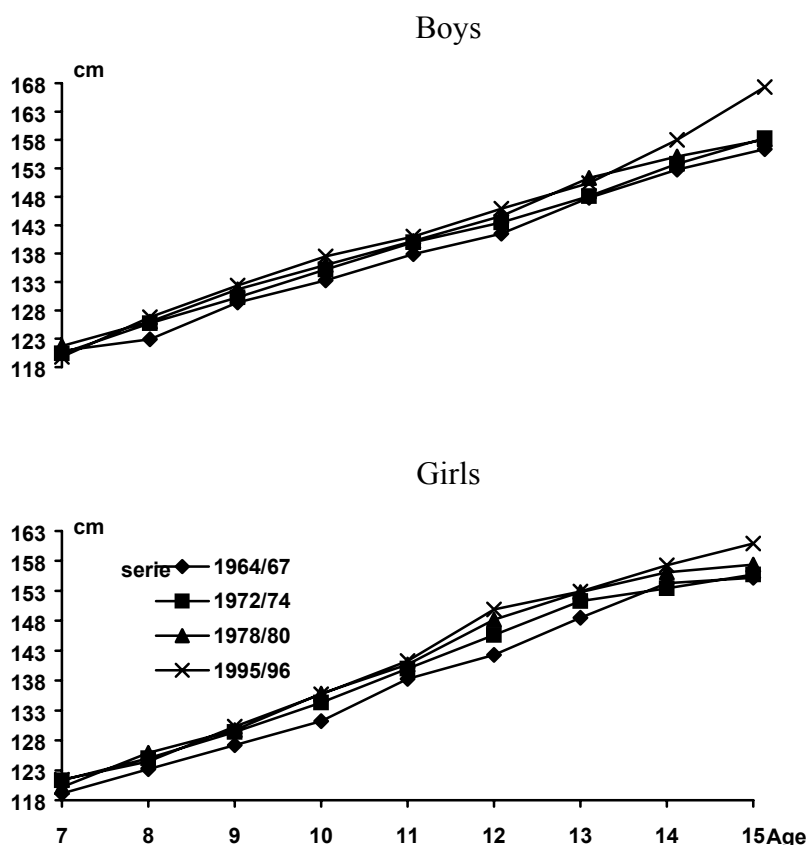


Fig. 1 Body height of boys and girls between the age of 7 and 15 in a respective series

The greatest differences in the analyzed variables were observed during the maturity spurt. They are equal to 10.9 cm in boys and 7.6 cm in girls respectively. The boys aged 15 from serie IV are on the average taller than their

peerce from serie I by 7%, while the height of girls is 5.3% greater. Table 8 includes the average increments between particular series of children for all the analyzed variables. It is quite clear that the greatest increment over analyzed 30 year period occurred for body mass and height in case of both sexes.

Table 2

Body height of boys and girls between the age of 7 and 15 in a respective series

Age	BOYS				GIRLS			
	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96
7	120.9	120.4	121.7	119.8	119.1	121.3	120.2	121.4
8	122.9	125.7	126.0	126.8	123.2	125.0	125.9	124.5
9	129.4	130.2	131.7	132.4	127.2	129.4	129.7	130.3
10	133.3	125.2	136.0	137.5	131.2	134.3	135.8	135.7
11	137.9	140.0	140.2	141.0	138.3	140.0	140.7	141.3
12	141.5	143.5	144.6	145.9	142.3	145.6	148.2	149.9
13	147.8	148.1	151.3	150.4	148.5	151.3	152.8	152.9
14	152.8	153.8	155.1	158.0	154.3	153.4	156.1	157.3
15	156.4	158.3	158.1	167.3	155.2	155.7	157.4	160.9

Table 3

Body mass of boys and girls between the age of 7 and 15 in a respective series

Age	BOYS				GIRLS			
	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96
7	22.5	23.6	23.6	22.6	21.6	22.9	23.4	23.4
8	24.1	25.6	23.8	22.6	23.6	24.6	25.0	23.7
9	27.1	27.2	28.6	28.8	25.6	27.7	26.6	26.8
10	29.6	30.2	31.7	31.7	27.5	29.7	30.8	30.8
11	31.4	32.4	33.6	34.2	31.1	33.8	34.4	32.5
12	33.4	31.1	35.4	38.2	34.1	38.5	39.4	41.7
13	38.3	37.6	40.9	41.2	41.2	42.3	44.2	44.8
14	42.6	43.4	47.3	48.7	43.6	45.4	47.8	47.6
15	45.9	47.3	49.0	57.2	51.1	50.1	51.7	57.0

The next considered trait included body mass. From the data collected in table 3, presented graphically in fig. 2 it is obvious that changes in body mass are similar to those of body height. It must be indicated that the trend of this variable is not so intensive in boys up to the age of 11, yet it is visible. After this

period the differences between particular series are highly significant and reach maximal values at the age of 15 (11.3 kg), what accounts to 3.8 kg per decade.

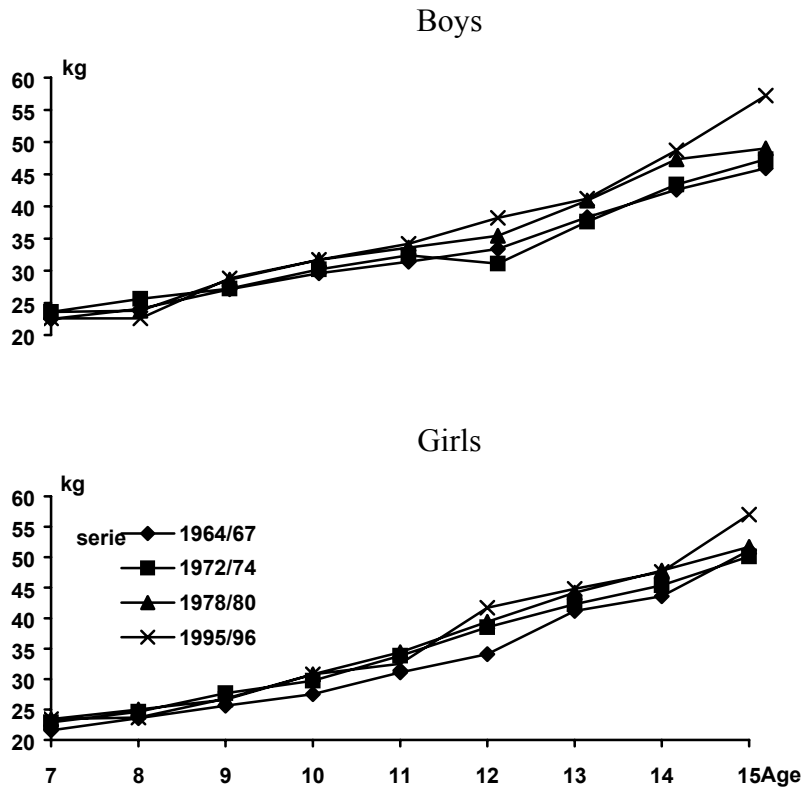


Fig. 2 Body mass of boys and girls between the age of 7 and 15 in a respective series

During the whole period of time discussed, boys and girls from serie I showed the lowest values of body mass. As in the case of body height, the greatest differences are registered between serie I and IV in boys aged 15 and in girls aged 12, what corresponds to the maturity spurt for both sexes. The differences are 11.3 kg for boys and 7.6 kg for girls respectively. The average increase in body height over the 30 year time period equalled to 1.1. kg per decade. The highest intensity for secular trend was observed for series II and III for boys, and I and II for girls. The average increase for body mass during this period of time equalled to 1.7 kg per decade.

Table 4

Shoulder width of boys and girls between the age of 7 and 15 in a respective series

Age	BOYS				GIRLS			
	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96
7	26.4	26.3	26.4	25.9	26.1	26.9	25.9	26.4
8	27.1	27.2	27.3	27.5	27.1	27.0	26.6	26.9
9	28.2	28.1	28.5	28.7	27.2	27.9	27.4	27.6
10	28.7	29.1	29.2	29.4	28.5	29.2	28.6	29.0
11	30.2	30.0	30.1	30.4	30.0	30.2	30.1	30.0
12	30.4	30.7	31.2	31.2	31.0	31.2	31.2	31.8
13	32.3	31.3	32.2	32.3	32.7	32.7	32.7	32.3
14	33.0	33.0	34.1	33.8	34.2	33.1	33.5	33.0
15	33.8	34.4	33.4	36.3	34.2	33.9	33.6	33.9

Table 5

Hip width of boys and girls between the age of 7 and 15 in a respective series

Age	BOYS				GIRLS			
	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96
7	19.7	19.2	18.8	18.5	19.3	19.1	18.2	19.0
8	20.1	19.9	19.8	20.2	20.1	19.8	19.4	19.3
9	20.9	20.6	20.5	20.7	20.4	20.4	20.2	20.2
10	21.4	21.4	21.0	21.4	21.2	21.3	20.5	21.4
11	22.2	22.0	21.8	22.1	22.5	22.3	21.0	21.9
12	22.5	22.5	22.4	22.9	23.2	23.3	22.9	23.9
13	23.6	23.0	23.2	23.6	24.8	24.3	23.8	24.7
14	24.5	23.6	24.5	24.7	25.9	24.5	25.0	25.2
15	25.1	25.0	24.6	26.3	26.2	26.0	26.1	26.8

During the analyzed 30 years, the average increase of body mass was close to 3.3 kg which gives a value 1.1. per decade. It must be noted that similarly to body height, the last time period is characterized by significant slowing down of the trend. From the variables describing body structure, shoulder and hip width was chosen. The results of this variables are presented in fig. 3 and 4. The long-term changes in width variables are not as systematic as those of body height and mass.

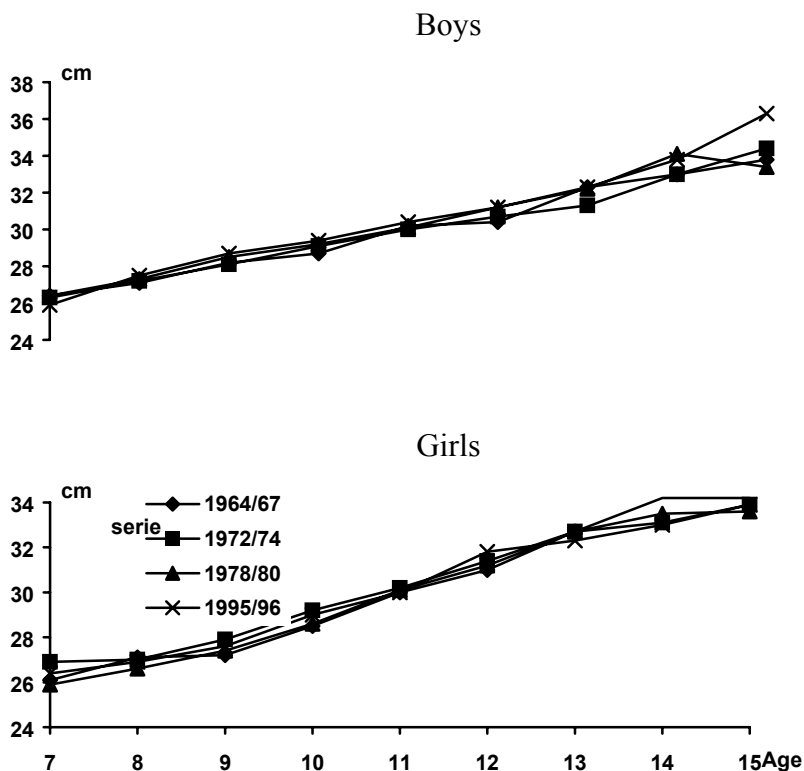


Fig. 3. Shoulder width of boys and girls between the age of 7 and 15 in a respective series

Table 6

Quetelet's index of boys and girls between the age of 7 and 15 in a respective series

Age	BOYS				GIRLS			
	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96
7	18.6	19.6	19.4	18.9	18.1	18.9	19.5	19.3
8	19.6	20.4	18.9	17.8	19.1	19.7	19.9	19.0
9	20.9	20.9	21.3	21.7	20.1	21.4	20.5	20.6
10	22.2	22.3	23.3	23.0	21.0	22.1	22.7	22.7
11	22.8	23.1	24.0	24.3	22.5	24.1	24.4	23.0
12	23.5	24.5	24.5	26.2	24.0	26.4	26.6	27.8
13	25.9	25.4	27.0	27.4	27.7	28.0	28.9	29.3
14	27.9	28.22	29.9	30.8	28.2	29.6	30.6	30.3
15	29.5	29.9	31.0	34.2	32.9	32.2	32.8	35.4

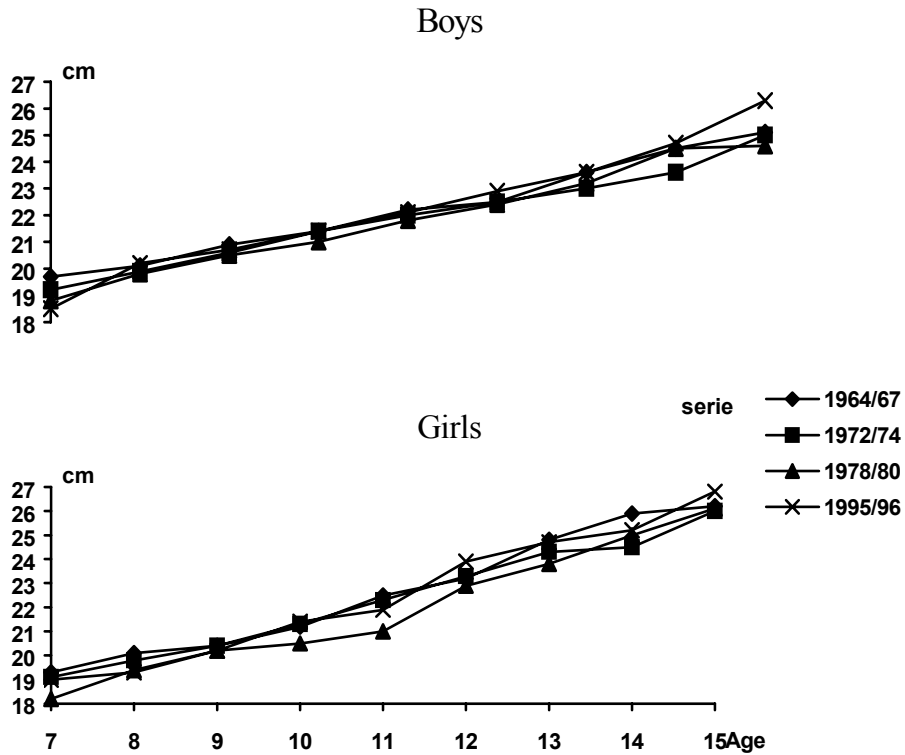


Fig. 4. Hip width of boys and girls between the age of 7 and 15 in a respective series

The highest values of shoulder width occurred in boys from serie IV (except age 7 and 14), while girls from this serie showed smaller shoulder width than their peerce from serie I. Since the females from serie IV show significantly greater values of body height in comparison to serie I, one can conclude that a tendency of slimming of the body of girls from rural regions occurs. The biggest differences were observed between series II and III (1972-1980). During this time period hip width decreased on the average by 0.3 cm. Shoulder width on the other hand showed a graduall increase in successive years for boys, and equalled 0.2 cm per decade. This variable did not change in case of females. A decrease in hip width was also observed for both sexes. This especially visible in boys between serie I and II, and girls between series II and III. During those periods time hip width decreased by 0.3 cm per decade in boys and by 0.5 per decade in girls. The lowest values are observed in females from serie III (1978-1980).

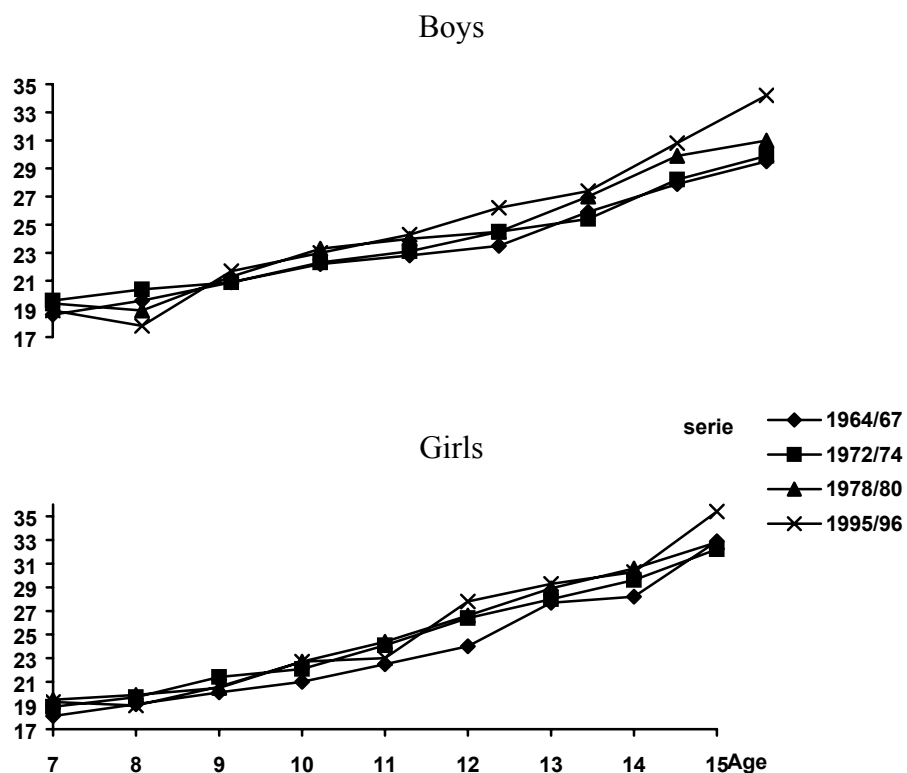


Fig. 5. Quetelet's index of boys and girls between the age of 7 and 15 in a respective series

Table 7

Shoulder-hip index of boys and girls between the age of 7 and 15 in a respective series

Age	BOYS				GIRLS			
	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96	serie I 1964/67	serie II 1972/74	serie III 1978/80	serie IV 1995/96
7	74.6	73.0	71.2	71.4	73.9	71.0	70.1	72.0
8	74.2	73.2	72.5	73.5	74.0	73.3	72.5	71.1
9	74.1	73.3	71.9	72.1	74.9	73.1	73.5	73.2
10	74.6	73.5	71.9	72.8	74.4	72.9	71.9	73.8
11	73.5	73.3	72.4	72.7	75.0	73.8	69.8	73.0
12	74.0	73.3	71.8	73.4	74.8	74.2	73.5	75.1
13	73.1	73.5	72.0	73.1	75.8	74.3	72.9	76.5
14	74.2	71.5	71.8	73.1	75.8	74.0	74.5	76.4
15	74.3	72.7	73.7	72.5	76.7	76.7	77.7	79.0

Table 8

Mean values of chosen somatic variables in percentages [%/10 years increment] of boys and girls between the age of 7 and 15 in a respective series

SERIE	BODY HEIGHT		BODY MASS		SHOULDER WIDTH		HIP WIDTH	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1964/67/ 1972/74	1.0%	1.4%	1.4%	5.9%	0.0%	0.4%	-1.3%	-1.2%
1972/74/ 1978/80	1.0%	0.8%	4.6%	3.2%	0.9%	-1.1%	-0.4%	-2.5%
1978/80/ 1995/96	0.8%	0.5%	2.4%	0.8%	1.0%	0.4%	1.7%	2.9%
1964/67/ 1995/96	2.8%	2.7%	8.4%	9.9%	1.9%	0.4%	0.03%	-0.7%

The Quetelet's index values are illustrated in fig. 5. The lowest values of this variable are characteristic for boys in serie I, while the highest ones for serie IV, and such a tendency is especially visible from age 9. Starting at this age the differences between serie I and IV gradually increase, reaching maximal values at the age of 15 what once again corresponds to maturity spurt.

In females undoubtedly through out the whole analyzed time period its values are lowest for serie I (1964-1967). This is the consequence of lowest values of body mass and height in serie I in comparison to the other. Until the age of 11 the highest values of this index is observed in serie III (1978-1980), what is the result of the highest body mass, as well as and also after age 11 in serie IV (1995-1996). As in the case of boys the greatest differences occurred during the maturity spurt, at age 12 between serie I and IV.

A very interesting trend is characteristic for the hip-shoulder index presented graphically in fig. 6. In boys highest values of this variable are observable in serie I, what indicates relatively greater hip width in boys of this serie. Worth noticing is the fact that a significant decrease of the hip-shoulder index occurs after age 11-12 what indicates slimming down of the body. In females, as in the case of males, after the age of 11 the highest values are observed in serie I. The values of this index, decrease in successive series, reaching the lowest values in serie III for girls, and in serie IV for boys. The

highest differences in the values of this index was registered in case of females during the maturity spurt between series I and III.

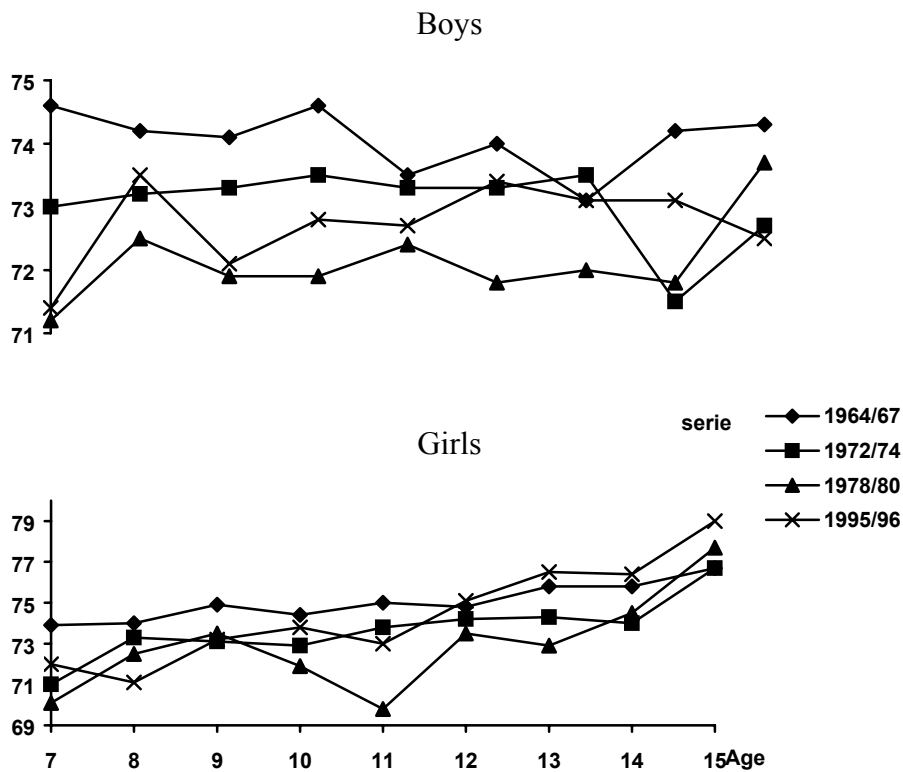


Fig. 6. Hip-shoulder index of boys and girls between the age of 7 and 15 in a respective series

Conclusions

On the basis of the presented results following conclusions were drawn:

- ✓ During the analyzed 30 years, in the observed population, secular changes occurs for all considered variables, as well as for anthropometric indexes, during the entire tested ontogenetical period (from 7 to 15 years).
- ✓ The intensity of the secular trend is different for particular variables. The highest increments were registered in case of body mass and height.
- ✓ The greatest differences between particular series in the considered somatic variables occurred during the maturity spurt.

- ✓ The greatest dynamics of secular increments was observed between the years 1964-1974, while the smallest one between 1980-1996. Almost a three times smaller secular changes during this period were influenced by the economical crisis of the 90's of the 20th century.
- ✓ Long-term changes in physical fitness can not be considered without somatic development.

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