Wasiluk Agnieszka, Saczuk Jerzy. Weightness of girls aged 10-12 from the lubelskie and podlaskie voivodship in the years 2006-2016–2021. Journal of Education, Health and Sport. 2022;12(5):193-203. eISSN 2391-8306. DOI http://dx.doi.org/10.12775/JEHS.2022.12.05.014
https://apcz.umk.pl/JEHS/article/view/JEHS.2022.12.05.014
https://zenodo.org/record/6570059

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 1, 2021. No. 32343. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).

Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 1 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe:Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

Received: 02.05.2022. Revised: 20.05.2022. Accepted: 22.05.2022.

Weightness of girls aged 10-12 from the lubelskie and podlaskie voivodship in the years 2006-2016–2021

Agnieszka Wasiluk
https://orcid.org/0000-0001-9781-8121 agnieszka.wasiluk@awf.edu.pl
Józef Piłsudski University of Physical Education in Warsaw, Faculty of Physical Education and Health, Biała Podlaska, Poland

Jerzy Saczuk
https://orcid.org/0000-0001-7090-8434 jerzy.saczuk@awf.edu.pl
Józef Piłsudski University of Physical Education in Warsaw, Faculty of Physical Education and Health, Biała Podlaska, Poland

Abstract
Introduction The nutritional status of children and adolescents is widely commented on. On the one hand. the number of people with excess body weight is growing. and on the other hand. the problem of malnutrition is becoming more and more visible. **The aim** of the study was to determine the fifteen-year changes in body height and BMI. including the frequency of underweight in girls living in towns and villages of the Lubelskie and Podlaskie voivodships. **Material and methods** For this study. the results of 7759 girls aged 10-12 were used. Information on the date of birth and the environmental conditions in which the respondents grew up was collected using the survey method. Body height and weight were measured. On their basis. BMI was calculated. In the groups of calendar age. the arithmetic means and standard deviation for body height and BMI were calculated at individual test dates. The statistical significance of differences between the teams was verified by the Anova analysis of variance and the Newmann-Keuls test. **Results** In the analyzed period. a significant increase in body height and BMI was found in girls. Higher values of the secular trend of body height were found in female urban dwellers compared to rural girls. The percentage of underweight in 2006 and 2016 was similar for girls from different backgrounds. However. in 2021 it was higher for female residents of the village. **Conclusion** The obtained results indicate the necessity to conduct systematic studies to assess the nutritional status of adolescents.
Key words: secular trend; body height; BMI; underweight; girls

Introduction

The issue of the nutritional status of children and adolescents in various regions of the world is widely commented on. From the conducted observations it follows, that the average BMI value and the prevalence of obesity have increased worldwide (NCD Risk Factor Collaboration 2017). Despite the fact that the trend of the increase in excess body weight in children and adolescents has stopped in highly developed countries (Wabitsch et al. 2017), it still continues in developing countries (Rivera et al. 2014). As a result, we can observe a double threat to the health of children and adolescents. On the one hand, the number of people with excess body weight is growing, on the other hand, the problem of juvenile malnutrition is becoming more and more visible. The analysis by Garrido-Miguel et al. (2021) follows, that in Europe, the prevalence of underweight is significant, overall around 8-9%, with an upward trend maintained. The coexistence of malnutrition and overnutrition is a serious problem in most countries and is also noticeable in the eastern regions of Poland. The research by Saczuk (2018) conducted from 1986-to 2016 shows, that the highest incidence of both deficiencies, and excess body weight is observed in the groups of the youngest children.

The last fifteen years in Poland have been a period of rapid changes and social transformations related to joining the European Union. At that time, a deepening of disproportions in the economic status of Polish society was noticeable, and differences in the nutritional status of children and adolescents became apparent. This problem is observed both in the areas of the country with higher economic indicators. and it is beginning to be noticed in regions with a slower pace of development (Wasiluk, Saczuk 2015). Therefore, the term seems interesting, at what pace do these changes take place in adolescents living in different environments. and at the same time, the areas of the country are underdeveloped in terms of economic and economic aspects. Therefore, the aim of this study was to identify 15-year changes in body height.

Material and methods

In 2006, as part of the statutory research of the Academy of Physical Education in Warsaw (DS 45), research was carried out on children and adolescents living in the Podlaskie and Lubelskie provinces. Measurements in the same areas of the country were also repeated in 2016 as part of the statutory research of the University of Physical Education in Warsaw (DS 203) and in 2021. The results of 7,759 students were used for this study. at the age of 10-12, 4,078 of them were town dwellers and 3,681 girls were from the villages. The number of girls surveyed in three stages of observation, taking into account the calendar age and place of residence, is summarized in Table 1.

Tab. 1. Number of surveyed girls, taking into account the observation date and place of residence

age in years	2006	2016	2021	total
village				
10	585	445	192	1222
11	565	394	195	1154
12	498	558	249	1305
total	1648	1397	636	3681
town				
10	772	320	265	1357
11	655	453	286	1394
12	503	496	328	1327
total	1930	1269	879	4078

Source: own study

The research was conducted in accordance with the principles contained in the Helsinki Declaration and they were approved by the Senate Ethics Committee operating at the University of Physical Education in Warsaw.

Using a questionnaire, information on the date of birth and environmental conditions were collected. in which the respondents grew up. Anthropometric measurements were carried out in accordance with accepted anthropometric techniques (IBP1696). Based on the height and weight measurements, the body mass index (BMI) was calculated. determining body weight in kilograms by the square of the body height. In the groups of calendar age, the arithmetic means and dissemination measures for body height and BMI were also calculated at individual test dates. The statistical significance of differences between the teams was verified by the Anova analysis of variance and the Newmann-Keuls test.

Then from the research material, people were selected as underweight. The basis for qualification to the above-mentioned teams according to the cut-off values developed by Cola et al. (2010). The obtained numbers allowed us to calculate the percentages of girls with normal BMI and with I°, II° and III° underweight, both at three observation Times, as well as taking into account the place of residence (town, village). The statistical significance of the differences between the number of people who qualified for each of the above-described groups was determined using the χ^2 test.

Results

During the fifteen years of observation (2006-2021), the body height of rural girls increased by an average of 2.20 cm. The biggest differences. statistically significant ($p \leq 0.05$) was found in 10-year-olds (4.67 cm), followed by an 11-year-old (3.13 cm). On the other hand, among twelve-year-olds, they were small and only indicated a tendency to increase the discussed somatic feature (Table 2). On the other hand, greater distances in the height of the body were noted in young town dwellers. In 2021, compared to 2006, the girls assessed were, on average, 3.46 cm higher, and the largest changes were observed in female students aged 11 (5.71 cm) and 12 years (4.16 cm), respectively. The mentioned differences were statistically significant at the level of $p \leq 0.05$. On the other hand, in the case of 10-year-olds, the results on both dates were similar. and the differences are statistically insignificant

In the last five years, female students from rural schools increased their body height by an average of 1.92 cm, and urban ones by 1.22 cm. In the discussed period, among adolescent women living in rural areas, the highest values of this somatic trait were observed in 10-year-old girls (2.77 cm), the smaller ones in 11-year-olds (1.63 cm), and twelve-year-olds

(1.36 cm). However, their peers from the cities. the greatest positive changes were observed in 11-year-olds (3.57 cm) and 12-year-olds (2.22 cm). On the other hand, at the age of 10, a significant reduction in body height (2.14 cm) was found. All the differences described above were statistically significant at the p≤ 0.05 level.

Tab. 2. Body height of girls, taking into account the dates of observation and place of residence

age in years	2006		2016		2021		Anova	2006 - 2016	2006 - 2021	2016r – 2021
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD				
village										
10	140.63	7.34	142.53	8.71	145.30	7.38	26.71	5.43*	10.09*	5.76*
11	145.54	8.61	147.04	8.07	148.67	8.14	11.09	3.87*	6.38*	3.15*
12	152.62	7.43	153.00	7.42	154.36	8.41	4.48	1.14	4.16*	3.31*
town										
10	140.92	7.38	143.65	6.60	141.51	5.99	17.59	8.36*	1.69	5.24*
11	145.74	8.30	147.88	7.27	151.45	6.15	57.05	6.54*	15.05*	8.83*
12	151.93	7.9	153.87	7.46	156.09	8.51	27.77	5.49*	10.50*	5.59*

* statistically significant difference at the level of p≤ 0.05 Source: own study

In the years 2006–2021, an increase in BMI was observed in young women living in rural areas. on average by 0.65 kg / m². The biggest positive difference, statistically significant at the level of p≤ 0.05, was observed in girls aged 12 years (2.02 kg/m²). and then at the age of 11 (0.14 kg/m²). On the other hand, 11-year-olds showed a decrease in the value of this indicator (0.21 kg / m²). In the analyzed period, greater average changes (1.57 kg / m²) in the body mass index were found in girls from cities. They were significantly significant in all groups of calendar age. The greatest changes were found in twelve-year-olds (2.12 kg / m²). followed by 11-year-olds (1.37 kg/m²) and 10-year-olds (1.21 kg/m²).
It would seem, that between 2016 and 2021, there were practically no changes in the average BMI value (0.05 kg / m²) in the surveyed village inhabitants. However, a detailed analysis shows. that the greatest positive distances. statistically significant at the level of p≤ 0.05. was reported among twelve-year-olds (1.10 kg/m²). When in younger age groups a statistically significant decrease in the body mass index was found. A decrease in BMI level by an average of 0.69 kg/m² was noticed in 11-year-olds and by 0.55 kg/m² in 10-year-olds.

Tab. 3. BMI of girls, taking into account the dates of observation and place of residence

age in years	2006		2016		2021		Anova	2006 – 2016r.	2006 - 2021r.	2016 – 2021
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD				
village										
10	17.34	2.85	17.88	2.58	17.13	2.77	7.02	4.43*	1.30	4.48*
11	17.71	2.68	18.54	2.57	17.85	2.58	24.57	6.81*	4.60*	9.47*
12	17.81	2.82	18.73	2.68	19.83	3.53	41.08	7.25*	12.64*	7.01*
town										
10	17.19	2.60	17.58	2.46	18.24	3.09	15.17	3.11*	7.72*	4.17*
11	17.46	2.65	18.08	2.37	18.83	4.79	19.66	4.58*	8.72*	4.48*
12	17.88	2.62	18.35	2.65	20.00	2.71	66.32	3.96*	15.92*	12.36*

* statistically significant difference at the level of p≤ 0.05 Source: own study

The picture of secular trends in the weight-to-height ratio described above is somewhat flattened and shows the results of all respondents. It is interesting, however, what changes occurred in girls in the frequency of normal weight-height proportions and individual degrees of underweight.

Between 2006 and 2021, the percentage of girls from the third age group was underweight (2.28%) statistically significantly ($p \leq 0.05$) in girls from the villages ($p \leq 0.05$). On the other hand, there was a tendency to increase the incidence of underweight II° (0.52%) and a decrease in the percentage of female students with I° underweight (1.04%) and normal weight-growth ratios (6.18%). On the other hand, in urban girls a significant ($p \leq 0.05$) regression was found in the incidence of all degrees of underweight. It was the highest in subjects with I° underweight (4.73%), followed by III° (1.88%) and II° weight deficiency (1.51%). On the other hand, the percentage of subjects with normal BMI showed an upward trend (6.41%), but it was statistically insignificant (Table 4).

On the other hand, in 2016-2021, a significant increase in the incidence of I° underweight (5.34%) was observed in young female rural residents, as well as the increase in the percentage of female students with II° bodyweight deficiency (1.11%). Moreover, a statistically significant ($p \leq 0.05$) decrease in the percentage of girls with correct weight-to-weight proportions (10.94%) was found. In the urban environment, over the last five years, girls showed a statistically significant decrease in the percentage of subjects with normal weight-to-height proportions (11.31%) and with II° underweight (0.97%). In the remaining groups, the differences were not significant (Table 4).

When analyzing the χ^2 test, environmental differences between all groups in 2006 and 2016 were noticed, but they were not statistically significant. On the other hand, in the last period of the study, interchangeable distances between girls from the urban and rural environments were found in II° and I° underweight (Table 4).

Tab. 4. Percentage of surveyed girls in 2006. 2016 and 2021 from towns and villages in groups from III°, II°, I° degree underweight. correct BMI; and test χ^2 values for environmental differences

year of research	2006	2016	2021	2006 – 2016	2006 – 2021	2016 – 2021
% of surveyed girls from the villages						
III° underweight	3.22	0.93	0.94	19.45*	10.91*	0.00
II° underweight	2.31	1.72	2.83	1.27	0.49	2.43
I° underweight	11.89	5.51	10.85	33.02*	0.39	15.03*
normal BMI	70.33	75.09	64.15	1.37	1.54	4.37*
% of surveyed girls from towns						
III° underweight	2.59	0.71	0.68	16.51*	13.12*	0.01
II° underweight	3.16	1.65	0.68	7.01*	18.96*	4.17*
I° underweight	10.88	6.15	6.14	18.46*	14.35*	0.00
normal BMI	71.45	77.86	66.55	2.42	1.24	5.31*
χ^2 test values for environmental differences						
III° underweight	1.17	0.39	0.31			
II° underweight	2.31	0.02	10.62*			
I° underweight	0.72	0.43	9.14*			
normal BMI	0.09	0.38	0.20			

* statistically significant difference at the level of $p \leq 0.05$ Source: own study

Discussion

Since at least the second half of the nineteenth century, the phenomenon of a steady increase in the average body height and an increase in body weight in relation to its height has been observed (Fudvoye and Parent. 2017). Recognized, that it is an effect of improving the standard of living and blurring of social inequalities (Gomula et al. 2021). This hypothesis was confirmed by the low values of anthropological indicators recorded in the periods of wars and famine. when a significant decrease in the average height and weight of the population was observed (Arage et al. 2021). Stated, that in most Western societies, the heritability of body height is estimated between 0.60 and 0.95 (Jelenkovic et al. 2016). However, these direct determinants of body height are additionally linked to, inter alia, socio-economic conditions.

Socio-economic changes. which took place after Poland joined the European Union had an impact on the magnitude of the secular trend in somatic development. Systematic changes in height and weight have been noted. In terms of somatic features. Dobosz (2012) conducted observations on a large national sample. found a slowdown in the growth rate of girls' body height in the years 1999-2009 compared to the decade 1989-1999. as evidenced by the results of the oldest youth. On the other hand, in younger groups of calendar age, he noted further acceleration of developmental processes, visible as the acceleration of growth and maturation. The high rate of dynamics of changes among girls, observed in the previous decades, was also maintained in the body weight. especially the youngest.

Please note. that, at the same time, the secular trend in somatic traits was different depending on the area under study. In children and adolescents from Kraków, in the years 2000-2010, the average height of the body slightly increased (by approx. 1.00 cm), with a greater increase in body weight and BMI (Kowal 2011). Greater distances in growth were observed in pupils of primary and middle schools from Silesia, in the years 2001-2002 and 2010-2011. The average height of the girls' bodies increased from 1.75 cm to 2.45 cm. There was also a significant increase in the average body weight and BMI (Ignasiak et al. 2016). Also, in the years 1986-to 2016, students from eastern Poland had an increase in body height and a significant increase in their weight. Which also translated into higher body mass index values. It needs to be highlighted, that the greatest changes were observed in the decade 1996-to 2006 and they concerned girls in the pubertal period, which indicates the acceleration of maturation (Saczuk 2018). Bartkowiak et al. (2021) also presented significant secular changes in the height and weight of rural schoolgirls from central-western Poland from 1986 to 2016. The above-mentioned authors noted an average increase in the height of the girls' bodies by 4.65 cm in the analyzed three decades. and body weight by 5.20 kg. The above-mentioned authors noted an average increase in the height of the girls' bodies by 4.65 cm in the analyzed three decades and body weight by 5.20 kg. The above-mentioned authors noted an average increase in the height of the girls' bodies by 4.65 cm in the analyzed three decades and body weight by 5.20 kg.

In the presented research results, between 2006 and 2021, further increases in body height and body mass index were noted. At the same time, greater distances in the height of the body were noted in female inhabitants of cities. and smaller for their peers from the villages. Inverse relationships were found in BMI. Such a picture of changes may be caused by the acceleration of maturation, and consequently, the earlier start of the pubertal height jump of the body by girls from the urban environment. According to Saczuk et al. (2018), the inhabitants of cities from the eastern parts of the country start puberty 0.17 years earlier than their peers from the villages. According to the cited authors, in eastern Poland, an acceleration of the maturation rate by about 0.22 years per decade is observed. It needs to be highlighted,

that the acceleration of growth causes a slender figure (Aris et al. 2019), hence, greater differences in body height and smaller differences in BMI were noted in urban girls.

Underweight among children and adolescents is an important clinical problem. and in the field of public health. It is associated with adverse health effects at all stages of human life and may reflect poverty in access to food (Ieiri et al. 2021), unhealthy eating habits (Rawal et al. 2021), or increased risk of developing many diseases. Children and adolescents who are underweight are more likely to develop infectious diseases (Goutines et al. 2021), have limited cognitive functions more often (Suryawan et al. 2021), mental disorders (Donkor et al. 2021. Zeiler et al. 2021) and a low assessment of the state of one's health (Linardon et al. 2021). For girls of childbearing age, being underweight is often associated with a higher risk of maternal mortality. premature delivery and intrauterine growth retardation of the fetus (Girsen et al. 2016, Domański et al. 2021).

The prevalence of underweight in Eastern Europe shows an increasing trend (from 9.1% to 12.0%). North (from 4.1% to 6.8%) and South (from 5.8% to 6.7%). On the other hand, in Western Europe, the incidence of underweight decreased from 14.0% to 11.8% (Garrido-Miguel et al. 2021). This is particularly disturbing in view of the fact, that regions, where there is an increase in malnutrition of populations in the future, will be even more exposed to the spread of obesity (Abdullah 2015). An analysis of the literature from 2005 to 2015 conducted by Malczyk (2016) revealed significant abnormalities in the nutritional status of children and adolescents in Poland. On average, 3% to 18% of boys were underweight. and in girls up to 20%. Olejnik et al. (2012) indicate an even higher percentage of children with bodyweight deficiency, who conducted their observations in the Podlaskie Voivodeship. The mentioned authors stated. that this is a problem24.2% of children and it is the highest in the younger age groups of the calendar age. The nutritional status of the surveyed children was influenced by having many children and the financial deficit of the families.

According to the Eurostat report (2018), the voivodeships of eastern Poland are among the poorest macroregions of the European Union. where the per capita income does not exceed 50% of the average EU income. Despite the introduction of the government 500+ program in 2016. as part of this, PLN 500 monthly for each child was started to be transferred, which helped less well-off families economically. we still observe significant environmental differences in the level of nutrition of adolescents. The changes observed over the last five analyzed years are particularly worrying. It follows from them. those female residents of the Lubelskie and Podlaskie voivodeships come from the villages. there was a significant increase in the percentage of respondents with I° underweight and a decrease in the correct weight-to-weight ratio. On the other hand, urban girls showed a marked reduction in the incidence of both underweight II°, as well as the correct BMI. Which in relation to both analyzed groups indicates an increase in the frequency of excess body weight. What Saczuk (2018) mentioned earlier in his work. It can therefore be assumed, that the examined schoolgirls are significantly exposed to irregularities in the way of eating. In addition, the research period covered the time of the pandemic when. the physical education classes were mainly conducted remotely. Hence it can be assumed, that the decrease in the percentage of subjects with bodyweight deficiency may be the result of limiting their physical activity. Which in relation to both analyzed groups indicates an increase in the frequency of excess body weight. What Saczuk (2018) mentioned earlier in his work. It can therefore be assumed. that the examined schoolgirls are significantly exposed to irregularities in the way of eating. In addition, the research period covered the time of the pandemic when. the physical education classes were mainly conducted remotely. Hence it can be assumed, that the decrease in the percentage of subjects with bodyweight deficiency may be the result of limiting their physical activity. Which in relation to both analyzed groups indicates an increase in the frequency of excess body weight. What Saczuk (2018) mentioned earlier in his work. It can therefore be assumed. that the examined schoolgirls are significantly

exposed to irregularities in the way of eating. In addition, the research period covered the time of the pandemic when. the physical education classes were mainly conducted remotely. Hence it can be assumed. that the decrease in the percentage of subjects with body weight deficiency may be the result of limiting their physical activity, the physical education classes were mainly conducted remotely. Hence it can be assumed, that the decrease in the percentage of subjects with body weight deficiency may be the result of limiting their physical activity. the physical education classes were mainly conducted remotely. Hence it can be assumed, that the decrease in the percentage of subjects with body weight deficiency may be the result of limiting their physical activity.

From research Gurzkowska et al. (2017) shows, that the size of the place of residence is not a significant risk factor for weight loss. Our recent observations contradict this. indicating significant disproportions in the frequency of I° and II° degree of body weight deficiency in girls from rural and urban environments. Please note, that the lifestyle of young urban and rural residents differs significantly (Kaczmarek and Wolański 2018). Therefore, we observe differences in secular trends between the inhabitants of these environments. Despite this, that has been proven time and time again, that regular exercise can significantly reduce the risk of excess body weight, which is confirmed, among others, by the studies by Suder et al. (2020). There are also reports in the literature, which deny it. Mason et al. (2017) found, that physically inactive girls are at a higher risk of weight deficiency. This is also confirmed by the Swedish observations of Elinder et al. (2011). Research on the relationship between weight deficiency, and the level of physical activity are, however, rare. In addition, most health programs in developed countries are geared towards obesity prevention, apart from the problem of malnutrition. However, it should be remembered. that the mechanism that determines the development of weight deficiency is very complex and requires further research. In addition, most health programs in developed countries are geared towards obesity prevention, apart from the problem of malnutrition. However, it should be remembered, that the mechanism that determines the development of weight deficiency is very complex and requires further research. In addition, most health programs in developed countries are geared towards obesity prevention. apart from the problem of malnutrition. However, it should be remembered, that the mechanism that determines the development of weight deficiency is very complex and requires further research.

Conclusions:

1. In the analyzed period, a significant increase in body height and body mass index was found in the examined girls.
2. Higher values of the secular trend of body height were found in town dwellers compared to girls from the villages.
3. The percentage of weight loss in 2006 and 2016 was similar in girls from different backgrounds, while in 2021 it was higher for female rural residents.
4. The obtained results indicate the necessity to conduct systematic research to assess the nutritional status of adolescents living in the Lublin and Podlasie voivodeships, as well as to conduct an in-depth analysis of the causes of malnutrition and undertake educational activities.

References

1. Abdullah A. The Double Burden of Undernutrition and Overnutrition in Developing Countries: an Update. *Curr Obes Rep*. 2015;4(3):337-349. doi:10.1007/s13679-015-0170-y
2. Arage G, Belachew T, Hajmahmud K, et al. Impact of early life famine exposure on adulthood anthropometry among survivors of the 1983-1985 Ethiopian Great famine:

a historical cohort study. *BMC Public Health*. 2021;21(1):94. doi:10.1186/s12889-020-09982-x
3. Aris IM, Rifas-Shiman SL, Zhang X, et al. Association of BMI with Linear Growth and Pubertal Development. *Obesity*. 2019;27(10):1661-1670. doi:10.1002/oby.22592
4. Bartkowiak S, Konarski JM, Strzelczyk R, Janowski J, Malina RM. Secular change in height and weight of rural school children and youth in west-central Poland: 1986 to 2016. *Am J Hum Biol*. 2021;33(2):e23461. doi:10.1002/ajhb.23461
5. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*. 2000;320(7244):1240-1243. doi:10.1136/bmj.320.7244.1240
6. Dobosz J, Stan kondycji fizycznej dzieci i młodzieży w Polsce.[The state of physical condition of children and adolescents in Poland] [w:] S. Nowacka-Dobosz. A. Zarychta. J. Dobosz [red.]. Raport z ogólnopolskiej debaty o uwarunkowaniach edukacji fizycznej w Polsce. AWF Warszawa. 2012. Polish.
7. Domanski G, Lange AE, Ittermann T, et al. Maternal pre-pregnancy underweight as a risk factor for the offspring: Survey of Neonates in Pomerania. *Acta Paediatr*. 2021;110(5):1452-1460. doi:10.1111/apa.15701
8. Donkor HM, Toxe H, Hurum J, et al. Psychological health in preschool children with underweight, overweight or obesity: a regional cohort study. *BMJ Paediatr Open*. 2021;5(1):e000881. doi:10.1136/bmjpo-2020-000881
9. Elinder LS, Sundblom E, Rosendahl KI. Low physical activity is a predictor of thinness and low self-rated health: gender differences in a Swedish cohort. *J Adolesc Health*. 2011;48(5):481-486. doi:10.1016/j.jadohealth.2010.08.005
10. Eurostat. (2018) Quality of life indicators. Statistics Explained. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Quality_of_life indicators (dostęp 5.01.2022).
11. Fudvoye J, Parent AS. Secular trends in growth. *Ann Endocrinol (Paris)*. 2017;78(2):88-91. doi:10.1016/j.ando.2017.04.003
12. Garrido-Miguel M, Martínez-Vizcaíno V, Oliveira A, et al. Prevalence and trends of underweight in European children and adolescents: a systematic review and meta-analysis. *Eur J Nutr*. 2021;60(7):3611-3624. doi:10.1007/s00394-021-02540-0
13. Girsen AI, Mayo JA, Carmichael SL, et al. Women's prepregnancy underweight as a risk factor for preterm birth: a retrospective study. *BJOG*. 2016;123(12):2001-2007. doi:10.1111/1471-0528.14027
14. Gomula A, Nowak-Szczepanska N, Koziel S. Secular trend and social variation in height of Polish schoolchildren between 1966 and 2012. *Acta Paediatr*. 2021;110(4):1225-1230. doi:10.1111/apa.15572
15. Goutines J, Miller LC, Sorge F. Infections and nutritional status of internationally adopted children in France. *Acta Paediatr*. 2021;110(4):1359-1365. doi:10.1111/apa.15612
16. Gurzkowska B, Kułaga Z, Grajda A, Góźdź M, Wojtyło M, Litwin M. The relationship between selected socioeconomic factors and thinness among Polish school-aged children and adolescents. *Eur J Pediatr*. 2017;176(6):797-806. doi:10.1007/s00431-017-2912-1
17. IBP. A guide to field methods. Handbook 9. Human Biology. Oxford. 1969.
18. Ieiri MCA, Kosaka S, Tomitsuka E, Umezaki M. Factors Affecting Undernutrition among School Children in Cebu, Philippines. *Ecol Food Nutr*. 2021;60(2):182-197. doi:10.1080/03670244.2020.1813733

19. Ignasiak Z, Sławińska T, Malina RM, Short term secular change in body size and physical fitness of youth 7–15 years in Southwestern Poland: 2001–2002 and 2010–2011. Anthropological Review. 2016;3:311–329.
20. Janina Olejnik BJ, Roszko-Kirpsza I, Marcinkiewicz S, Maciorkowska E, Uwarunkowania środowiskowe a stan odżywienia dzieci i młodzieży województwa podlaskiego [Environmental conditions and the nutritional status of children and adolescents in Podlaskie Voivodeship]. *Pediatria Polska*. 2012;87:41–46. Polish
21. Jelenkovic A, Hur YM, Sund R, et al. Genetic and environmental influences on adult human height across birth cohorts from 1886 to 1994. *Elife*. 2016;5:e20320. doi:10.7554/eLife.20320
22. Jelenkovic A, Yokoyama Y, Sund R, et al. Associations between birth size and later height from infancy through adulthood: An individual based pooled analysis of 28 twin cohorts participating in the CODATwins project. *Early Hum Dev*. 2018;120:53-60. doi:10.1016/j.earlhumdev.2018.04.004
23. Kaczmarek M, Wolański N, Rozwój człowieka od poczęcia do śmierci. [Human development from conception to death] PWN. Warszawa. 2018. Polish.
24. Kowal M, Cichocka B, Woronkiewicz A, et al. Międzypokoleniowe zmiany w budowie ciała i akceleracja pokwitania u dzieci i młodzieży w wieku 7-15 lat z populacji wielkomiejskiej w świetle uwarunkowań psychosocjalnych. [Intergenerational changes in body structure and acceleration of puberty in children and adolescents aged 7-15 from the metropolitan population in the light of psychosocial determinants]. Monografie AWF Kraków. 4. 2011. Polish
25. Linardon J, Greenwood CJ, Fuller-Tyszkiewicz M, et al. Young adult mental health sequelae of eating and body image disturbances in adolescence. *Int J Eat Disord*. 2021;54(9):1680-1688. doi:10.1002/eat.23575
26. Malczyk E, Stan odżywienia dzieci i młodzieży w Polsce na podstawie piśmiennictwa z ostatnich 10 lat (2005–2015). [Nutritional status of children and adolescents in Poland based on the literature from the last 10 years (2005–2015)]. Annales Academiae Medicae Silesiensis. 2016;70: 56–65. Polish
27. Mason A, Rantanen A, Kivimäki H, Koivisto AM, Joronen K. Family factors and health behaviour of thin adolescent boys and girls. *J Adv Nurs*. 2017;73(1):177-189. doi:10.1111/jan.13096
28. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *Lancet*. 2017;390(10113):2627-2642. doi:10.1016/S0140-6736(17)32129-3
29. Rawal T, Willeboordse M, Arora M, et al. Prevalence of Excessive Weight and Underweight and Its Associated Knowledge and Lifestyle Behaviors among Urban Private School-Going Adolescents in New Delhi. *Nutrients*. 2021;13(9):3296. doi:10.3390/nu13093296
30. Rivera JÁ, de Cossío TG, Pedraza LS, Aburto TC, Sánchez TG, Martorell R. Childhood and adolescent overweight and obesity in Latin America: a systematic review. *Lancet Diabetes Endocrinol*. 2014;2(4):321-332. doi:10.1016/S2213-8587(13)70173-6
31. Saczuk J, Rozwój morfofunkcjonalny dzieci i młodzieży ze wschodniej Polski w okresie transformacji ustrojowej. [Morphofunctional development of children and adolescents from eastern Poland in the period of systemic transformation]. Monografie i Opracowania. Akademia Wychowania Fizycznego Józefa Piłsudskiego w Warszawie. Filia w Białej Podlaskiej. 2018, 31. Polish.

32. Saczuk J. Wasiluk A.. Wilczewski A. 92018) Body height and age at menarche of girls from eastern Poland in the period of political transformation. Anthropological Review. 2018. 81(2). 130-145.
33. Suder A, Jagielski P, Piórecka B, et al. Prevalence and Factors Associated with Thinness in Rural Polish Children. *Int J Environ Res Public Health*. 2020;17(7):2368. doi:10.3390/ijerph17072368
34. Suryawan A, Jalaludin MY, Poh BK, et al. Malnutrition in early life and its neurodevelopmental and cognitive consequences: a scoping review. *Nutr Res Rev*. 2021;1-14. doi:10.1017/S0954422421000159
35. Wabitsch M, Moss A, Kromeyer-Hauschild K. Unexpected plateauing of childhood obesity rates in developed countries. *BMC Med*. 2014;12:17. doi:10.1186/1741-7015-12-17
36. Wasiluk A, Saczuk J, Underweight. overweight. and obesity in boys and girls at the age of 7-18 years from eastern Poland in the years 1986-2006. Medical Studies. 2015;2: 99 – 105.
37. Wilczewski A, Czy dystanse środowiskowe ulegają zmianie? [Do environmental distances change?] Monografie i Opracowania. WWFiS Biała Podlaska. 2013.14. Polish.
38. Zeiler M, Philipp J, Truttmann S, Waldherr K, Wagner G, Karwautz A. Psychopathological Symptoms and Well-Being in Overweight and Underweight Adolescents: A Network Analysis. *Nutrients*. 2021;13(11):4096. doi:10.3390/nu13114096