Anthropological Review • Vol. 79(3), 281–299 (2016)

DE GRUYTER OPEN

ANTHROPOLOGICAL REVIEW
Available online at: https://doi.org/10.1515/anre-2016-0021

Social distances decrease of body height and the maturation rate of Polish girls in urban and rural population in the period 1967–2009

Teresa Łaska-Mierzejewska[1], Janusz Dobosz[2], Sylwia Nowacka-Dobosz[2], Elżbieta Olszewska[2], Adam Wilczewski[3]

[1]Professor Emeritus, Warsaw
[2]Department of Theory of Physical Education and Correction, Academy of Physical Education in Warsaw
[3]Department of Anthropology and Anthropomotorics, Academy of Physical Education in Biała Podlaska

Abstract: The aim of the study is to present social distances in biological development of youth in the period of changes in economic and political situation in Poland.
Material and methods: 1. Nationwide study of children and adolescents aged 7.5 to 19.5 years started in 1979 and repeated every decade till 2009, 2. Survey conducted in the region of eastern Poland in 1987 and 2007, 3. Study of rural girls repeated four times between 1967 and 2001. The differences in body height and age at menarche between the inhabitants of towns and rural areas, as well as the differences between rural girls determined by diversified source of income for the family, will be presented. The age at menarche (AM) in each study was calculated using probit method. A monotonic decrease in body height differences between the inhabitants of towns, and girls living in rural areas was observed. On the basis of nationwide studies arithmetic means of the differences in terms of age were 1.9 cm in 1979 and 0.82 in 2009. At the same time, differences in the AM among girls in compared agglomerations decreased from 0.36 to 0.26, respectively. In eastern region of Poland the difference in body height between the residents of towns and villages in 1987 was 1.76 cm, and in 2007, only 0.38 cm; the difference of AM decreased from 0.41 to 0.14 years.
The research conducted on inhabitants of rural areas has shown the earliest maturation and slightly greater body height for girls from landless families and the latest maturation and the smallest body height for the daughters of farmers. The differences in AM between the two groups decreased from 0.53 years in 1967 to 0.15 in 2001.
The political transformation (1989) unequally influenced people on different levels of urbanization, different socio-professional groups and residents of various regions of the country, but was reflected in the results of anthropological research.
The largest social advancement measured in terms of acceleration of maturation in the period covered by the research was characteristic for rural girls, especially the daughters of farmers.

Key words: social distances, urban-rural, rural population diversity, body height, age at menarche

Review Article Received: April 4, 2016; Accepted for publication: July 27, 2016
DOI: 10.1515/anre- 2016-0021

Introduction

In the researches monitoring the biological development of the youth conducted repeatedly in different parts of Poland and by many authors, optimistic signs indicating a decrease of social differences in somatic features and at the menarcheal age are observed. Anthropological studies started in Poland after the Second World War, conducted in the 50s and 60s, and continued in the following decades, recorded accordingly the gradient variation of body height and other somatic features, and especially the gradient diversity of menstruation rate. The age at menarche proved to be much more eco-sensitive than the somatic features (Durda 2011; Szwed et al. 2013; Szwed 2015; Łaska-Mierzejewska and Olszewska 2003, 2007). Body height was always greater, and the menarche appeared earlier, when smaller was the fertility of the family; the higher was the level of education of surveyed adults or each parent, and the bigger was the agglomeration, in which the investigated individuals lived (Milicerowa 1968; Bocheńska 1978; Chrząstek-Spruch 1979; Bielicki 1981; 1989; Piasecki and Panek 1982; Jedlińska 1985; Bielicki et al. 1981; 1986; 1997; Borysławski et al. 1990; Gołąb ed. 1993; Hulanicka et al. 1990; 1994; 2001; Kaczmarek 1995; Skład et al. 2002; Wilczewski 2003; 2013).

At the same time, in well developed countries the relationship between the biological condition of children and adolescents and their varied position on socio-economic ladder has no longer been noted. Every society may be characterized by the groups varied due to level of education, income, or family's fertility. These inequalities, however, do not trigger biological effects in the form of significant differences in body height, or other biological indicators of living conditions. In these countries, the social gradients and biological secular trends disappeared (Brundtland and Walloe 1973; Lindgren 1988; Cernerud and Lindgren 1991). Thus, it may be stated that the life conditions, however varied, allow all young people to make full use of their genetic potential for individual development. This was recognized by Professor Bielicki et al. (1997: 12) as biological classlessness of population which can affect only wealthy societies.

The dependence between living conditions and maturation rate of children and youth, and the AM acceleration were however registered in many developed countries such as France (Boetsch and Bley 1980), Spain (Prado 1990), Portugal (Padez 2003, 2007), United Kingdom (Moris et al. 2011), as well as in many developing countries like South Africa (Jones et al. 2009) Cameroon (Pasquet et al. 1999), Gambia (Prentice et al. 2010).

Deceleration in the AM were registered in Poland during the acute economic crisis which took place from the middle of 70- this till the end of 80-this (Hulanicka and Waliszko 1991; Łaska-Mierzejewska and Olszewska 2003; 2007). Deterioration of living conditions during the 1980s affected not only the Polish population, but also others under similar political and economic system. A delay of menarcheal age was recorded in Bulgarian girls (Stoev 1994) in girls from Moscow (Yampolskaya 1994, Godina 1994), and in Cuban girls. The inhabitants of Habana menstruated an average 0,44 years later in 1993 (Prado et al. 2002) than those in 1963 (Łaska-Mierzejewska 1967).

The dependence between the standard of living of the population, and the

extent of differences in biological features of children and adolescents on varied socio-economic levels, was very well displayed in the research of Jedlińska et al. (1988) and Jedlińska Sławińska(1990). The study was conducted in two Polish regions with extreme wealth inequalities among rural population; wealthy region Leszno was compared with poor region of Ciechanów.-Differences of body height of farmers'children – the owners of farms over 16 ha and less than 5 ha – reached 0.21 SD in the affluent area of Leszno and 0.36 SD in a poor area of Ciechanów. Other studies of rural population revealed that body height of girls depending on the size of the homestead reached 0.12 SD in the area of Leszno, 0.28 SD in the region of Suwalki and 0.34 SD in the area of Ostrowia Mazowiecka (Łaska-Mierzejewska, Olszewska 2003). Ostrowia area was characterized by the lowest per capita income in the year of the study.

Meanwhile, age at menarche of Warsaw girls did not change significantly over the last few decades. At the end of the 1980s, the age at menarche of Warsaw girls amounted to 12.76 years (Charzewski et al. 1991, 1998), and in 2013 – to 12.74 years (Siniarska-Wolańska, unpublished data), body height of children and adolescents in the capital has not changed over the last 15 years (Palczewska and Niedźwiecka 2001; Siniarska et al. 2015). These are the clear signs of a slowdown in secular trend of varsovian youth, as well as the absence of accelerated maturation of girls in Warsaw.

The aim of the study is to present social distances in biological development of girls between 1967 and 2009. During this period, from the second part of 70-this.took place acute economic crisis, in 1989 "communism" collapsed and political and economic transition have started.

Material and Methods

The material used in this study comes from three independent studies undertaken by the researchers of Józef Piłsudski University of Physical Education in Warsaw in years 1967- 2009 (Table 1).

1. Nationwide study (Trześniowski 1990; Przewęda and Trześniowski 1996; Przewęda and Dobosz 2003; Dobosz 2012)

Nationwide study of children and adolescents aged 7.5 to 19.5 years started in 1979 and repeated every decade till 2009.

Table 1. Numbers of examined girls and the investigators' names in Literature

		Years of studies			
1. Nationwide study		1979[1]	1989[2]	1999[3]	2009[4]
	city	23844	23766	6539	3421
	rural	33594	33467	14521	2955
2. The Eastern Polish region		1987[5]		2007[5]	
	town:	14458		4016	
	rural:	11927		3654	
3. Rural girls:		1967[6]	1977[7]	1987[8]	200[9]
	Farmers	2532	2368	4514	2881
	Non-farmers	2438	3676	5111	4476

[1]Trześniowski 1990, [2]Przewęda, Trześniowski 1996, [3]Przewęda, Dobosz 2003, [4]Dobosz 2012, [5]Wilczewski 2013, [6]Łaska-Mierzejewska 1970, [7]Łaska-Mierzejewska 1983, [8]Łaska-Mierzejewska, Łuczak 1993, [9]Łaska-Mierzejewska, Olszewska 2003, 2007.

The survey included children and adolescents of both sexes from all types of schools participating in physical education classes. The results taken under consideration referred to girls living in the cities with population of over 100,000 and the inhabitants of rural areas. Urban girls came from better educated and less numerous families in comparison with their rural counterparts. Parents' education fell into four categories: higher, secondary, vocational and elementary. Number of children per family was divided into: one child; two children; three or four children; five or more children.

2. Study of Eastern Poland in 1987 and 2007 (Wilczewski 2013)

Eastern region of Poland constitute about 20.0% area of the country and is inhabited by 14.67% of the Polish population. It is a typical agricultural region in which 51.3% inhabitants live on the countryside (national average – 38.2%). Residents of this region have a lower level of education (1.5% less of higher education and 5.0% more of primary education) and greater fertility of families (GUS, Statistical Yearbook 2008).

The research was conducted in the years 1985– 1987 and repeated in 2005–2007 in the following former provinces: Biała Podlaska, Suwalki, Chelm, Zamość, Bialystok, Przemyśl and Krosno. The surveyed girls were classified into three groups depending on the size of the inhabited agglomeration: village up to 1000 inhabitants, small town 1.000–25.000, town over 25.000. For the purpose of present study only two groups were analyzed: rural inhabitants and residents of towns over 25.000, biggest in the region. The number of children per family was classified into four groups: one child; two children, three to five children; six and more children. In the second stage of the research the fraction of girls from families with 6 or more children decreased from 7% to 2.5%, which made impossible to calculate the mean menarcheal age in girls within this group of fertility.

3. Study of rural girls 1967–2001 (Łaska-Mierzejewska and Olszewska 2003; 2007)

The main criterion of respondents' categorization was the type of family income; three socio-professional groups were recognised: 1. farmers – for whom farming was the only source of income 2. farmer-workers – land owning families with at least one member employed elsewhere 3. landless rural inhabitants. Farmer families were characterised by the highest percentage at the lowest educational status of the parents, the highest percentage at large families and the lowest ownership of household appliances. Farmer-workers families occupied intermediate position in the same categories. Since 1977 the number of children in the families has also been registered, which allowed to distinguish the three groups: girls from the families with one or two children, three or four children and five or more. The data concerning the educational level of fathers and, of mothers (since 1987) was also acquired and put into categories of elementary, vocational and secondary along with higher. The research was repeated four times between 1967 and 2001in the same schools if possible.

In this paper, the differences in body height and age at menarche between the inhabitants of cities (over 100 000 inhabitants) and rural areas, between the inhabitants of towns (over 25 000 inhab-

itants) and rural areas, the differences depending on educational status of each parent and the family's fertility, as well as the differences between rural girls determined by diversified source of income for the family, will be presented. The age at menarche (AM) in each study was calculated with probit method.

The three researches providing the base of this article revealed, during the period 1967- 2009, an increase in fractions of girls from families with smaller number of children and daughters of better educated parents, and a sharp decrease in fractions of girls from numerous families with merely elementary level of parental education.

Results

The socio-economic situation in Poland in the period covered by the research underwent drastic changes. The 1970s may be recognised as the time of "prosperity on credit". The end of 1970s and the 1980s brought the economic crisis and introduction of martial law, whereas the end of 1990s and the following years is the period of profound political and economic transformation. The changes variously affected the people on distinctive levels of urbanization, from different socio-professional groups and residents of various regions of the country. Their biological consequences, however, were reflected in the results of anthropological researches conducted in different periods by numerous authors.

Nationwide study 1979–2009 by Janusz Dobosz and Sylwia Nowacka-Dobosz

Increases in body height and lowering the age at menarche between successive tests were higher among girls from villages compared to those from cities. This resulted in a reduction of differences between the biological characteristics of the residents of the tested environments. Mean differences of body height in 7.5–19.5 age groups decreased from 2.11 cm in 1979 to 0,82 cm in 2009. These dissimilarities resulted mainly from early maturation of urban inhabitants, as the mean differences of body height in 17.5–19.5 age group, after the completion of the growth process, amounted to 0.76 cm in 1979 and to 0.11 cm in 2009 only. Differences between the age at menarche in urban and rural girls decreased from 0.36 in 1989 to 0.26 years in 2009. For more details, see Table 2.

In 1989, the maturation of urban girls in all categories of each parent's educational level was earlier than in girls from the rural area. The higher educational status of the parents was correlated with earlier maturation. The variation between the age at menarche of daughters of fathers with primary and higher education was 0.15 in the urban and 0.33 years

Table 2. Age at menarche of girls from city and rural area in nationwide study in Poland

	Years of study						Acceleration	
	1989		1999		2009			
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	89/99	99/09
Rural	13.33	1.09	12.94	1.17	12.58	1.41	0.39	0.36
City	12.97	1.09	12.63	1.15	12.32	1.47	0.34	0.31
Difference rural-city	0.36	–	0.30	–	0.26	–	0.06	0.04

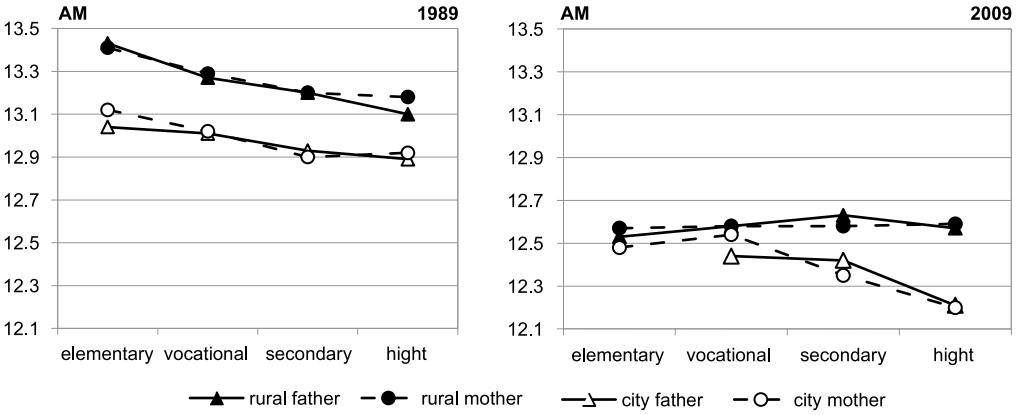

Fig. 1. Age at menarche (AM) of girls from city and rural area in nationwide study by the father's and mother's education in 1989 and 2009

in the rural areas. For girls whose fathers received elementary education, the difference in age at menarche between the village and the city was 0.39 years. In other categories of education differences were between 0.21 and 0.27 years. Depending on the category of mother's education differences between the cities and rural areas ranged from 0.26 to 0.30 years (Fig. 1). In 2009, the education level of each of the parents did not significantly diversify the age at menarche of rural girls. In the urban area, differences between parents' primary and higher educational level significantly differentiated the age at menarche; 0.23 years and 0.34 years in case of fathers and mothers respectively (Fig. 1).

In 1999, the fertility of families had a very significant impact on the maturation of girls from both the city and the rural areas. The differences of age at menarche between the only daughters and girls from families with five or more children amounted to about half a year (Fig. 2). In 2009 in the rural area, there were no registered dependences between the age at menarche and the fertility of the families or parents' education. In the cities the fertility rate had a significant influence on the maturation of girls; especially a marked difference, same as 10 years before, was observed between the girls from families with one or two children (Fig. 2). The number of urban girls from families with five or more children examined in 2009 (n=112) was insufficient to estimate the age at menarche reliably.

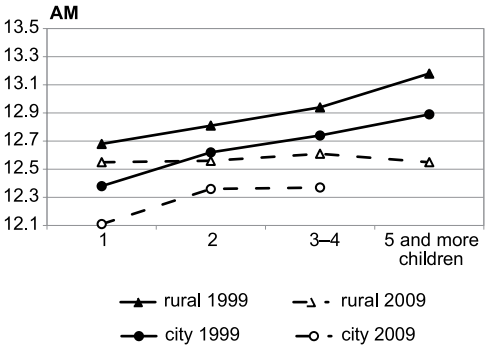

Fig. 2 Age at menarche (AM) of girls from city and rural area in nationwide study by number of children per family in 1989 and 2009

Study of Eastern Poland in 1987 and 2007 by Adam Wilczewski

In 1987, the body height of girls living in towns was greater than in their rural peers. Variations in all age groups from 7 to 19 years were significant at a confidence level p <0,01; the arithmetic mean of the differences was 1.83 cm. In 2007, as compared to 1987, girls' body height increased by an average at 3.81 cm, amounting to 4.60 cm in the rural area, and to 3.24 cm in the towns. These changes resulted in a reduction in average body height difference between girls from urban and rural areas to just 0.48 cm. In 2007, statistically significant differences were noted only for participants between 7 and 11 years of age. The decrease in the age at menarche in the two decades amounted to 0.38 years in the towns and 0.64 years in the villages. This resulted in a significant decrease in difference of maturation rate of inhabitants of compared agglomerations, from 0.41 to 0.15 years, while still maintaining at the statistically significant level (Table 3).

In the eastern region of Poland, parents' educational level had a significant effect on the rate of their daughters' maturation. In the rural area, "secondary" educational category also includes daughters of parents with higher educational level, as the numbers of this level of education were not sufficient for the calculation of the average age at menarche. In 1987, the educational level of each parent had a greater impact on the rate of maturation of girls from the towns than from the rural areas. In an urban environment the difference in age at menarche among girls whose parents belonged to the extreme categories of education were 0.44 years (fathers) and 0.30 years (mothers). In rural areas the differences between the daughters of parents with primary education and at both secondary and higher level of education were respectively 0.12 and 0.11 years. Differences between the age at menarche in inhabitants of towns and villages were the greater the higher was the status of parents' education. The disparity between rural and urban girls with higher and secondary education of parents was 0.38 years in case of fathers and 0.25 years in the group of mothers.

In 2007 parents' education still diversified the daughters' menarcheal age. The difference in rural areas between extreme categories of fathers' education was 0.40 years and mothers' 0.44 years, and in urban areas 0.44 years and 0.49 years respectively. This means an increase in the role of educational level in shaping the status of the rural families in the eastern region of the country, which was not recorded in the nationwide research.

Last 20 years brought a marked decrease in age at menarche difference between girls from towns and villages. In groups of primary, vocational and secondary levels of fathers' education, girls from rural areas menstruated slightly earlier than their urban counterparts. In

Table 3. Age at menarche of girls from town and rural area in the Eastern Polish region

	Years of study				Acceleration
	1987		2007		
	$\bar{X}$	SD	$\bar{X}$	SD	07/87
Rural	13.58	1.23	12.94	1.41	0.64
Town	13.17	1.25	12.79	1.67	0.38
Difference rural – town	0.41	–	0.15	–	0.26

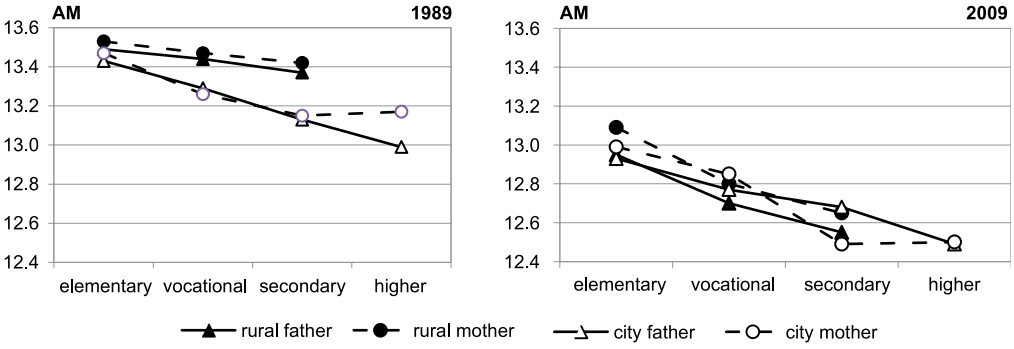

Fig. 3. Age at menarche (AM) of girls from town and rural area in the Eastern Polish region by the father's and mother's education in 1987 and 2007

1987 and in 2007, in towns, mother's secondary and higher education did not diversify the age at menarche of daughters (Fig. 3).

In 1987, the age at menarche of girls in urban and rural areas increased with the growing number of children in the family (Fig. 4). Differences between extreme categories of fertility were: 0.9 years in urban areas and 0.5 years in rural areas. The clearest contrasts between inhabitants of towns and villages related to girls from families with small number of children; the only daughters from the urban areas matured 0.3 years earlier than their rural peers. Between 1987 and 2007 the age at menarche girls from all groups of families' fertility was decreasing.

In 2007, the fertility had a greater influence on building the status of the family in the countryside than in the towns, and the difference in age at menarche in girls from families with extreme categories of fertility rate remained at the level from 20 years before; while in the towns this criteria markedly decreased compared to 1987.

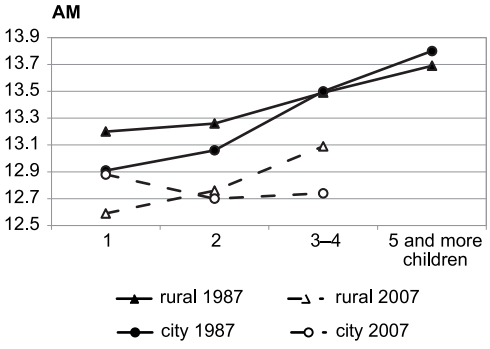

Fig. 4. Age at menarche (AM) of girls from town and rural area in the Eastern Polish region by number of children per family in 1987 and 2007

Study of rural girls 1967–2001 by Teresa Łaska-Mierzejewska and Elżbieta Olszewska

In the studied period socio-economic disparities between the variously defined rural population groups in Poland were great enough to exert biological effects such as later maturation (age at menarche) and a lower body height of girls belonging to the lowest categories of each of the distinguished social factors, compared to the girls belonging to the highest categories of these factors.

The source of income for the family is the most decisive stratification factor of rural inhabitants. The studies conducted

in 1967 and 1977 reported that the lowest socio-economic status, measured by body height and age at menarche, was provided by families, for which the farm was the only source of income, and the highest by the families of rural landless inhabitants. In 1967, the daughters of farmers maturated 0.53 years later (Fig. 5) and were on average 2.93 cm lower than those from non-farmer families. The study repeated in 1977 revealed a considerable acceleration of maturation and positive secular trend in body height. Acceleration of maturation (reduction in menarcheal age) amounted to 0.64 years, wherein 0.66 years in farmers group, and 0.57 years in each of the other groups. The increase in body height of the girls amounted from 1.7 to 4.8 cm, depending on the age group. More intense growth of body height was observed in girls of non-farmer families in comparison with the farmer families.

"The reassessment" of the economic situation of selected groups of families took place during the time of economic crisis, and the biological consequences of these events have been recorded in a study conducted in 1987. The research revealed a inhibition of the acceleration of maturation, and in some groups of girls also delayed maturation, called deceleration, both not previously reported in Poland. The biggest delay in the age at menarche was observed in girls from landless families, from 0.06 to 0.42 years, depending on the studied region of the country, as this group was subject to food rationing. Increase of body height process has been drastically reduced, and in girls from non-farmers families almost completely ceased; this led to the loss of body height advantage in comparison to girls from farmers' families. The studies repeated in 2001, 12 years after the introduction of political and economic transformation, revealed an improvement of living conditions of rural inhabitants.

Fig. 5. Age at menarche (AM) of girls from farmers, farmer-workers and non-farmers families in consecutive studies

A considerable acceleration of maturation and significant secular trend in body height were observed. In case of all participants, age at menarche was reduced lowered by 0.34 years, but the size of the acceleration of maturation of girls in each group differed significantly. The greatest acceleration of 0.30 years, was recorded in girls from farmers' families, and the smallest, 0.17 years – among the daughters of landless rural inhabitants. This is a dramatic manifestation of the severe economic situation of this family group after closure of many enterprises in the neighbouring cities, and especially after the statutory liquidation of state-owned farms in 1992. Despite this, the girls from non-farmers families remained an early maturing group, and the latest maturation was achieved by daughters of farmers. The difference in age at menarche, however, decreased from 0.33 years in 1987 to just 0.15 years in 2001 (Table 4).

Education of parents and the fertility of the family had an influence on the rate of maturation and body height of the examined girls, but the size of the difference between the extremes of both variables reduced in subsequent studies. Body

Table 4. Age at menarche of girls from farmers' and non-farmers' families and acceleration between consecutive researches

Social groups	Years of study								Acceleration		
	1967		1977		1987		2001				
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	67/77	77/87	87/01
Farmers'	14.30	1.30	13.64	1.29	13.67	1.27	13.32	1.98	0.66	–0.03	0.35
Non-farmers'	13.77	1. 20	13. 20	1.11	13.34	1.14	13.17	1.96	0.57	–0.14	0.17
Difference	0.53		0.44		0.33		0.15		0.09	0.11	0.18

Table 5. Differences of body height (cm) between extreme categories of the numbers of children per families and father and mother education in consecutive study

Years of study	1977	1987	2001
Numbers of children per family (1–2 – 5 and more)	2.35	1.93	1.72
Father education (elementary – secondary + higher)	1.32	1.23	1.00
Mother education (elementary – secondary + higher)	–	1.38	0.06

Table 6. Differences of age at menarche between rural girls belonging to the extreme categories of the numbers of children per families and father and mother education in consecutive study

Years of study	1977	1987	2001
Numbers of children per family (1–2 – 5 and more)	0.66	0.53	0.27
Father education (elementary – secondary + higher)	0.54	0.38	0.21
Mother education (elementary – secondary + higher)	–	0.29	0.13

height was greater and the age at menarche was earlier, the smaller was the number of children in the family, and the higher was the educational status of the parents. The number of children in the family is the factor strongly influencing the living conditions in relation to other factors analyzed (Tables 5, 6).

A reduction of the differences between the age at menarche in girls from the families of farmers and non-farmers (Table 4), from families with small number of children and numerous families, as well as in the relation to the level of education of fathers and mothers (Table 6) was observed throughout the period of the study. The process of leveling in body height in girls from farmers' and non-farmers' families, who in 1967 and 1977 were higher than their peers from farmers' families was also recognized. Differences in body height depending on the educational level of each parent and the differences between the groups of family's fertility decreased between consecutive studies (Table 5).

Discussion

The results of this study, revealing the monotonic decrease in the body height differences and the maturation rate of girls belonging to the extreme categories of variously defined social groups, share a very high similarity with the results of nationwide research of children and the youth from urban and rural regions (Fig. 6, 7), collected by colleagues from

the Institute of Anthropology of the Polish Academy of Sciences in the period 1966–2012 (Bielicki et al. 1986; Hulanicka et al. 1990; Hulanicka and Waliszko 1991; Kozieł et al. 2014) and the results of a research conducted on the inhabitants of the city of Rzeszow and its rural surroundings (Radochońska and Dudzik, 2005; Radochońska et al. 2006). The differences of body height were monotonically decreasing in successive categories of socio-economic factors and became statistically insignificant considering the level of urbanization and education of parents (in 2012), but remained significant due to the number of children in the family (Fig. 6, Kozieł et al. 2014).

The differences in age at menarche between the extreme SES (Socioeconomic Status) categories underwent a reduction from 0.82 years in 1966 to 0.46 in 2012. In the same time dissimilarities between the girls from big cities and rural areas decreased from 0.62 to 0.39 years (Fig. 7, Kozieł et al. 2014). The outcomes of the nationwide research of menarcheal age analyzed in our work revealed that the differences between the inhabitants of cities and villages in 1979 and 2009 decreased from 0.36 to 0.25 years. The similarity of the results presented in Fig. 7 and Fig. 5 is also worth attention.

Girls from the city of Rzeszow examined in 1976–1977, were higher by an average at 1.5 cm then the inhabitants of the village at Krasne and 1.24 cm then the girls from Boguchwala, while in 2004 the differences amounted to 0,7cm and –0,21cm respectively (Radochońska and Dudzik 2005). The first study revealed that the girls from Boguchwala menstruated 0.6 years later, and the girls from Krasne about 0.7 years later than girls from the city of Rzeszow; in 2004, the differences were respectively –0.1 and 0.1 years (Radochońska et al. 2006). The publication of Radochońska et al. (2006) brought however an error of method in the results of the AM, as all the girls examined were below 14.5 years of age and the girls with delayed puberty were not considered. In the research conducted on 9599 rural girls in 2001 (Łaska-Mierzejewska and Olszewska 2003) only 90% out of 633 14.5 years old girls menstruated, whereas 95.6% result was noted by Cichocka et al. (2012) in the group of girls of the same age from the city of Cra-

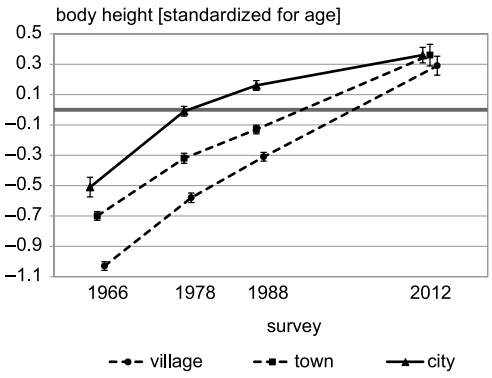

Fig. 6. Mean values of body height girls (standardized for age) depending on the degree of urbanization in the period 1966–2012 (Kozieł at al. 2014)

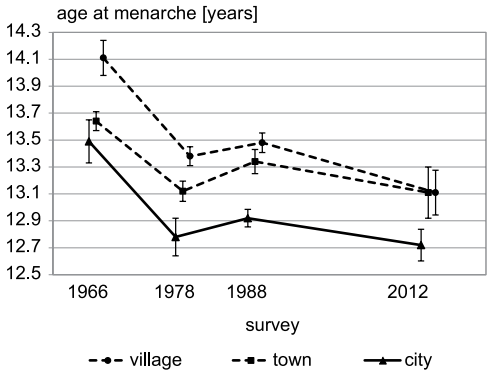

Fig. 7. Age at menarche depending on the degree of urbanization of residence in the period 1966–2012 (Kozieł at al. 2014)

cow. It was in the group of 17.5-year-olds where all the participants from quoted publications began menstruating. The average age at menarche published by Radochońska et al. (2006) is therefore underestimated and incomparable with the results of methodically correct surveys; it may, however, illustrate the phenomenon of the development rate leveling of inhabitants of Rzeszow and its rural surroundings.

A study conducted in 2009–2010 in Wielkopolska region reveled the advantage in body height of urban children and youth over their rural peers, however, no differences in body height depending on the number of children in the family or father's education were noted (Durda 2011) as they are reported in the nationwide survey (Kozieł et al. 2014; Dobosz 2012). Other research conducted in Wielkopolska proved that the number of children per family is its most decisive determinant of the age at menarche (Szwed et al. 2013), which is considerably more eco-sensitive biological feature than body height. On the basis of the one-time retrospective studies conducted on the age at menarche in Wielkopolska region in 2006–2012 the author (Szwed 2015) reported major differences in the age at menarche between the extremes of the following social variables: number of children per family (0.86 years), agglomeration size (0.64 years), father's education (0.43 years) and mother's education (0.39 years). These differences reflect the socio-economic situation of respondents in the past 2–3 decades, as they are based on retrospective studies. Similar results concerning the age at menarche at girls with extreme categories of family's fertility (0.9 years) were registered in 1987 with residents of towns in eastern regions of Poland.

It is worth noticing that the results may be affected by the classification of information. The studies of rural girls (analyzed in this paper) revealed a monotonic growth of AM appearing together with increasing family size for each additional child from 1 to 7+. In 2001, the age at menarche amounted to 12.99 and 13.52 in case of the only children and the girls from families with 7 children respectively. In the same study, when three fertility groups were distinguished: families with 1–2 children, 3–4, and 5 and more children, the difference in menarcheal age between the extremes was only 0.27 years, however it was still statistically significant (Łaska-Mierzejewska and Olszewska 2003).

This variable determines the economic situation of the family, indicating into how many parts a loaf of bread should be cut. Moreover, in Poland and especially in its rural areas, fertility is negatively correlated with parental education: the lower the status of education, the greater fertility of the family. Among rural girls surveyed in 2001, 30.9% of girls came from large families (5 or more children), when the father had primary education and only 11.6%, when the father had secondary or higher education. Mechanisms for the reduction of the differences in the maturation rate of urban and rural inhabitants.

The results of present study, as well as the nationwide research data gathered by the Institute of Anthropology of the Polish Academy of Sciences (Kozieł et al. 2014) and the investigation of the girls from Rzeszow and its rural surroundings (Radochońska and Dudzik 2005; Radochońska et al. 2006) prove that the most remarkable social advancement was achieved by the villagers and especially daughters of farmers. The acceleration of

maturation of these girls was considerably highers than in urban residents and girls from landless rural families. In the period 1966–2012 lowering the age at menarche in case of rural girls amounted to 1.0 years, residents of large cities to 0.77 years, and small towns inhabitants merely to 0.54 years (Kozieł et al. 2014). The acceleration of maturation of girls from rural farm families in the period 1967–2001 amounted to 0.98 years, and in non-farm families to 0.60 years.

The differences in body height of urban and rural girls mainly related to the age groups in which maturation process had already started. The girls from the cities were taller because of earlier maturation in comparison with their rural peers, who were characterized by larger body height increments between decades. In Eastern Poland in 2007, the body height of female inhabitants of both agglomerations at the age at 17.5– 19.5 did not differ significantly, whereas 18 years old rural girls occurred to be 0.5 cm taller than the town residents (Wilczewski 2013).

Between the studies of rural population in 1987 and 2001 the percentage at better educated parents raised and the proportion of numerous families decreased. A remarkable improvement in household equipment and the acreage at arable land possessed by the families were also noted. The accelerated maturation among all rural girls examined amounted to 0.34 years, in farm owning families to 0.35 years and in landless group to only 0.17 years (Łaska-Mierzejewska and Olszewska 2003). The effects of the crisis were not reported during the body height measurements performed on a group of conscripts in 1995 and 2001(Bielicki et al. 1997; 2003). This biological feature is less eco-sensitive then menarcheal age, which was indicated in the examination of the body height (Durda 2011) and age at menarche (Szwed et al. 2013) of girls from Wielkopolska region.

A significant acceleration of maturation was recorded after the political transformation in Poland, especially in eastern regions of the country where between 1987 and 2007 the age at menarche decreased by 0.64 years in rural areas and by 0.41 years in towns (Wilczewski 2013).

For several decades, rural single-family housing is no different from urban construction in terms of sanitary standards. A range of grocery and industrial goods available for the rural customers in shops and supermarkets placed in large cities and towns is the same. The growing percentage at better educated parents and the decrease in proportion of numerous families in rural areas are positive factors responsible for equalisation of biological development of residents of cities, towns and villages. Apart from beneficial determinants mentioned above, the maturation rate is also accelerated by negative processes such as gradual deterioration of the family structure and "chemicalization of our surrounding".

The first signals indicating that girls from families with disturbed structures begin to menstruate earlier than their peers from undisturbed families, were recorded during the research of Warsaw females conducted by Milicerowa and Piechaczek in 1976. The results were published only in a form of a lecture given during a Seminar on Secular Trends organised by the Institute of Anthropology of the Polish Academy of Sciences in Wrocław in 1978. The authors concluded that the outcome was some sort of artifact. However, the veracity of their conclusions was later confirmed by Hulanicka (1986; Hulanicka et al. 2001), Popczyk

(1990) and Cichocka et al. (2012). The results of researches indicated that the severe stress caused by family conflicts accelerates maturation. A systematic increase in divorce rate, births in unmarried partnerships and single motherhood may be observed in Poland. Between 1960 and 2008 the divorce rate increased more than four times – from 14.8 to 65.5 thousands. The rural inhabitants decide to divorce three times less frequently than city residents, however for their children the trauma is undoubtedly more severe because of stronger community disapproval.

Cichocka et al. (2012) conclude, referring to the Demographic Yearbooks that about 20–28% of children grow in families with disturbed structure, and such proportion may lower the mean age at maturation calculated for the total number of children. Cichocka and Żarów (2002) emphasize the relationship between the divorce rate and the age at menarche in three Polish cities. Warsaw is characterized by the highest divorce rate and the earliest maturation among girls. Since the mid-70s metropolitan females have begun menstruation at the 12.7–12.8 years of age (Charzewski et al. 1991; 1998). In the city of Cracow the divorce rate is the lowest and age at menarche is the latest. During three consecutive studies conducted in Cracow in 1966, 1970 and 1983 the mean menarcheal age amounted to 13.15 years and decreased to 12.87 years in 2000 and to 12.68 years a decade later (Woronkowicz et al. 2012). City of Wrocław occupies an intermediate position in terms of both variables.

The beginning of menstruation is conditioned by production of sex hormones of appropriate for the given stage at biological development concentration. Such compounds as xenoestrogens and xenoandrogens produced by human and nature derived phytoestrogens provide the source for exogenous hormones. They may occur in a variety of industrial products of daily use, such as pharmaceuticals, cosmetics, cleaning products, substances used in agriculture, such as pesticides, feed additives, ingredients of our diet, with particular emphasis on meat. Hormonal additives are used on a large scale by farmers to accelerate muscle growth in meat animals and poultry. The breeders are aware of the dangers of this practice, which is evidenced by disabling hormonal supplement form the diet of cattle reared for milk production and for reproduction (Czupryńska et al. 2007; Andersson and Skakkebaek 1999). Researches conducted on prepubertal age children indicate that even small differences in hormone levels and a very low dose of steroid hormones can produce biological effects. Studies have shown significant molecular influence of extremely low doses of estrogen. Special attention should be devoted to permanent effects of xenoestrogens that may occur during sensitive periods of ontogeny, prenatal development and puberty. In fact, the threshold values of xenoestrogen derivatives are not recognized in terms of the regulation of development, however the molecular level may be of great importance (Andersson and Skakkebaek 1999).

A gradual decrease in environmental differences in the development and maturation of young people, is seen as a highly positive process. It is closely connected with the improvement in the economic and cultural situation after the transformation of the political system in Poland. However, the continuous lowering of age at menarche may also carry certain risks. Early and very early mat-

uration is highly correlated with body fat percentage (Łaska-Mierzejewska and Łuczak 1996; Chrzanowska 1992; van Lenthe et al. 1996) and the obesity may bring the risk of cardiovascular disease, breast cancer and high level of cholesterol. Thus, accelerated maturation cannot be considered only as a positive aspect.

Conclusion

During the period 1966 to 2009 we registered positive and negative secular trends of height and menarcheal age. The investigations of rural girls done in 1967 and repeated in 1977, the years of credit prosperity in Poland, registered the greatest acceleration of the age at menarche by 0,64 years and the increase of height by 1.8 to 4.3 cm, depending on the age group. The researches repeated in 1987 (rural girls) and 1989 (nationwide) registered the influence of the acute economic crisis on biological condition of children and youth. The trend of body height increase was strongly inhibit. For the first time in Poland the deceleration in menarcheal age was registered. In rural girls the deceleration was most pronounced in girls from landless rural families (by 0,14 years) which suffered from food rationing. After the political and economic transformation (1989), the data collected in 2001 (rural girls), in 2007 (eastern part of Poland) and in 2009 (nationwide researches) registered the great acceleration in menarcheal age (see Tables 2–4), and positive secular trend in body height, greater in rural girls in comparison to town and city inhabitants, social distances in maturation rate and in the stature of girls decreased. In rural investigations the daughters from farmers families, which were the latest maturing group, accelerated their AM twice so much (0.34 year) in comparison to the girls from landless rural families; the last group of rural population suffered from the greatest unemployment after liquidation in 1992 the state owned agricultural farms. The difference in AM between the daughters of farmers and the girls from landless rural families decreased from 0.53 years in 1967 to 0.15 years in 2001.

Social gradients of the age at menarche and body height throughout the period 1967–2009 were differentiated in their dimentions, but identically oriented: the AM was earlier and the stature was higher, when the inhabited agglomeration was bigger, the higher status of education possessed the parents, the smaller number of children had the family.

As follows from AM data higher social advancement was achieved by rural families, in which the acceleration of maturation rate amounted to 0.75 years, in comparison to the inhabitants of city (0.65 years) and those of towns in eastern part of Poland (0.38 years).

In rural population during the period 1967–2001 the highest social advancement was achieved by the farmers families, when their daughters accelerated their AM by 0.98 years in comparison to the girls from landless rural families with AM acceleration by 0,60.

The farmer families, being the main producers of food till 1989 don't suffered from food shortage during the economic crisis and from grate unemployment after 1992.

The largest social advancement measured in terms of acceleration of maturation in the period covered by the research was characteristic for rural girls, especially the daughters of farmers.

Authors' Contributions

TŁ-M study conception, design and management in 1967–2009, acquisition of data on rural populations in 1967 and consecutive surveys till 2001, selection of research data for the present analysis, writing the manuscript. JD participation in the nationwide study in 1999, study conception in 2009, selection of data from surveys 1979–2009 for the present analysis, graphical elaboration of all tables and figures presented in this manuscript. SN-D participation, collection and elaboration of data from nationwide studies in 1999 and 2009; selection and analysis of the literature cited in the Introduction and Discussions of this manuscript. EO participation in the 2001 study on rural girls, statistical elaboration of the data collected in 1987 and 2001; graphical presentation of the results in tables and figures. AW conception and management of surveys in the eastern part of Poland in 1987 and 2007, selection and description of the results based on these surveys. All authors critically read and approved the final version of the manuscript.

Conflict of interest

The Authors declare that there is no conflict of interests.

Corresponding author

Elżbieta Olszewska, Department of Theory of Physical Education and Correction, Academy of Physical Education in Warsaw, Marymoncka 34, 00-968 Warsaw, Poland, e-mail address: elzbietaawf@o2.pl

References

Andersson AM, Skakkebæk NE. 1999. Exposure to exogenous estrogens in food: possible impact on human development and health. Eur J Endocrinol 140:477–85.

Bielicki T. 1981. Niektóre antropologiczne przejawy rozwarstwienia społecznego współczesnej ludności Polski. Kosmos 6:376–86.

Bielicki T, Welon A, Waliszko A. 1981. Zmiany w rozwoju fizycznym młodzieży w Polsce w okresie 1955– 1978. Wrocław: Monografie Zakładu Antropologii PAN.

Bielicki T. 1989. Nierówności społeczne w oczach antropologa. Nauka Polska 3:13–29.

Bielicki T, Waliszko A, Hulanicka B, Kotlarz K. 1986. Social class gradients in menarcheal age in Poland. Ann Hum Biol 13(1):1–11.

Bielicki T, Szklarska A, Welon Z, Brajczewski C. 1997. Nierówności społeczne w Polsce. Antropologiczne badania poborowych w trzydziestoleciu (1965– 1995). Wrocław: Monografie Zakładu Antropologii PAN.

Bielicki T, Szklarska A, Kozieł S, Welon Z. 2003. Transformacja ustrojowa w Polsce w świetle antropologicznych badań 19-letnich mężczyzn. Wrocław: Monografie Zakładu Antropologii PAN.

Bocheńska Z. 1978. Zmiany w rozwoju osobniczym człowieka w świetle trendów sekularnych i różnic społecznych. Kraków: Wyd. AWF.

Boetsch G, Bley D. 1980. Age des premiéres regles dans une population de filles scolarisées Parisiennes. Cahiers du Centre de recherché antropologiques 7(1):3–6.

Borysławski K, Krupiński, Piasecki E. 1990. Środowiskowe uwarunkowania rozwoju dzieci i młodzieży dolnośląskiej w latach 1986–1990, wyniki czteroletnich badań. Materiały i Prace Antropologiczne 111:57–79.

Brundtland GH, Walloe L. 1973. Menarcheal age in Norway: Halt in the trend towards earlier maturation. Nature 241 (539):478–79.

Cernerud L, Lindgren GW. 1991. Secular changes in height and weight of Stockholm

school children born in 1933, 1943, 1953 and 1963. Ann Hum Biol 18(6):497–505.
Charzewski J, Łaska-Mierzejewska T, Piechaczek H, Łukaszewska L. 1991. Wiek menarche dziewcząt warszawskich w 1976–1986 roku. Wychow Fiz Sport 2:15–29.
Charzewski J, Lewandowska J, Piechaczek H, Syta A, Łukaszewska L. 1998. Wiek menarche dziewcząt warszawskich 1986–1997. Wych Fiz Sport 1: 61–66.
Chrzanowska M. 1992. Biologiczne i społeczno-ekonomiczne determinanty rozwoju podskórnej tkanki tłuszczowej u dzieci i młodzieży (rozprawa habilitacyjna). Kraków: Monografia AWF 49.
Chrząstek-Spruch H. 1979. Longitudinal studies of environmental influences on child growth. Stud Hum Ecol 3:179–202.
Cichocka A, Żarów R. 2002. Zmiany sekularne wieku menarche u dziewcząt z Krakowa, Warszawy i Wrocławia w latach 1965–2000 a sytuacja psychosocjalna. Pediatr Pol 77(4):317–22.
Cichocka BA, Woronkowicz A, Kowal M, Sobiecki J, Kryst Ł, Kruszelnicki P, el. al. 2012. Dalsze przyspieszenie wieku menarche dziewcząt z Krakowa. Pediat Pol 87(5):460–66.
Czupryńska K, Marchlewicz M, Wiszniewska B. 2007. Wpływ ksenoestrogenów na męski układ płciowy. Post Biol Komórki 34(2):317–33.
Dobosz J. 2012. Kondycja fizyczna dzieci i młodzieży w wieku szkolnym. Siatki centylowe. Warszawa: Wydawnictwo AWF.
Durda M. 2011. Biological status of adolescents in relation to their lifestyle behaviours and family's socioeconomic status. In: M Kaczmarek, editor. Health and well-being in adolescence part I physical health and subjective well-being. Poznań: Bogucki Wydawnictwo Naukowe. 111–37.
Godina E. 1994. Some latest trends in the somatic development of Moscow school children. In: Hajniš K, editor. Growth and ontogenetic development in man IV. Prague: Charles University. 123–7.
Gołąb S editor. 1993. Biologiczne i społeczne uwarunkowania zmienności przebiegu rozwoju fizycznego dzieci i młodzieży z Nowej Huty. (Wyniki badań ciągłych). Kraków: Wydawnictwo Monograficzne AWF.
Hulanicka B. 1986. O wpływie czynników psychicznych na dojrzałość płciową dziewcząt. Materiały i Prace Antropologiczne 107:45–80.
Hulanicka B, Brajczewski C, Jedlińska W, Sławińska T, Waliszko A. 1990. City-Town – Village Growth of Children in Poland in 1988. Wrocław: Monografie Zakładu Antropologii PAN 7.
Hulanicka B, Waliszko A. 1991. Deceleration of age at menarche in Poland. Ann Hum Biol 18:507–13.
Hulanicka B, Kolasa E, Waliszko A. 1994. Dziewczęta z Górnego Śląska. Wrocław: Monografie Zakładu Antropologii PAN.
Hulanicka B, Gronkiewicz L, Koniarek J. 2001. Effect of familial distress on growth and maturation in girls: a longitudinal study. Am J Hum Biol 13:771–76.
Jedlińska W. 1985. Wpływ niektórych czynników środowiska społecznego na wysokość ciała dziewcząt szkolnych w Polsce. Prz Antropol 51:15–37.
Jedlińska W, Sławińska T, Kotlarz K. 1988. Influence of family socio economic status on body height in children from a rich farmingregion. Studies in Physical Anthropology 9:7–37.
Jedlińska W, Sławińska T. 1990. Influence of family socio-economic status of body height in children from a poor farming region. Studies in Physical Anthropology 10:69–89.
Jones LL, Griffiths PL, Norris SA, Pettifor JM, Cameron N. 2009. Age at menarche and the evidence for a positive secular trend in urban South Africa. Am J Hum Biol 21(1):130–2.
Kaczmarek M. 1995. Wpływ warunków życia na wzrastanie i rozwój człowieka. Poznań: Wydawnictwo Naukowe UAM.
Kozieł S, Nowak-Szczepańska N, Gomuła A. 2014. Antropologiczne badania dzieci i młodzieży w Polsce w latach 1966–2012. Zmiany sekularne i różnicowanie społeczne. Wrocław: Oficyna Wydawnicza: Arboretum.

Lindgren GW. 1988. Auxology – education: some aspect of children's physical and mental growth in relation to socio-economic factors in Sweden. Zagreb: Collg Anthrop 12:228.

Łaska-Mierzejewska T. 1967. Desarrollo y maduración de los niños y jòvenes Cubanos de la Habana. Rev Cub Ped 39: 385–447.

Łaska-Mierzejewska T. 1970. Effect of ecological and socioeconomic factors on the age at menarche, body height and weight of rural girls in Poland. Hum Biol 42:284–92.

Łaska-Mierzejewska T. 1983. Wpływ społecznego zróżnicowania ludności wiejskiej na wiek menarche i jego trend sekularny. Materiały i Prace Antropologiczne 103:21–43.

Łaska-Mierzejewska T, Łuczak E. 1996. Uwarunkowania wysokiej zależności pomiędzy budową ciała i wiekiem menarchy. Prz Antropol 59:115–9.

Łaska-Mierzejewska T, Olszewska E. 2003. Antropologiczna ocena zmian rozwarstwienia społecznego populacji wiejskiej w Polsce w okresie 1967–2001. Badania dziewcząt. Warszawa: Studia i Monografie AWF.

Łaska-Mierzejewska T, Olszewska E. 2007. Anthropological assessment of changes in living conditions of the rural population in Poland in the period 1967–2001. Ann Hum Biol 34(3):362–76.

Milicer H. 1968. Wiek menarche dziewcząt wrocławskich w 1966 roku w świetle czynników środowiska społecznego. Materiały i Prace Antropologiczne 76:25–52.

Morris DH, Jones ME, Schoemaker MJ, Ashworth A, Swerdlow AJ. 2011. Secular trends in age at menarche in women in the UK born 1908–93: results from the Breakthrough Generations Study. Paediatr Perinat Epidemiol 25(4):394–400.

Padez C. 2003. Social background and age at menarche in Portuguese university students: a note on the secular changes. Am J Hum Biol 15:415–27.

Padez C. 2007. Secular trend in Portugal. J Hum Ecol 22(1):15–22.

Palczewska I, Niedźwiecka Z. 2001. Wskaźniki rozwoju somatycznego dzieci i młodzieży warszawskiej. Med Wieku Rozw 5(1): 115–8.

Piasecki E, Panek S. 1982. Czynniki różnicujące rozwój młodzieży nowohuckiej. MPA 102:115–82.

Pasquet P, Manguelle-Dicoum Biyong A, Rikong-Adie H, Befidi-Mengue R, Garba MT, Froment A. 1999. Age at menarche and urbanization in Cameroon: current status and secular trends. Ann Hum Biol 26:89–97.

Popczyk A. 1990. Wiek menarche w regionie Warmii i Mazur z uwzględnieniem oddziaływań zmiennych środowiska społeczno – rodzinnego i nałogu nikotynowego rodziców. Praca doktorska, Uniwersytet Wrocławski.

Prado C., 1990, Secular changes in height, weight and menarche in Spain during the last three decades (1955–1985). Journal of Human Ecology, 1, 21–29.

Prado C, Jimenez JM, Ruben M. 2002. La edad de menarquia y aparición de caracteres sexuales secundarios; cambio secular en población Cubana. Revista Española de Antropologia Fisica 23:57–64.

Prentice S, Fulford A.J, Landing MA, Jarjou, Goldberg G.R. and Prentice A. 2010.

Evidence for a downward secular trend in age of menarche in a rural Gambian population. Ann Hum Biol. 37(5): 717–721. Ann Hum Biol 37(5):717–21.

Przewęda R, Trześniowski R. 1996. Sprawność fizyczna polskiej młodzieży w świetle badań z roku 1989. Warszawa: Wydawnictwo AWF.

Przewęda R, Dobosz J. 2003. Growth and physical fitness of Polish Youth in two successive decades. J Sport Med Phys Fit 43(4):465–74.

Radochońska A, Dudzik S. 2005. Tendencja przemian w rozwoju dzieci ze wsi podrzeszowskich w wieku od 7 do 14 lat. Przegląd Medyczny Uniwersytetu Rzeszowskiego 1:31–40.

Radochońska A, Dudzik S, Perenc L. 2006. Zmiany sekularne wieku menarche u dziewcząt z Boguchwały i Krasnego badanych w latach 1976/77, 1988/89 oraz 2003/04 na tle populacji dziewcząt rze-

szowskich. Przegląd Medyczny Uniwersytetu Rzeszowskiego 1:64–69.

Siniarska A, Grzelak J, Nieczuja-Dwojacka J, Durka D. 2015. Zmiany w budowie ciała dzieci i młodzieży warszawskiej w ciągu ostatnich 15 lat. Referat na XLV Ogólnopolskiej Konferencji Naukowej Polskiego Towarzystwa Antropologicznego.

Skład M, Zieniewicz A, Popławska H, Saczuk J. 2002. Poziom rozwoju fizycznego dziewcząt i chłopców z rodzin o bardzo dużej liczbie dzieci. Roczniki Naukowe Akademii Wychowania Fizycznego w Warszawie Zamiejscowy Wydział Wychowania Fizycznego w Białej Podlaskiej 9:221–30.

Stoev R. 1994. Sexual maturation in girls from Bulgaria. In: K Hajniš, editor. Growth and ontogenetic development in man IV. Prague: Charles University. 197–200.

Szwed A, John A, Czapla Z, Kosińska Z. 2013. Influence of socioeconomic factors on age at menarche in Polish girls. Anthropol Anz 70:455–70.

Szwed A. 2015. From menarche to menopause. Family conditioning of the determinants of a woman's reproductive period. Poznań: Uniwersytet im. Adama Mickiewicza, Seria Antropologia 28.

Trześniowski R. 1990. Rozwój fizyczny i sprawność fizyczna młodzieży szkolnej w Polsce. Z warsztatów badawczych AWF Warszawa. Warszawa: Wydawnictwo AWF.

van Lenthe FJ, Kemper HCG, van Mechelen W, Twisst JWR. 1996. Longitudinal development and tracking of central patterns of body fat the adolescence and adulthood. The Amsterdam growth and health study. Int J Epidemiol 25:1162–71.

Wilczewski A. 2003. Wiek menarche dziewcząt z południowego Podlasia w latach 1990–2000. In: J Zagórski and M Skład, editors. Uwarunkowania rozwoju dzieci i młodzieży wiejskiej. Lublin: IMW. 57–60.

Wilczewski A. 2013. Czy dystanse środowiskowe w rozwoju dzieci i młodzieży ze wschodniego regionu Polski ulegają zmianie? Biała Podlaska: AWF Warszawa, Wydział Wychowania Fizycznego i Sportu w Białej Podlaskiej.

Woronkowicz A, Cichocka B, Kowal M, Kryst L, Sobiecki J. 2012. Physical development of girls from Krakow in the aspect of socioeconomical changes in Poland (1938–2010). Am J Hum Biol 24:626–32.

Yampolskaya YUA. 1994. The acceleration of physical development of a human being for the passed decades and the prognosis of this process for the next years. In: K Hajniš, editor. Growth and ontogenetic development in man IV. Prague: Charles University. 207–17.