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ORIGINAL ARTICLE

Socio-economic status as an environmental factor – incidence of underweight, overweight and obesity in adolescents from less-urbanized regions of Poland

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Abstract

Introduction. Under-nutrition, over-nutrition and obesity incidence in relation to environmental diversity and socio-economic influences in adolescents from less urbanized regions of Poland has not been widely studied.

Objective. To determine the correlation between socio-economic status and incidence of underweight, overweight and obesity in adolescents located in less-urbanized regions of Poland.

Material and methods. The study involved 553 adolescents aged 13–18 living in 2 less-urbanized regions of Poland (small towns and villages in the central and north-eastern regions). The sample was randomly chosen. The distinguishing determinants of socio-economic status (SES) included 6 features. The SES index (SESI) was calculated. Low, average and high SESI adolescents were distinguished. Using logistic regression, the odds ratio (OR) of underweight (BMI<18.5kg/m^2), overweight (BMI≥25kg/m^2) and obesity (BMI≥30kg/m^2) incidence was calculated after BMI conversion using the international cut-off by Cole et al. (2000, 2007). The reference group were adolescents with low SESI (OR=1.00).

Results. 11% of the adolescents were underweight, 14% were overweight and 3% were obese. The odds ratio of underweight incidence for the average SESI adolescent was 0.33 (95%CI: 0.15, 0.73; p<0.01) and in high SESI adolescents – 1.05 (95%CI: 0.78, 1.42; p>0.05). The odds ratio of overweight incidence in the average SESI adolescent was 1.73 (95%CI: 0.93, 3.19; p>0.05) and in high SESI adolescents – 1.14 (95%CI: 0.83, 1.57; p>0.05). The odds ratio of obesity incidence in the average SESI adolescent was 0.70 (95%CI: 0.21, 2.34; p>0.05) and in high SESI adolescents – 0.76 (95%CI: 0.40, 1.44; p>0.05). Adjustments for gender, age or region of residence did not significantly change the ORs values or their interpretation.

Conclusions. Underweight incidence in adolescents from less urbanized regions of Poland depended on socio-economic status. An adolescent with average socio-economic status was 3 times less likely to be underweight than an adolescent with low socio-economic status. The correlation between socio-economic status and overweight and obesity was not significant.

Key words

socio-economic status, overweight, underweight, obesity, adolescents, BMI

INTRODUCTION

Socio-economic conditions are significant determinants of health. One of the features of socio-economic status affecting the health condition is the place of residence and the rate of urbanisation. In Poland, detailed data concerning the level and diversification of poverty in rural areas and in small towns from a local perspective are not available. However, there has been a gradual impoverishment of people inhabiting suburban areas, situated far from industrial centres and large municipal agglomerations [1]. This applies particularly to areas where small non-commercial farms are prevalent and employment possibilities are limited.

The severe effects of negative socio-economic stimuli are particularly experienced by children and youths [2, 3]. Generally, persons of lower socio-economic status tend to follow a less healthy diet and lifestyle in comparison to persons of higher socio-economic status living in the same country, region or environment [4, 5]. It was established that more children from families of low socio-economic status, compared with children from families of higher socio-economic status, have irregular meals, skip breakfast before going out, do not have a meal at school, have too long breaks between meals and have their main meal in the late afternoon hours [3]. Those children reveal worse psychophysical efficiency, concentration difficulties, behavioural disorders and weakened cognitive functions, which negatively affect the processes of learning and memory [6].

Most research shows that Polish children and adolescents from families of low socio-economic status and/or living in small towns or villages reach similar developmental indicators as adolescents from towns or from families with high socio-economic status, and that the previously-observed social gradients in somatic development disappear [7, 8]. On the other hand, some studies have revealed small developmental differences to the disadvantage of children and adolescents living in more difficult conditions [8, 9, 10]. They also revealed a tendency to a lower body height and more massive body build, and to more frequent overweight

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and obesity, as well as worse motor development and a lower level of social competences.

To date, it has not been clearly determined to what extent healthy behaviours resulting from various socio-economic statuses can affect the disparities in health condition. The research results are divergent and show that the contribution of the socio-economic status to maintaining health can range from 12% – 72% [4, 11]. Discrepancies in the assessment can result from using a limited number of single determinants of socio-economic status. For this reason, the use of an integrated indicator of socio-economic status which combines multiple single determinants is beneficial [12, 13].

Environmental diversification within the communities inhabiting small towns and villages in less-urbanized regions and the impact of the socio-economic status on the incidence of health disorders in adolescents is an area which still remains to be investigated. It is not clear to what extent adolescents from small towns and villages from families of low socio-economic status are at risk of overweight, obesity or underweight.

OBJECTIVE

The aim of the study was to determine the relationship between socio-economic status and the incidence of underweight, overweight and obesity in adolescents from less-urbanized regions of Poland.

MATERIALS AND METHOD

The study used data collected in 2010–2011 and was conducted with the consent of the Bioethical Committee of Collegium Medicum in Bydgoszcz (Decision No. 102/2008). All interviews and measurements were conducted by well-trained interviewers.

The research was carried out in small towns and villages in north-eastern Poland (Suwałki Region) and central Poland (Kujawy-Pomeranian Region). Students of junior and senior secondary schools were recruited in 4 previously-selected small towns and 4 villages. The research sample was randomly selected, using 2-phase random sampling. Initially, 1–2 junior and senior secondary schools were selected in each locality, and then 2–3 classes in each of the schools. The inclusion criteria for participation in the study were: 1) students presence at school and 2) agreement to attend given by students and students' parents or legal guardians.

The research involved a Total of 576 persons. 23 students did not agreed to attend in antropometric measurements. Finally, the data uses in the study were collected from 553 persons (243 boys and 310 girls) aged 13–18 years (mean: 15.9±1.45 years) (Tab. 1). 259 came from north-eastern Poland and 294 from central Poland. The students aged 13–14, 15–16 and 17–18 years constituted groups of 113, 187 and 253 people, respectively (Tab. 1).

Socio-economic status assessment. General information was collected using the survey technique in individual interviews. Socio-economic situation (SES) was characterized using 6 determinants which, in total, had 23 categories. Individual categories of SES determinants were assigned numerical values. The higher numerical values (provided in brackets) corresponded to categories with a more favourable socio-economic situation of adolescents and their families:

- place of residence – 3 categories: country (1), town <50,000 inhabitants (2), town 50,000–100,000 inhabitants (3);
- education of father – 3 categories: elementary (1), secondary (2), higher (3);
- education of mother – 3 categories: elementary (1), secondary (2), higher (3);
- self-declared economic situation – 4 categories: bad (1), satisfactorily (2), good (3), very good (4);
- description of household – 6 categories: we live very poorly – we do not have enough resources even for the cheapest food and clothing (1); we live poorly – we do not have enough resources for housing fees (2); we live modestly – we have enough resources only for food and clothing (3); we live very thriftily (4); we live relatively thriftily (5); we live very well – we can afford everything without limitations (6);
- number of children in family – 4 categories: 6–11 children (1); 4–5 children (2); 2–3 children (3); 1 child (4).

Table 1. Sample characteristics

Variables		N	%
Total		553	100
Gender	boys	243	44
	girls	310	56
Region of residence	Suwalski	259	47
	Kujawsko-Pomorski	294	53
Age	13–14 years	113	20
	15–16 years	187	34
	17–18 years	253	46
Place of living	Country	372	67
	town <50,000 inhabitants	124	23
	town 50,000–100,000 inhabitants inhabitants	57	10
Education of father	elementary	254	46
	secondary	254	46
	higher	45	8
Education of mother	elementary	216	39
	secondary	262	47
	higher	75	14
Self-declared economic situation	bad	4	1
	satisfactorily	60	11
	good	349	63
	very good	140	25
Description of household	we live very poorly	1	0
	we live poorly	2	0
	we live modestly	15	3
	we live very thriftily	44	8
	we live relatively thriftily	256	46
	we live very well	235	43
Number of children in family	6–11	22	4
	4–5	110	20
	2–3	363	66
	1	58	10

N – sample size

A weighted SES index (SESI) was determined, calculated as the sum of numerical values assigned to individual categories of SES determinants (minimum 6 points, maximum 23 points). Weighting ensured an equal share of each of the 6 SES determinants. Using a tercile distribution, the following groups of persons were determined:
– low SES (bottom tercile, SESI<14 points);
– average SES (middle tercile, SESI from 14–16 points);
– high SES (upper tercile, SESI>16 points) (Tab. 2).

Table 2. Sample distribution in adolescents by socio-economic status index (SESI)

SESI	Boys + Girls		Boys		Girls	
	N	%	N	%	N	%
Low	166	30	65	27	101	33
Average	196	35	94	39	102	33
High	191	35	84	34	107	34
Total	553	100	243	100	310	100

N – sample size

In a previous study, some indices characterising the socio-economic situation were tested and the better one chosen [14].

Nutritional status assessment. Weight (kg) and height (cm) measurements were taken and body mass index (BMI, kg/m^2) was calculated [15, 16]. Underweight (BMI<18.5kg/m^2), overweight (BMI≥25kg/m^2) and obese (BMI≥30kg/m^2) adolescents were distinguished after BMI calculations according to international criteria developed by Cole et al. [17, 18].

Statistical treatment. Feature distributions were compared using Pearson's chi^2 test. The p value <0.05 was considered to be statistically significant.

Logistic regression analysis was used to assess the effect of socio-economic situation on the incidence of underweight, overweight and obesity in children. The normality of antropometric variables distribution was checked by Shapiro-Wilk test [19]. The distribution of BMI was not compatible with normal distribution, but normality is not required for independent variables in logistic regression [19]. The odds ratio (OR) for the incidence of underweight, overweight and obesity was calculated, without adjusting and after adjusting for gender, age and region of residence (Suwałki Region, Kujawy-Pomeranian Region). A referential group (OR=1.00) consisted of persons with low SESI. Wald's statistics were used to assess the significance of the impact of SESI on the index under analysis. Statistical analysis was performed using Statistica 10.0 PL software by StatSoft.

RESULTS

Table 3 presents the mean values of weight, height and BMI in adolescents by gender and age. There were no differences between girls and boys in the mean values of BMI for each age group.

11% of the adolescents were underweight, 14% were overweight and 3% were obese (Tab. 4, 5). 9% of the boys and 13% of the girls were underweight, while 18% of boys and 11% of girls were overweight, and 3% of boys and 2% of girls were obese.

Table 3. Mean values of weight, height and body mass index (BMI) in adolescents by gender and age

	Gender	Age (years)	N	M	25th#	50th	75th	SD
Weight (kg)	Boys	13–14	47	53.9	44.5	52.3	63.8	12.9
		15–16	95	60.8	52.4	59.2	68.2	12.2
		17–18	101	68.7	61.5	67.5	74.5	11.3
		Total	243	62.7	53.5	62.5	69.5	13.2
	Girls	13–14	66	53.8	46.5	53.0	59.5	9.2
		15–16	92	54.0	48.5	52.4	59.5	8.4
		17–18	152	59.1	51.9	57.5	62.7	11.3
		Total	310	56.4	49.5	54.5	61.5	10.4
Height (cm)	Boys	13–14	47	165.0	158.0	165.0	170.0	8.4
		15–16	95	171.4	168.0	172.0	176.0	8.8
		17–18	101	178.4	175.0	178.0	183.0	6.9
		Total	243	173.1	168.0	174.0	179.0	9.4
	Girls	13–14	66	163.3	160.0	164.0	170.0	6.6
		15–16	92	164.7	160.5	164.0	168.0	5.7
		17–18	152	165.1	162.0	165.0	169.0	5.9
		Total	310	164.6	160.0	165.0	168.5	6.1
BMI (kg/m^2)	Boys	13–14	47	19.6	17.4	19.0	21.6	3.8
		15–16	95	20.6	18.3	19.9	21.7	3.2
		17–18	101	21.6	19.6	21.1	23.7	3.2
		Total	243	20.8	18.5	20.2	22.4	3.4
	Girls	13–14	66	20.1	18.0	19.9	22.0	2.5
		15–16	92	19.9	17.9	19.3	21.6	2.6
		17–18	152	21.6	19.5	21.1	22.9	3.7
		Total	310	20.8	18.6	20.4	22.1	3.3

N – sample size; M – mean; # – Percentiles; SD – standard deviation

There were only a few differences in underweight, overweight and obesity incidence between girls/boys in low, average and high SESI (Tab. 4). More girls were underweight with low SESI than girls with average SESI (14% vs. 5%, respectively; p<0.05). More girls were underweight aged 17–18 years with low SESI than girls aged 17–18 years with average SESI (10% vs. 0%, respectively; p<0.05). Fewer boys aged 13–14 years with low SESI were overweight than boys aged 13–14 years with average SESI or boys aged 13–14 years with high SESI (0% vs. 33% or 27%, respectively; p<0.05). More boys aged 17–18 years with low SESI were obese than boys aged 17–18 years with average SESI or boys aged 17–18 years with high SESI (10% vs. 0% or 0%, respectively; p<0.05).

The odds ratio of underweight incidence for adolescents with average SESI was 0.33 (95%CI: 0.15, 0.73; p<0.01) and with high SESI adolescents it was 1.05 (95%CI: 0.78, 1.42; p>0.05) in comparison to low SESI (Tab. 5). The odds ratio of overweight incidence for adolescents with average SESI was 1.73 (95%CI: 0.93, 3.19; p>0.05) and for high SESI adolescents – 1.14 (95%CI: 0.83, 1.57; p>0.05). The odds ratio of obesity incidence in average SESI adolescents was 0.70 (95%CI: 0.21, 2.34; p>0.05) and for high SESI adolescents – 0.76 (95%CI: 0.40, 1.44; p>0.05). Adjusting for gender, age or region of residence did not significantly change the ORs values or their interpretation.

Table 4. Presence of underweight[1], overweight[2] and obesity[3] in adolescents by gender, age and socio-economic status

	Gender	Age (years)	SESI							
			Total		Low		Average		High	
			N	%	N	%	N	%	N	%
Underweight	Boys	13–14	47	15	4	27	2	10	1	9
		15–16	95	7	3	10	1	3	3	10
		17–18	101	9	2	10	2	5	5	12
		Total	243	9	9	14	5	5	9	11
	Girls	13–14	66	6	1	4	1	5	2	11
		15–16	92	20	8	30	4	11	6	21
		17–18	152	11	5	10[e]	0	0[e,f]	12	20[f]
		Total	310	13	14	14[h]	5	5[h,i]	20	19[i]
Overweight	Boys	13–14	47	21	0	0[a,b]	7	33[a]	3	27[b]
		15–16	95	15	4	13	4	12	6	19
		17–18	101	20	4	20	7	18	9	21
		Total	243	18	8	12	18	19	18	21
	Girls	13–14	66	14	2	8	6	27	1	6
		15–16	92	4	2	7	0	0	2	7
		17–18	152	14	6	13	10	23[g]	5	8[g]
		Total	310	11	10	10	16	16	8	7
Obesity	Boys	13–14	47	4	0	0	2	10	0	0
		15–16	95	4	1	3	1	3	2	6
		17–18	101	2	2	10[c,d]	0	0[c]	0	0[d]
		Total	243	3	3	5	3	3	2	2
	Girls	13–14	66	0	0	0	0	0	0	0
		15–16	92	1	0	0	0	0	1	3
		17–18	152	4	3	6	2	5	1	2
		Total	310	2	3	3	2	2	2	2

[1]BMI<18.5 kg/m^2; [2]BMI≥25 kg/m^2; [3]BMI≥30 kg/m^2 after BMI conversion using international cut-off by Cole et al. [17, 18].
SESI – socio-economic status index.
N – sample size.
[a-a, b-b,…,i-i] – significance of differences at p<0.05 by Pearson's chi^2 test.

Table 5. Odds ratio (OR) for underweight[1], overweight[2] and obesity[3] in adolescents by socio-economic status

		Total	SESI		
			Low	Average	High
Sample size		553	166	196	191
Underweight	Number of cases	62	23	10	29
	Percentage of cases (%)	11	14	5	15
	OR (95% CI)		1.00	0.33 (0.15; 0.73)**	1.05 (0.78; 1.42)
	Gender-adjusted OR (95% CI)		1.00	0.33 (0.15; 0.73)*	1.06 (0.79; 1.43)
	Age-adjusted OR (95% CI)		1.00	0.34 (0.15; 0.73)**	1.05 (0.78; 1.42)
	Region of residence-adjusted OR (95% CI)		1.00	0.34 (0.16; 0.74)**	1.00 (0.74; 1.37)
Overweight	Number of cases	78	18	34	26
	Percentage of cases (%)	14	11	17	14
	OR (95% CI)		1.00	1.73 (0.93; 3.19)	1.14 (0.83; 1.57)
	Gender-adjusted OR (95% CI)		1.00	1.69 (0.91; 3.14)	1.12 (0.81; 1.55)
	Age-adjusted OR (95% CI)		1.00	1.72 (0.93; 3.19)	1.12 (0.81; 1.55)
	Region of residence-adjusted OR (95% CI)		1.00	1.74 (0.94; 3.22)	1.15 (0.83; 1.59)
Obesity	Number of cases	15	6	5	4
	Percentage of cases (%)	3	4	3	2
	OR (95% CI)		1.00	0.70 (0.21; 2.34)	0.76 (0.40; 1.44)
	Gender-adjusted OR (95% CI)		1.00	0.67 (0.20; 2.25)	0.75 (0.39; 1.43)
	Age-adjusted OR (95% CI)		1.00	0.69 (0.21; 2.33)	0.73 (0.38; 1.39)
	Region of residence-adjusted OR (95% CI)		1.00	0.70 (0.21; 2.36)	0.76 (0.40; 1.46)

[1]BMI<18.5 kg/m^2; [2]BMI≥25 kg/m^2; [3]BMI≥30 kg/m^2 after BMI conversion using international cut-off by Cole et al. [17, 18].
CI – confidence interval.
significance of differences by Wald's statistics: * – p<0.05; ** – p<0.01.
SESI – socio-economic status index.
Note: Odds ratios (95% CI) were estimated by logistic regression analysis. The adjusted underweight, overweight and obesity included gender, age and region of residence.

DISCUSSION

In adolescents located in less-urbanized regions of Poland, a significant impact of the socio-economic situation on the incidence of underweight was determined, along with a slight effect on the incidence of overweight and obesity.

The obtained results show the favourable effect of a better situation of the family environment on the lower incidence of underweight. Generally, the risk of underweight was 3-fold lower (odds ratio: 0.33) in adolescents with an average socio-economic status, compared with adolescents with low socio-economic status. This observation corresponds to the reports of other authors who carried out research among children and youth living, e.g. in Warsaw, the Podkarpacie and Podbeskidzie Regions and in the Kielce Region [20–22]. They demonstrated that a higher level of education of parents, a low number of children in the family, and upbringing in the family with both parents, favoured proper body weight in adolescents. Adolescents from families of higher socio-economic status had a higher level of knowledge concerning health, which was conductive to pro-healthy habits and, consequently, better health condition [5].

The presented research did not reveal any differences in the incidence of underweight in adolescents with high and low socio-economic situations. This is a surprising result because of the higher environmental differentiation between adolescents from families of low and high socio-economic status than between the youth of low and average socio-economic status. For this reason, higher differences in the incidence of underweight could be expected between groups of adolescents with extremely different socio-economic situations. The explanation should be sought for in other factors, related, for example, to aspects of school environment and/or psychological conditions, which could modify the effect of socio-economic factors. It can be claimed that the incidence of underweight in adolescents with high socio-economic status has been influenced by the opposite effects of many other factors. The favourable impact of a good socio-economic situation for girls could be modified by the fashion to have a slim figure, and in boys the trend to maintain an

athletic body build [3]. It has been proved that privileged classes are subject to higher social pressure than persons of low socio-economic status [4, 5].

In adolescents from less-urbanized regions of Poland, no significant impact was found of the socio-economic situation on incidence of underweight, overweight and obesity was found. However, the presented results suggest the existence of a certain tendency. In adolescents with a better socio-economic situation, the odds ratios for the incidence of overweight were higher (between 1.12–1.74), and the odds ratios for the incidence of obesity were lower (between 0.67–0.76) than in adolescents with low status. It could be assumed that a better socio-economic situation was conductive to overweight, but only to a moderate extent. Since the odds ratios quoted were not significant, these suggestions need to be confirmed by examinations of body composition and biochemical markers of nutritional status.

Generally, many studies have found a favourable effect of better socio-economic situation and a lower risk of overweight and obesity in persons with high socio-economic status [5, 23]. Such conclusions are drawn from research conducted among persons from a broad social cross-section. The current research suggests a tendency of frequent incidence of overweight in youth with a better socio-economic situation. However, this observation concerns adolescents from less-urbanized regions of Poland, i.e. living in potentially worse environmental conditions, with lower social diversification. For this reason, some relationships between the socio-economic status and the incidence of overweight and obesity may differ from those described in the literature.

Underweight, overweight and obesity in children and youth are a serious global problem and a threat to public health. According to research carried out in 2005 by Haslama and James [24], about 10% of the world population under 18, and about 30% of American children and adolescents are overweight or obese [25]. About 20% of children have excessive body weight, in which about 5% are obese [26]. Polish national research conducted within the HFCAS (Household Food Consumption and Anthropometric Survey) programme revealed underweight in 8% of boys and 10% of girls under 18, overweight in 16% of boys and 11% of girls and obesity in 4% of boys and 3.5% of girls [27]. In own research, underweight was found in 9% of boys and 13% of girls, overweight in 18% of boys and 11% of girls and obesity in 3% of boys and 2% of girls. These results correspond to the above-quoted national data. They indicate a similar incidence of underweight, overweight and obesity in adolescents from less-urbanized regions of Poland, compared to the national Polish data.

Study strengths. The research was carried out on a randomly-selected sample, which increases the strength of conclusions and makes it possible to generalize the results. The high compatibility of results, independent of the adjustment method, is the strength of this study. This proves the strong relation between the incidence of underweight and the socio-economic status. This relation did not depend on the impact of confounders, such as gender, age or region of residence.

Study limitations. The research was conducted among adolescents from small-town and rural environments. Such an approach resulted from the research assumption of the project and focus on the environment which potentially creates worse conditions for the development of adolescents. Unquestionably, the lack of youth originating from an urban environment restricted diversification of the socio-economic situation of the examined sample. On the other hand, the structure of the research made it possible to analyse the diversity inside the communities inhabiting small towns and villages in less-urbanized regions of Poland.

CONCLUSIONS

The incidence of underweight in adolescents from less-urbanized regions of Poland depended on the socio-economic status. Adolescents with average socio-economic status were 3 times less-threatened with the incidence of underweight than adolescents of a lower status. The presented results demonstrate the environmental diversification within communities of small towns and villages in less-urbanized regions, and the potential risk of malnutrition in adolescents living in worse conditions.

The incidence of overweight and obesity in adolescents from less urbanized regions of Poland requires further studies. The relationship between socio-economic status and the incidence of overweight and obesity was insignificant. However, the results suggest a tendency towards the frequent incidence of overweight in youth with better socio-economic situations. Nevertheless, this observation concerns adolescents living in potentially worse environmental conditions and with lower social diversification.

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