

## Trends of underweight and obesity prevalence among adolescent girls in the selected population of the Silesian Agglomeration

Rozpowszechnienie niedowagi i otyłości u nastolatek w wybranej populacji aglomeracji śląskiej

<sup>1</sup>Wojciech Pałasz, <sup>2</sup>Karolina Ziara-Jakutowicz, <sup>3</sup>Joanna Oświęćimska, <sup>4</sup>Piotr Gorczyca,  
<sup>3</sup>Katarzyna Ziara

<sup>1</sup>Mediana, General Practitioner Office, Ruda Śląska <sup>2</sup>Department of Genetics, Institute of Psychiatry and Neurology, Warsaw <sup>3</sup>Department of Pediatrics, School of Medicine with Division of Dentistry in Zabrze, Medical University of Silesia, Katowice <sup>4</sup>Department of Psychiatry, School of Medicine with Division of Dentistry in Zabrze, Medical University of Silesia, Katowice

<sup>1</sup>Mediana, Praktyka Lekarza Rodzinnego, Ruda Śląska <sup>2</sup>Zakład Genetyki, Instytut Psychiatrii i Neurologii, Warszawa <sup>3</sup>Katedra i Klinika Pediatrii, Wydział Lekarski z Oddziałem Lekarsko-Dentystycznym w Zabrzu, Śląski Uniwersytet Medyczny, Katowice <sup>4</sup>Katedra i Oddział Kliniczny Psychiatrii, Wydział Lekarski z Oddziałem Lekarsko-Dentystycznym w Zabrzu, Śląski Uniwersytet Medyczny, Katowice

### Abstract

**Introduction.** Poland lacks epidemiological studies assessing the incidence of eating disorders (ED) in the population of children and teenagers, and reports on eating habits as well as knowledge of teenagers with ED are scarce. A study on a very big cohort of girls from a big city in the Silesian agglomeration was planned in order to assess the incidence of underweight and obesity as predictive factors of ED. **Objective of the study.** 1. Determination of the state of nutrition in the examined population of 18-year-old girls. 2. Retrospective determination of the state of nutrition of the same girls when they were 14 years old. 3. The answer to the question whether the examined group exhibits the tendency to consolidate abnormalities in terms of the body weight over time. **Material and methods.** 1047 female students of secondary schools, aged 18, were subjected to anthropometric measurements (body weight, height, BMI, BMI-SDS) and took part in a survey questionnaire devoted to their eating habits. The measurement results of the same girls aged 14 were obtained retrospectively. **Results.** When the subjects were 14 years old, 79.7% of them had a normal body weight, 14.9% were obese, and 5.4% were underweight. At the age of 18, 76.6% of the subjects had a normal body weight, 17.2% were obese, and 6.2% were underweight. 4.7% of the girls with a normal weight aged 14 reduced their body weight, and 9.2% became obese at 18 the age of 18. None of the underweight subjects demonstrated obesity at the age of 18, and 45.6% maintained their body weight below the normal limits. 66% of the girls who were obese at the age of 14 maintained their obesity at the age of 18. **Conclusions.** 1. Most girls in the examined population at 14 and 18 years of age demonstrate a normal nutrition state. Obesity was observed in 15% of the examined females at the age of 14 and in 17% at the age of 18, whereas 5% of girls aged 14 and 6% of girls aged 18 are underweight. 2. From early to late adolescence a tendency to persistent abnormalities of the nutritional status is observed in girls. 3. Obesity in girls aged 14 is a predictor for obesity at the age of 18 and perhaps in the adult life.

### Key words

state of nutrition, obesity, eating habits, girls

### Streszczenie

**Wstęp.** W Polsce brakuje badań epidemiologicznych oceniających zapadalność na zaburzenia odżywiania (ED) w populacji dzieci i młodzieży, a doniesienia na temat zachowań żywieniowych i wiedzy nastolatków na temat ED są nieliczne. Zaplanowano badania szerokiej kohorty dziewcząt dużego miasta aglomeracji śląskiej celem oceny częstości występowania niedowagi i otyłości jako czynników predykcyjnych ED. **Cel pracy.** 1. Określenie stanu odżywienia badanej populacji dziewcząt w 18 roku życia. 2. Retrospektywne określenie stanu odżywienia tych samych dziewcząt w 14 roku życia. 3. Odpowiedź na pytanie, czy wśród badanej grupy dziewcząt istnieje z upływem lat skłonność do utrwalania się nieprawidłowości w zakresie masy ciała. **Materiał**

**i metody.** U 1047 uczennic szkół ponadpodstawowych w wieku 18 lat dokonano pomiarów antropometrycznych (masa ciała, wzrost, BMI, BMI-SDS) i przeprowadzono ankietę dotyczącą ich nawyków żywieniowych. Uzyskano retrospektywnie wyniki pomiarów tych samych dziewcząt w wieku 14 lat. **Wyniki.** W 14 roku życia 79,7% badanych miało prawidłową masę ciała, 14,9% otyłość, 5,4% niedowagę. W wieku 18 lat prawidłową masę ciała wykazywało 76,6% badanych, otyłość 17,2%, a niedowagę 6,2%. 4,7% dziewcząt z prawidłową masą ciała w wieku 14 lat obniżyło masę ciała, a 9,2% osiągnęło otyłość w 18 r.ż. U żadnej badanej z niedowagą nie obserwowano otyłości w 18 r.ż., a 45,6% utrzymało masę ciała poniżej normy. 66% dziewcząt otyłych w wieku 14 lat utrzymało nadal otyłość w 18 r.ż. **Wnioski:** 1. Większość dziewcząt badanej populacji w 14 i 18 r.ż. prezentuje prawidłowy stan odżywienia. Otyłość sięga 15% w 14 r.ż. i 17% w 18 r.ż., zaś niedobór masy ciała dotyczy 5% dziewcząt w 14 r.ż. i 6% w 18 r.ż. 2. Od wczesnej do późnej adolescencji obserwuje się u dziewcząt skłonność do utrzymywania się nieprawidłowości w zakresie stanu odżywienia. 3. Otyłość u dziewcząt w 14 r.ż. stanowi czynnik ryzyka otyłości w 18 r.ż. i być może w wieku dorosłym.

### Słowa kluczowe

stan odżywienia, otyłość, nawyki żywieniowe, dziewczęta

## Introduction

Political and economic transformations, as well as the processes of globalisation, bringing Poland closer to the western culture, have caused an increase in the incidence of eating disorders (ED) amongst Polish children and teenagers. These are not only specific eating disorders, such as *anorexia nervosa* (AN) or *bulimia nervosa*, but also not otherwise specified eating disorders, such as the binge eating disorder, the avoidant / restrictive food intake disorder, the night eating syndrome [1]. Also, increasing frequency of obsessive-compulsive disorders relating to eating 'healthy food' and avoiding 'unhealthy food' (*orthorexia*) is observed among young people [2].

Furthermore, epidemiological data indicate a growing incidence of overweight and obesity among children and teenagers. It is estimated that this problem concerns already ca. 30% of girls aged between 6 and 10 in Europe [3].

## Objectives of the study

Poland lacks broad epidemiological studies assessing the incidence of ED in the population of children and teenagers, and reports on eating habits in school students, or on the teenagers knowledge of ED are scarce [4]. Results of these studies point to a low level of awareness of children and their parents of the factors that lead to ED and the threats they entail. Therefore, the aim of this study was to determine cases of underweight and obesity as predictive factors of eating disorders, and to assess the incidence of these abnormalities in a numerous group of school-age students from a large city.

Since eating disorders affect girls more often than boys, this study was limited only to a group of girls, comprising almost all secondary school girls in a selected city of the Silesian agglomeration. We assumed that this study would cover issues which had been discussed very rarely among teenagers in Poland, such as eating habits, sources of their knowledge on eating disorders, their knowledge of methods of losing weight and applying reducing diets, as well as the assessment of demographic factors and social conditions which may influence these disorders. It was assumed that the trial would consist in obtaining a detailed medical history of the

subjects, supported with a survey devoted to eating habits and a physical examination, taking into account symptoms which might indicate eating disorders and determining the actual state of nutrition of the respondents.

Such broad studies had not been conducted in Poland before.

Objective of the study: 1. Determination of the state of nutrition in the examined population of girls aged 18. 2. Retrospective determination of the state of nutrition in the same girls at the age of 14. 3. Answer to the question whether there is a tendency to consolidate the body weight abnormalities in the examined group of girls over time.

## Material and methods

The study covered 18-year-old girls – students of all secondary schools in Ruda Śląska, i.e. 1047 girls, born in 1986/87. The study protocol was approved by the Bioethics Committee of the Silesian Medical Chamber (Resolution No. 11/2006) and the consent of the school principals was also obtained.

Inclusion criteria were: female gender, age, and consent to take part in a research project. The study did not cover exclusively those students who did not agree to it, or students who were absent from school on the specific date of the examinations.

The study procedure accompanied the standard examinations of the health condition of students completing the secondary school and they took place in offices of school nurses.

Each girl was subjected to a physical examination, comprising the assessment of the state of nutrition, i.e. the assessment of the excess / deficiency of adipose tissue, state of the skin, hair, body hair, teeth, presence of muscular atrophy, pulse, and blood pressure. The BMI value was determined and the value of BMI-SDS was calculated according to Polish populational normal ranges. Depending on the obtained result of the BMI-SDS value, the examined girls were divided into groups of girls with a normal body weight, girls with the body weight below the normal limits (BMI-SDS < -2), and obese girls (BMI-SDS > +2). Additionally, an anonymous

survey was conducted. For the purposes of this research project we developed our own survey questionnaire containing questions about the girls' educational ambitions, the level of education of the girls' parents, and realtions in their families. During the physical examination of 18-year-old girls, data on the body weight and height of the same girls at the age of 14 were obtained retrospectively on the basis of their periodical medical examination charts. Their BMI and BMI-SD values at the age of 14 were calculated.

**Statistical analysis**

The database was prepared in the Microsoft Excel spreadsheet. The Statistica software, v. 4.3 En was used for statistical calculations. The assumed level of significance in the statistical calculations was  $\alpha = 0,05$ . The following values were determined as parameters of the descriptive statistics: arithmetic mean, median, minimum and maximum value, standard deviation (SD), lower and upper quartile, standard error (SE), and 95% confidence interval around the mean value, skewness, and curtosis. The mean value was presented in the formula:  $W_{\bar{x}} = \bar{X} \mp 1,98 \times SE$ , where SE – standard error,  $\bar{X}$  – mean value from the sample.

The value of the standard error was applied because it determines the accuracy of the assessment of the mean value in the population. In a situation where the distributions of variables differ significantly from the normal distribution, we cannot make use of the standard deviation. For all the parameters, the consistency of their distributions with the normal distribution was verified. The consistency assessment was made using the Shapiro-Wilk test and histograms of the variables with the Gaussian bell curve marked on them. For the qualitative variables, contingency tables were calculated and an analysis of multiway contingency tables was carried out. Collective cross tables, tables of expected values, as well as differences of the observed and expected values were calculated. On the basis of the tables, descriptive statistics were calculated: Pearson's chi-square and the significance level p, Tau-b Kendal correlation coefficient, Spearman's R. The results were rendered graphically by means of interaction

diagrams and categorised histograms. The presence of correlation between the examined features was verified by means of assessing Spearman's rank correlation coefficient.

**Results**

Table I presents data relating to individual auxological parameters examined, i.e. height, body weight, calculated values of BMI and BMI-SDS in the entire studied group of girls aged 18 as of the time of the study, and obtained retrospectively from periodical medical examinations carried out on the same girls at the age of 14.

Most examined girls (550, 52.5%) went to the general secondary schools; the second largest group consisted of girls who went to technical secondary schools (383; 36.6%), and the least numerous group consisted of girls who went to vocational schools (114; 10.9% of all subjects). The analysis of the subjects in terms of their body weight and the profile of their school did not demonstrate any statistically significant correlations. A similar distribution of the body weight values was observed in individual groups. No correlation between the body weight and the chosen school profile was observed. Ca. 3/4 of all the subjects, the girls who went to general secondary schools, technical secondary schools, and vocational schools, had a normal body weight.

**General distribution of body weight in the examined girls**

At the age of 14, 834 (79.66%) girls had a normal body weight; in 57 (5.44%), girls body weight was below the normal limits and 156 (14.9%) of girls were obese. At the age of 18, 802 (76.6%) girls had a normal body weight; 65 (6.21%), girls were underweight, and 180 (17.19%) girls were obese (Tab. II).

**Characteristics of individual groups and the variability of body weight**

Auxological parameters of the subjects divided into individual groups are provided in Tables III-V.

**Table I.** Auxological parameters on all examined girls aged 14 and 18 years  
**Tabela II.** Parametry auksologiczne wszystkich badanych dziewcząt w wieku 14 i 18 lat

Examined auxological parameters	Girls examined at the age of 14 n = 1047 mean age: 14 years ± 0.23 (13.5-14.5 years)		Girls examined at 18 years of age n = 1047 mean age: 18 years ± 0.25 (17.5-18.5 years)	
	mean ± SEM	range	mean ± SEM	range
Height (cm)	157.56 ± 0.24	132–179	164.3 ± 0.18	145–185
Weight (kg)	48.44 ± 0.33	23.0–95.0	57.72 ± 0.32	34.0–122.0
BMI (kg/m <sup>2</sup> )	19.34 ± 0.1	12.4–34.4	21.32 ± 0.11	14.6–43.7
BMI-SDS	0.28 ± 0.05	-3.4–8.2	0.44 ± 0.06	-3.6–14.0

**Table II.** Number and percentage of examined girls aged 14 and 18 years according to their body weight  
**Tabela II.** Liczebność i odsetek badanych dziewcząt w zależności od masy ciała w wieku 14 i 18 lat

Girls at the age of 14 number (percent) n= 1047			Girls at 18 years of age number (percent) n= 1047		
group 1 normal weight	group 2 underweight	group 3 obesity	group 1 normal weight	group 2 underweight	group 3 obesity
<b>834</b> (79.66%)	<b>57</b> (5.44%)	<b>156</b> (14.9%)	<b>802</b> (76.6%)	<b>65</b> (6.21%)	<b>180</b> (17.19%)

**Table III.** Characteristics of girls who were normal weight at 14 years of age. Auxological parameters of these girls at the age of 14 and 18 years

**Tabela III.** Charakterystyka dziewcząt, u których w wieku 14 lat stwierdzono prawidłową masę ciała (grupa 1). Parametry auxologiczne tych dziewcząt w wieku 14 i 18 lat

**GROUP 1 (normal weight)**

Examined auxological parameters	Girls examined at the age of 14 n = 834		Girls examined at 18 years of age n = 802	
	mean ± 1.96xSEM	range	mean ± 1.96xSEM	range
<b>Height (cm)</b>	<b>157.61 ± 0.26</b>	132–179	<b>164.33 ± 0.21</b>	145–185
<b>Weight (kg)</b>	<b>46.51 ± 0.26</b>	29.0–79.0	<b>55.90 ± 0.26</b>	34.0–90.0
<b>BMI (kg/m<sup>2</sup>)</b>	<b>18.60 ± 0.07</b>	14.9–22.6	<b>20.66 ± 0.08</b>	15.0–29.7
<b>BMI-SDS</b>	<b>- 0.11 ± 0.04</b>	- 2.0–2.0	<b>0.04 ± 0.05</b>	-3.4–5.5

**Table IV.** Characteristics of girls who were underweight at the age of 14 (group 2). Auxological parameters of these girls at the age of 14 and 18 years

**Tabela IV.** Charakterystyka dziewcząt, u których w wieku 14 lat stwierdzono obniżoną masę ciała (grupa 2). Parametry auxologiczne tych dziewcząt w wieku 14 i 18 lat

**GROUP 2 (underweight)**

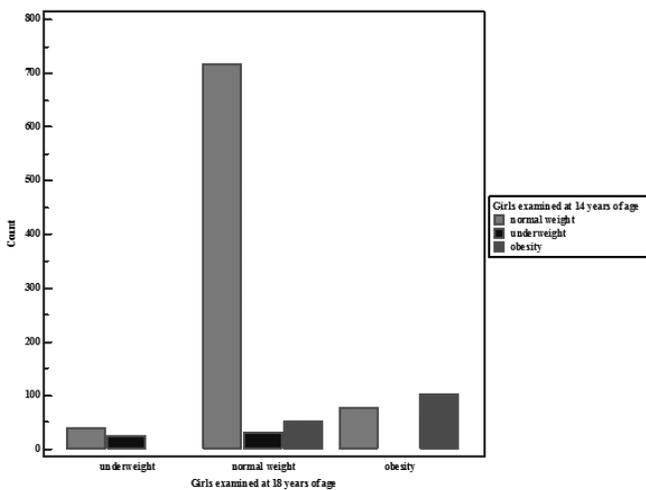
Examined auxological parameters	Girls examined at the age of 14 n = 57		Girls examined at 18 years of age n = 65	
	mean ± 1.96xSEM	range	mean ± 1.96xSEM	range
<b>Height (cm)</b>	<b>149.46 ± 1.23</b>	133–167	<b>163.54 ± 0.76</b>	148–173
<b>Weight (kg)</b>	<b>31.54 ± 0.62</b>	23.0–40.0	<b>48.32 ± 0.95</b>	36.0–70.0
<b>BMI (kg/m<sup>2</sup>)</b>	<b>14.04 ± 0.08</b>	12.4–14.8	<b>17.76 ± 0.26</b>	14.6–23.9
<b>BMI-SDS</b>	<b>- 2.51 ± 0.04</b>	- 3.4–2.1	<b>-1.72 ± 0.16</b>	-3.6–2.0

**Table V.** Characteristics of girls who were obese at the age of 14 (group 2). Auxological parameters of these girls at the age of 14 and 18 years

**Tabela V.** Charakterystyka dziewcząt, u których w wieku 14 lat stwierdzono otyłość (grupa 3). Parametry auksologiczne tych dziewcząt w wieku 14 i 18 lat

**GROUP 3 (obesity)**

Examined auxological parameters	Girls examined at 14 years of age n = 156		Girls examined at 18 years of age n = 180	
	mean ± 1.96xSEM	range	mean ± 1.96xSEM	range
Height (cm)	160.29 ± 0.54	139–177	164.42 ± 0.43	145–180
Weight (kg)	65.06 ± 0.65	45.0–95.0	70.94 ± 1.04	46–122.0
BMI (kg/m <sup>2</sup> )	25.22 ± 0.19	22.7–34.4	26.16 ± 0.35	19.1–43.7
BMI-SDS	3.38 ± 0.10	2.1–8.2	3.37 ± 0.21	-0.9–14.0



**Fig. 1.** Number and percentage of girls in specific groups according to changes of body weight observed at the age of 14 and 18 years of age

**Ryc. 1.** Liczebności odsetek dziewcząt w obrębie poszczególnych grup w zależności od zmian masy ciała obserwowanych w wieku 14 i 18 lat

In the group of girls aged 14 with a normal body weight (group 1) 718 girls (86.1%) did not change their body weight, 39 girls (4.7%) reduced their body weight below the normal limits, whereas 77 girls (9.2%) became obese at the age of 18 (Fig. 1).

Among 156 girls with obesity at the age of 14 (group 3), the reduction of their body weight to the normal values was observed in 53 girls (34%), whereas in 103 girls (66%) obesity was still observed. No girl in this group demonstrated a body weight reduction below the normal limits (Fig. 1).

**Eating habits**

The survey respondents answered questions about their eating habits, such as: the feeling of overeating, the fear of weight gain, binge eating episodes, vomiting after overeating, and attempts to lose weight, undertaken currently or in the past.

The most frequently recorded answer was the fear of weight gain – declared by 45.6% of the respondents. Most often the fear of weight gain was declared by girls with a normal body weight (70.9%) (Fig. 2 a). 42.5% respondents admitted to binge eating episodes (Fig.2 b). Those were most often girls with a normal body weight (77.9%), who also most frequently reported vomiting after such episodes (69.2) (Fig. 2 c).

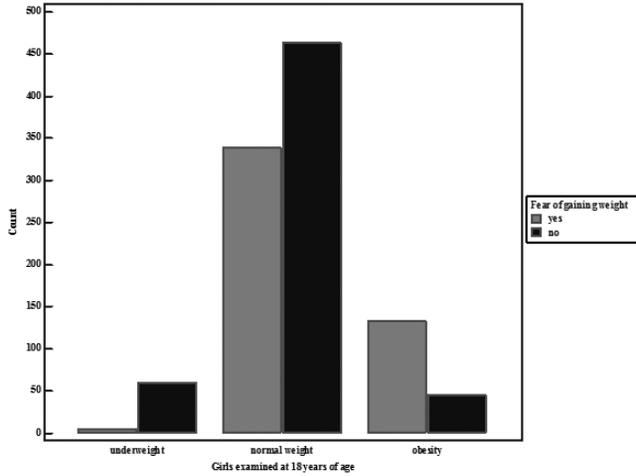
The feeling of overeating was reported by 26.7% of all the respondents, also most often by girls with a normal body weight and obese girls (76.3% vs 20.1% of respondents) (Fig. 2 d).

The analysis of the numbers of the girls who provided a positive answer to questions relating to abnormal eating habits in individual groups, allowed us to conclude as follows:

1. In the underweight group the feeling of overeating is declared by 15% of the respondents (10 girls), and 7% (5 girls) are afraid of weight gain. 40% (26 subjects) within this group admit to binge eating episodes, but none of them admits to provoke vomiting.

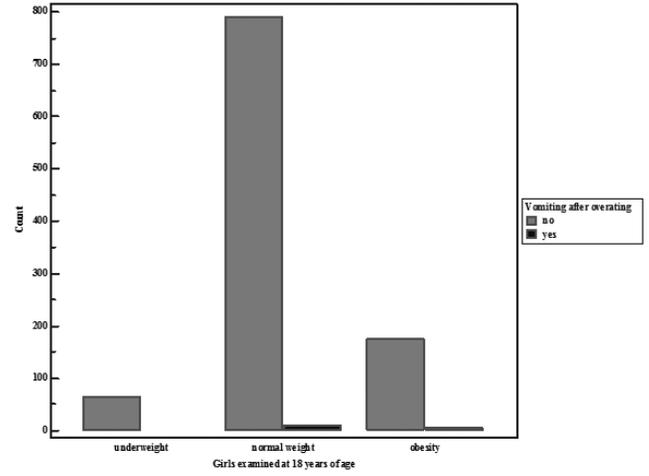
2. In the group of obese girls the fear of weight gain is the most common, as it is declared by 74% (134 subjects). Binge eating episodes are declared by 40% of girls in this group (72 subjects), and the feeling of overeating – by 31% (56 subjects). Only four respondents with obesity admitted to provoke vomiting after binge eating episodes.

3. In the group of girls with a normal body weight, most girls experienced binge eating disorders (346 subjects, 43%), and 42% (339 subjects) reported the fear of weight gain, whereas 213 girls (23%) experienced the feeling of overeating. 9 (3%) girls from this group admitted to provoke vomiting after binge eating (Fig. 2 a-d).



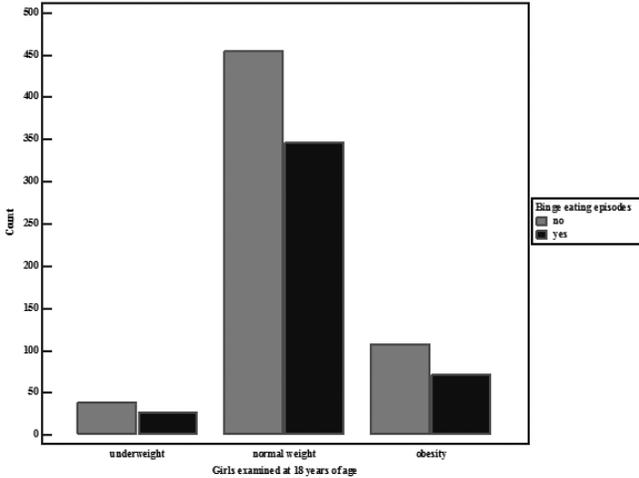
**Fig. 2 (a).** Number and percentage of the girls examined at the age of 18 years of age of according to eating behaviors (fear of gaining weight)

**Ryc. 2 (a).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od zachowań żywieniowych (obawa przed przytciem)



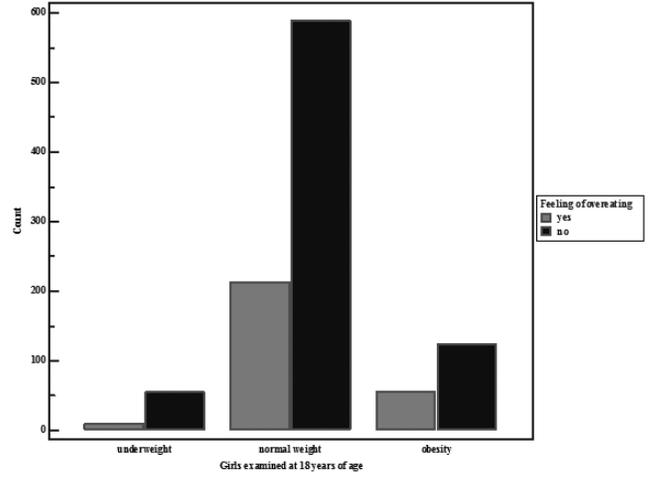
**Fig. 2 (c).** Number and percentage of the girls examined at the age of 18 years of age of according to eating behaviors (vomiting after overeating)

**Ryc. 2 (c).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od zachowań żywieniowych (wymioty po objadaniu się)



**Fig. 2 (b).** Number and percentage of the girls examined at the age of 18 years of age of according to eating behaviors (binge eating episodes)

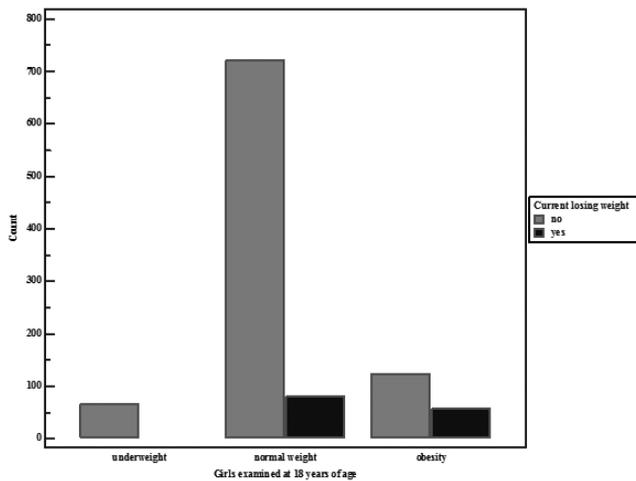
**Ryc. 2 (b).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od zachowań żywieniowych (napady objadania się)



**Fig. 2 (d).** Number and percentage of the girls examined at the age of 18 years age of according to eating behaviors (feeling of overeating)

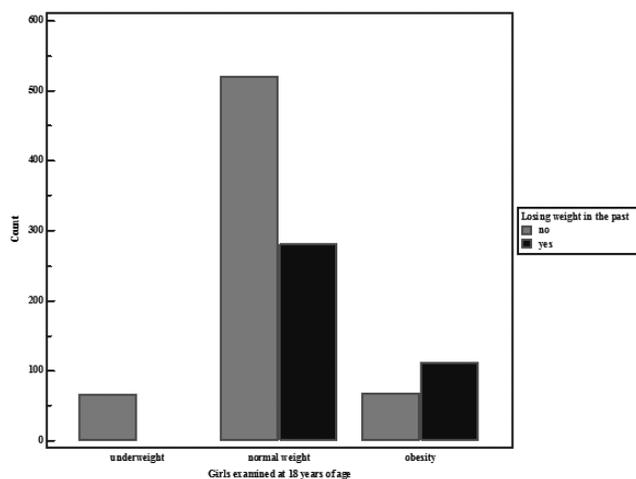
**Ryc. 2 (d).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od zachowań żywieniowych (poczucie przejadania się)

37.6% respondents admitted to undertaking attempts to lose weight in the past, and 13.1% admitted to dieting at the moment. The biggest share of girls reporting attempts to lose weight in the past or at the moment comprised girls with a normal body weight (71.5% and 58.4%, respectively) (Fig. 3 a,b).



**Fig. 3 (a).** Number and percentage of the girls examined at the age of 18 years of age of according whether the activities to loss of weight are undertaken currently or have been undertaken in the past (losing weight currently)

**Ryc. 3 (a).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od odchudzania (odchudzanie się aktualnie)



**Fig. 3 (b).** Number and percentage of the girls examined at the age of 18 years age of according to losing weight (losing weight in the past)

**Ryc. 3 (b).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od odchudzania (odchudzanie się w przeszłości)

None of the underweight girls had undertaken any attempts to lose weight in the past as well as at the time of the study. In the group of obese girls, 62% of the respondents (112 girls) admitted to undertaking attempts to lose weight in the past, and 31% (57 girls) to such attempts undertaken at the time of the study (Fig. 3 a,b).

### Sources of knowledge of maintaining body weight, diet, losing weight

Most often the respondents looked for information on maintaining body weight, dieting, and ways to lose weight on the Internet (40.4% of the respondents), followed by the magazines for teenagers (35.2%), and friends (26.6%). Television shows were the least frequent source of knowledge in this respect – only 9.6% of the respondents used them for this purpose. This type of knowledge was most often searched for by girls with a normal body weight.

Only 1.3% of underweight girls looked for information on maintaining body weight in the sources listed above, including, comparably often, teenage magazines, friends, and the Internet, and, least frequently, the television.

The group of obese girls as well as of the girls with a normal body weight obtained their knowledge of dieting and methods of losing weight on the Internet (85 subjects (47%) and 323 subjects (40%) respectively), followed by magazines (69 subjects (38%) and 282 subjects (35%), respectively), further on from friends (57 subjects (32%), and 205 subjects (25%), respectively), and, least frequently, from TV commercials (18 subjects (10%) and 80 subjects (10%), respectively).

### Anti-obesogenic behaviour

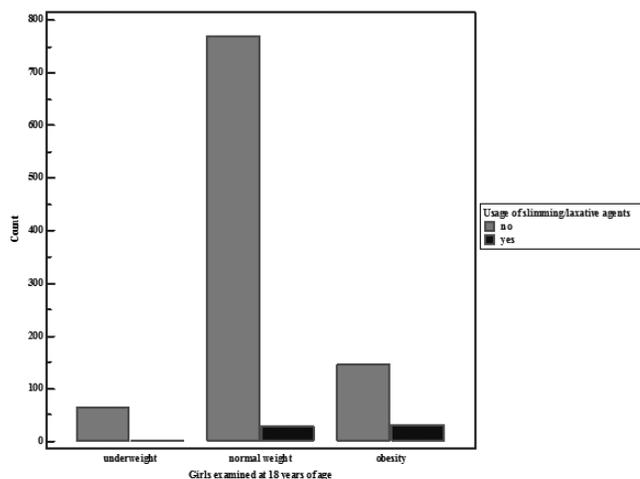
Most frequently girls with a normal body weight (77.9%), and, next, obese girls (19.9%) admitted to take physical exercise in order to maintain a normal body weight. Slimming agents and laxatives were used most commonly by obese girls (51.6%), and, next, by girls with a normal body weight (46.77%) (Fig. 4 a).

In the group of underweight girls, 11 (17%) of them admitted to exercise gymnastics in order to maintain a low body weight, and only one from 65 respondents reported that she had used slimming agents to reach this goal (Fig. 4 b).

Physical activity in order to reduce or maintain body weight is used by over a half of the obese respondents (101 girls, 56.4%), and 18% (32 subjects) reported that they use slimming agents or laxatives for this purpose (Fig. 4 a).

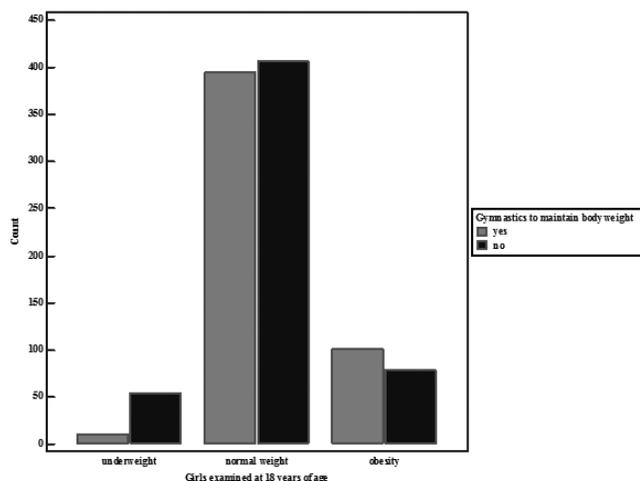
On the other hand, in the group of girls with a normal body weight, half of them (395 subjects, 49.3%) use physical exercise in order to maintain their body weight, and slimming agents are used by 3.6% of them (29 girls) (Fig. 4 a,b).

Only 62 girls (5.95%) provided answers to an open question concerning slimming agents used by the respondents. It demonstrated the fact that such questions are not particularly useful in a survey, unlike closed multiple-choice questions. The persons who did provide answers (the results are not tabulated) most often pointed exclusively to



**Fig. 4 (a).** Number and percentage of the girls examined at the age of 18 years of age according to activities undertaken to lose weight (usage of slimming/laxative agents)

**Ryc. 4 (a).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od podejmowanych aktywności w celu zmniejszenia masy ciała (stosowanie środków odchudzających/przeczyszczających)



**Fig. 4 (b).** Number and percentage of the girls examined at the age of 18 years of age according to activities undertaken to lose weight (gymnastics to maintain body weight)

**Ryc. 4 (b).** Liczebność i odsetek dziewcząt badanych w wieku 18 lat w zależności od podejmowanych aktywności w celu zmniejszenia masy ciała (gimnastykowanie się celem zmniejszenia masy ciała)

reducing diet. Some respondents, however, demonstrated their detailed knowledge of slimming agents they used (e.g. Applefit, Lacarnita, Bio-slim, Adipex). The more interesting answers to the question concerning the best method leading to losing weight, besides the most frequent ones – dieting and physical exercise – included strong will, self-control, and the use of a slimming agent called Adipex.

#### Educational ambitions and talents

Girls with a normal body weight reported talents in humanities (525 girls) twice as often than in sciences (259 girls). In the other groups the respondents more frequently claimed to be talented in humanities than in sciences, too. The willingness to continue their education at universities was declared by the majority of the respondents in each group.

#### Parents' education

Most mothers had vocational education (47.4%) or secondary education (35.3%), followed by higher education (9.1%), and primary education (8.1%). Mothers of girls from all the examined groups (underweight, obese, and with a normal body weight) most often had vocational, secondary, higher and/or primary education, respectively.

Mothers with secondary education most often had underweight daughters (77.3% of mothers), and least frequently daughters with a normal body weight (6.3%). Other mothers (with primary, vocational, and higher education) most often had daughters with a normal body weight (78.6%, 75.2%, and 78.% of mothers, respectively), whereas least frequently – underweight daughters.

Most fathers had vocational education (54.6% of fathers) or secondary education (31.8% of fathers), similarly to mothers; further on, primary education (7.8%), and the fewest fathers (5.3%) had higher education degree.

Most often girls in all the examined groups (underweight, obese, and with a normal body weight) had fathers with vocational education, followed by girls who had fathers with secondary education, higher education degree, and/or primary education, respectively.

Most often fathers with primary, vocational secondary, and higher education had daughters with a normal body weight. Fathers with higher education degrees, on the other hand, had obese daughters much less frequently than other fathers (5.45% vs. 18.5%, 17.9%, 17.3% of fathers, respectively).

#### Economic status

Three categories of families were established: (1) family of limited means, (2) moderately well-off family, and (3) well-off family. According to the data provided by the respondents in the survey questionnaire devoted to the economic status of their families, the majority of the girls (804 subjects, 77.1%) came from moderately well-off families and families of limited means (149 subjects, 14.3%), and the smallest group declared that they came from well-off families (89 subjects, 8.6%). In each group of the respondents (underweight, with a normal body weight, and obese) respondents also most frequently answered that their families were is moderately well-off,

followed by families of limited means, and, least frequently, well-off.

### **Relations in the family**

The question whether parents devote too little attention to respondents' problems was provided with negative answers by a significant majority of the respondents (89.2%) from each group (underweight, obese, and with a normal body weight) (60 girls (92.3%); 146 girls (82.5%), and 721 girls (90.5%), respectively), claiming that their parents were not indifferent to their problems. The group of girls who gave positive answers to this question most often included girls with a normal body weight (67.9%), then obese girls (27.7%), and, least frequently, underweight girls (4.5%).

According to the respondents, most often the dominating person in the family is their father (56% of all girls). In all the examined groups of girls (underweight, obese, and with a normal weight), most often the father is the 'head' of the family (38 girls (59.4%), 90 girls (50.6%) and 452 girls (57%), respectively).

The question whether the respondent believes she has better relations with her father than with her mother was answered negatively by most of them (77.1 % of the girls), and this situation repeated itself in each examined group. On the other hand, the question whether the respondent had better relations with her mother, was answered positively by most girls (87.1%), and this situation was repeated in each examined group.

## **Discussion**

The results of our study point to the variable state of nutrition in the population of girls from Ruda Śląska. This is a city in the Silesian agglomeration, with the population of about 146,000, where women constitute 51.3% of all residents [5].

The assessment of the state of nutrition of girls aged 14 in this city demonstrated that obesity affects as many as 14.9% of the subjects, and the percentage of obese girls at the age of 18 increased to 17.2%. Nearly 2/3 of obese girls examined at the age of 14, were still obese at the age of 18. Therefore, we presume that this state in obese girls will be maintained or will deteriorate over time, which may have serious health-related consequences. It was also demonstrated that none of the obese girls was underweight at the age of 18, despite undertaking attempts to reduce their body weight, and only 1/3 of them succeeded in normalising their body weight.

On the other hand, the underweight affected 5.4% of the subjects at the age of 14 and this percentage was at a similar level in 18-year-old girls (6.2% of the subjects). Over a half of the teenage girls (54.4%) gained body weight insufficiently, but as many as 45.6% of them were still underweight. It can be presumed that this group of subjects may represent girls with an increased risk of anorexia nervosa. One of the subjects underweight at the age of 14 was obese at the age of 18.

Obesity and underweight are important indicators of a variable state of nutrition of teenage girls, and they constitute significant predictors of the incidence of eating disorders in the population of young girls. Underweight is a condition which is metabolically more beneficial, as it considerably reduces the risk of obesity in the adulthood. Obesity, on the other hand, has the tendency to consolidate over time. If we observe obesity in young girls, it is highly probable that they will stay obese at a more advanced age and it will be increasingly difficult to reduce their body weight. Therefore, preventive measures should be directed towards maintaining the state of a normal body weight or slight underweight in children as early as possible, e.g. by means of an appropriate diet, education in terms of nutrition rules amongst parents, not overfeeding children, and recommending regular physical activity.

The examination of the state of nutrition of young people is an essential element of a far-sighted pro-health policy. It refers to an extremely important age group of young people, whose health should be taken special care of. In some western countries a separate field of medicine has been distinguished – adolescent medicine. This results from the concern about the future health of the adult population, which is formed earlier in adolescence, as the state of nutrition affects the incidence of serious weight-related disorders [6].

According to reports of the WHO, the number of European children with obesity is estimated at about 20% – with a clear upward tendency. In Poland in 2005 already 13% of children aged 13–15 were overweight or obese [7], which is also confirmed by the results obtained in this study (14.9% obese girls aged 14).

Some studies devoted to the state of nutrition of children and teenagers in the Polish population have been conducted so far, but they involved different age groups of children and adolescents living in different regions of Poland [8–12]. Authors estimated the state of nutrition by means of the BMI, or BMI-SDS, relating these values to the growth charts currently applicable in Poland. Some assumed that the normal body weight range for children is between the 25<sup>th</sup> and 75<sup>th</sup> percentile [13], but others took a wider range of the norm (between the 3<sup>rd</sup> and 97<sup>th</sup> percentile), which was also used in this study [12].

Underweight in girls in Warsaw, examined in 2005, was demonstrated in 6.1% of 14-year-old girls [14], and in 3–4.7% of girls in the study of Oblacińska et al. [15]. In the study carried out by authors from Podlaskie Province only 74.7% of girls aged 16 had a normal body weight [11].

Pyrżak et al. [12], examined the state of nutrition in 541 children (277 boys and 264 girls) aged 7–9, coming from several randomly selected regions of Masovia Province, assumed that the values below -1 SDS were underweight, values between +1 and +2 SDS were overweight, and obesity was diagnosed for values above +2 SDS. They observed that in 78.6% of the examined children the state of nutrition was normal. The analysis of the incidence of eating disorders in this age group revealed underweight in the entire group at the level of 5.4%, (including 2.8% of girls), overweight in the entire group

at the level of 12% (including 5.4%) of girls, and obesity in the entire group in 7% of children (including 3% of girls).

Another study, conducted in the years 1998–1999 by the Institute of Mother and Child in Warsaw, involving a large population of 4259 school-aged children, observed a higher incidence of obesity in girls than in boys, both in the group of children living in big cities (10.9% vs 7.3%, respectively) and in the rural areas (11.2% vs 6.7%, respectively) [16]. These authors also assumed that BMI values above the 97<sup>th</sup> percentile indicated obesity.

Other authors [13] analysed the state of nutrition of one year group of middle school students (aged 14), including 315 girls and 343 boys, in Radomsko. They recognised underweight as BMI values below 25<sup>th</sup> percentile and obesity for BMI values above the 97<sup>th</sup> percentile. They demonstrated that the average BMI value in girls aged 14 was  $19.6 \pm 3.2 \text{ kg/m}^2$ , the values similar to those in to our study ( $19.3 \pm 0.1 \text{ kg/m}^2$ ). The authors concluded that 46.7% of all of the analysed students had the BMI within the normal limits, out of which normal BMI was observed in 45.7% of girls. BMI values below the 3<sup>rd</sup> percentile, pointing to severe malnutrition, were observed in 7.9% of the subjects, including 7.6% of girls, and above the 97<sup>th</sup> percentile, pointing to obesity – in 5.6% of the subjects, including 4.8% of girls. BMI values below the 25<sup>th</sup> percentile were observed in 40% of girls and 42% of boys, which led to the conclusion that the problem of malnutrition should be attributed to a bad social and economic situation of Radomsko and low social awareness in the subject of healthy nutrition rules.

Our study evaluated the state of nutrition of a selected year group of female middle school students on the basis of retrospective data obtained from charts of periodical medical examinations of the subjects. We examined a much bigger group, comprising as many as 1049 girls, coming from a much bigger city than Radomsko, which, according to the authors at the time of the study, had the population of 50,949 [13]. We demonstrated the incidence of normal body weight in 14-year-old girls of 79.6%, underweight – 5.4%, and obesity – 14.9%, although the assessment of the state of nutrition was based on the calculation of not only the BMI value itself, but also of the BMI standard deviation score (BMI-SDS).

On the other hand, the state of nutrition of girls aged 18 was the subject matter of a study carried out by other authors [17], who evaluated the risk factors for the incidence of *anorexia nervosa* and bulimia. They determined the BMI value in 100 female students of secondary schools on the basis of data from a relevant survey questionnaire. The average body mass index in the girls was  $20.6 \pm 3.1 \text{ kg/m}^2$ . Most subjects (67%) had a normal body weight (BMI: 18.5 – 24.9  $\text{kg/m}^2$ ). Underweight was detected in 24% of the subjects (BMI < 18.5  $\text{kg/m}^2$ ), with 6 girls with the BMI value lower than 17.5  $\text{kg/m}^2$ , whereas 9% of the girls were overweight or obese (BMI > 25  $\text{kg/m}^2$ ).

Concordantly, in our study most girls aged 18 (76.6%) had a normal body weight, 6.2% were underweight, and as many as 17.2% of the girls were obese. We evaluated the state of nutrition on the basis of BMI-SDS, and the measurements were made by one investigator during a physical examination. The authors

cited above based their conclusions only on survey data, which might not have been fully objective. It could be presumed that in an anonymous survey, not subjected to any verifications, girls whose body weight was 'inappropriate' provided lower values, more adjusted to their wishes. This may justify the higher percentage of underweight subjects in this study.

Variable state of nutrition in the group of the girls that we examined indicates that it is justified to monitor the state of nutrition and to implement early corrective and preventive measures.

The strength of our research project is its prospectiveness. We evaluated the same subjects in a specific time interval. Additionally, the evaluation took place at important stages of development, i.e. at the beginning and at the end of puberty. Therefore, our results illustrate individual variability of body mass over the period of four years. No such studies had been conducted before. We are aware that the limitation of our data is that they relate to the results of research performed 10 years ago and only in the selected population of girls. However, the additional questionnaire containing questions on the nutritional behavior of the same girls is an element enriching and complementing the results obtained.

Analysing individual groups separately, we can conclude that, amongst respondents who provided positive answers to questions relating to abnormal eating habits, an identical percentage of girls (40%) with underweight or obesity and a similar percentage of girls with normal weight (43%) reported binge eating episodes, but only 4 girls with obesity and 9 with a normal body weight admitted to provoke vomiting.

Our results also confirm the increased tendency to control the body weight among normal weight people and the related phenomenon called 'pan-diet-mania' ('everybody is dieting'). It is promoted not only in the media, but it is also founded in adults as deep, atavistic mechanisms of attractiveness and competition in the natural selection processes. This means that an individual attaches much greater importance to her/his appearance, silhouette, body weight, etc., especially in the period of adolescence and in collective environments (school, work), where there is a greater chance of exposure to confrontation with other potential rivals. The effects related to the loss of importance of these values, accompanying the increase of the body weight, are observed in people in stable relationships, who have succeeded in such a selection task, and have achieved the sense of security. And vice versa, a threat to or breakdown of a marriage / partnership results in an increased importance of the attractiveness of the body silhouette and its mass, which – in combination with a stress reaction – leads to a change of eating habits and to the reduction of extra weight.

The results of our study referring to the attempts to lose weight today and in the past in a numerous, and therefore representative group of girls, are perhaps related to the prevalence of such attempts observed in young girls. As many as 38% of respondents admitted to undertake attempts to lose weight in the past, and 13% of them are in the course of such attempt at the moment. Among all the respondents,

the girls with a normal body weight reported episodes of undertaking attempts to lose weight much more often than the obese girls.

The results of a study, carried out in the Institute of Mother and Child in 2006 [18], demonstrate that the reducing slimming diet was applied even by very young children. Such a diet was applied by about 2% of the girls with a normal body weight aged 13-15 by 22% girls aged 18 [18, 19].

In a study conducted by other authors [17] it was demonstrated that 71% of normal weight girls aged 18 had tried to lose weight in the past, and only 29% of them stated that they did not see any need for it. Physical activity and appropriate diet were the most frequently mentioned ways to maintain body weight. Nevertheless, when asked about ways of spending their free time, the girls most often answered they spent their time socialising and watching TV, and only 1/3 of all the respondents admitted to physical activity.

Nearly a half of the girls examined by us admitted to exercise gymnastics in order to maintain or reduce their body weight, and those were usually the girls with a normal body weight. As many as nearly a half of the subjects with a normal body weight and 17% of underweight subjects answered that they exercised gymnastics in order to maintain low body weight, but only 56% obese subjects admitted to it.

About 6% of the girls participating in our survey admitted to use slimming agents and laxatives, and such substances were most frequently used by the obese girls. In this study diet was a frequently mentioned way to obtain a normal body weight, although these results cannot be assessed accurately due to an open formula of the question and the fact that the answers provided were too diversified.

Nawrocka et al. [20], when studying food habits and physical activity amongst 159 secondary school students (average age:  $13.9 \pm 1.4$  years), prepared a special survey questionnaire on the composition of meals, their frequency, the preferred food products, the frequency and form of the preferred physical activity, and attempts to lose weight in the past and motivation to it. They observed numerous nutritional errors in the students examined, related to – without limitations – type, quantity, and time of consuming individual meals. They also noted that a vast majority of students devoted sufficient time to doing sports. According to these authors, the most errors related to eating habits and physical activity are made by students of schools located in rural areas, and the fewest by students of schools in big cities. This study also implies that about a half of the students examined with the normal BMI value would like to lose weight and about 1/3 of them have already tried reducing diets. The authors point out that these numbers gradually increase with age. This is confirmed in the study by Bogdański et al. [21], who showed that almost 40% of young people aged 18 had already tried to reduce their body weight. These results are in line with ours, as we demonstrated that a half of examined subjects had exercised gymnastics in order to reduce their body weight. It should be noted that *anorexia nervosa* and bulimia, which start with attempts to lose weight, are the opposites of obesity [20].

There have been single studies devoted to the level of awareness of good eating habits in young people, in the context of obesity, as well as studies referring to the knowledge of teenagers on *anorexia nervosa* and the threats that this condition entails [4, 22, 23].

Chwałczyńska et al. [22] evaluated the knowledge of the term 'anorexia' and of the risk factors of the development of this condition in a group of 99 girls (average age:  $14.9 \pm 0.92$  years; average BMI:  $19.2 \pm 2.5$  kg/m<sup>2</sup>), using a relevant survey questionnaire. They demonstrated that 90% of the subjects knew the term 'anorexia', and as many as 30% of the group of the oldest girls (average age:  $16.1 \pm 0.4$  years) had observed this phenomenon in their environment. They also observed that a vast majority of the respondents devoted a lot of time to their appearance.

Mazur et al. [23] emphasise that the television is the main source of information on food products for children and teenagers, followed the Internet where the exposure to commercials of food products has been growing. The next place where the exposure to commercials of food products has been growing is the Internet. Nevertheless, it is believed that parents' habits and peers' influence often have greater effect on children's consumer choices than advertising.

A survey carried out among 407 middle school and secondary school students aged 13-19, 59.7% of whom were girls (average age:  $15.5 \pm 1.6$ ; average BMI:  $21.2 \pm 2.8$  kg/m<sup>2</sup>) and 40.3% were boys ( $15.9 \pm 1.6$  years;  $20.1 \pm 2.3$  kg/m<sup>2</sup>, respectively) demonstrated that as many as 70.5% of the respondents get their knowledge of *anorexia nervosa* predominantly from the media (television and the Internet), much less frequently from school, parents, or from any other sources [4]. Most respondents proved their good knowledge of symptoms and complications of AN, and 54.3% of the respondents claimed that the pressure of the environment could be the stimulus leading to *anorexia nervosa*, whereas 47.9% of the respondents pointed to the media. The authors conclude that young people's knowledge of symptoms and complications of *anorexia nervosa* seems wide and predominantly comes from the media. Nevertheless, due to a significant percentage of teenagers with bad eating habits, which was indicated by the results of the survey, more education on the prevention of eating disorders is needed in this group of young people.

Our survey questionnaire also contained questions on the sources of knowledge of methods of maintaining body weight, dieting, and losing weight applied most frequently by the respondents. The results point to a considerable influence of the Internet as the fundamental source of knowledge of maintaining body weight and dieting, since as many as 40% of the respondents pointed to the Internet as the main source of information. The second most popular source of knowledge was the press, i.e. teenage magazines (35% of the respondents). Friends provided knowledge of these issues in case of 26% of the girls. Only 10% of the respondents pointed to TV commercials as the source of their knowledge in this respect. It could be presumed that the television is the medium

which has the greatest effect on children in their earlier stages of life, in the process of their passive watching of TV shows chosen by their parents. Today, at the age of the Internet, the situation is changing in favour of active search for (search for) knowledge by young people, who more and more often are capable of making use of advanced technologies. The context of the group of friends as the point of reference and knowledge verification is also interesting. Persons interested in undertaking body weight reduction often exchanges information and look for confirmation of their resolutions in their peer group.

Important information emerging from this study demonstrates a tendency to consolidate inappropriate state of nutrition in the examined girls. During the time interval subjected to the evaluation, the girls who were obese at the age of 14 most often remain obese at the age of 18. On the other hand, a considerable percentage of underweight girls at the age of 14 (nearly 46%) remain underweight at the age of 18. We are concerned with the fact that there is a clear tendency to put on weight within such a short time interval in girls with a normal body weight since as many as 9.2% of them were obese at the age of 18.

Our survey questionnaire contained questions referring to environmental and family conditions, as well as questions referring to the subjects' relations with their parents. Formulating one's own opinions, views, or attitudes in young people largely results from cultural influences and the family environment they live in. Young people in the period of adolescence are a group which is very susceptible to all types of environmental influences.

There is evidence that environmental factors affect the state of nutrition and the development of eating disorders. Many studies confirmed the influence of family-related factors on the body weight in children, such as BMI of their parents. Witanowska et al. [24] observed a relationship between the state of nutrition in girls and the BMI value of their parents, and demonstrated the significance of the influence of the child's birth weight as well as a lower level of education of their fathers on the development of obesity. On the other hand, reports by Kobzova et al. [25], indicate that there is a lower risk of overweight and obesity in children born into families where parents have a better education.

In our study, we demonstrated that mothers with secondary education most frequently had underweight daughters. Fathers with a university degree, on the other hand, had obese daughters least frequently.

Our previous research [26] devoted to socio-economic conditions of *anorexia nervosa*, conducted on 146 girls suffering from *anorexia nervosa*, demonstrated that girls with AN come from families which are typical for the Polish population. No statistically significant differences in the parents' level of education between the group of the girls suffering from AN and a group of 166 healthy subjects were observed. The most frequent professions of the parents of the girls examined were economist, teacher and salesperson. We demonstrated that subjects suffering from AN usually came from a big city.

Amongst 81% of girls coming from cities, 53% lived in cities with the population higher than 100,000.

In this study we did not observe any correlation between the chosen school profile (technical secondary school, general secondary school, vocational school) and the body weight of the girls. Body weight was normal in about ¾ of the subjects irrespective of the profile of the school they attended. No significant correlations between body weight and talents and willingness to get a university degree were established, either. Girls from all of the groups examined declared interests in the humanities twice as often as in the sciences. Most respondents declared their willingness to continue their education at a university level, which may testify to their high educational ambitions.

On the basis of the surveys themselves, it is very difficult to determine the economic status of the respondents. Answers to this question are usually very subjective, not supported by any objective data, such as e.g. their parents' wages or tangible property. The financial situation of families could be indirectly assessed by eliciting answers to such questions as parents' current employment, family's place of residence (detached house or multi-family residential building), number of family members, etc.; such data, however, do not reflect the actual economic status, either. Therefore, the data obtained in our study indicating that most respondents came from moderately well-off families, and the least numerous group of subjects from well-off families, should be regarded as an approximation only.

Contrary to reports of some other authors, we did not demonstrate any effect of the economic status of families on the body weight of the subjects. The research of Witanowska et al. [24] demonstrated an increasing tendency of obesity being reached depending on a better economic status of families. On the other hand, the others did not observe such a correlation [27], despite the fact that the overall economic status of the respondents' families was similar.

Among significant factors fostering the development of eating disorders are inappropriate family relations [28], hindering child's autonomous development in adolescence. Other significant factors include eating disorders, mental diseases, or alcoholism in the family [29]. Specific family relations leading to eating disorders in children were described by Minuchin in his trailblazing studies in the 1980s, defining them as entanglement, blurring of the borders, overprotectiveness, offishness, and inability to handle conflicts.

We did not consider such detailed analyses when constructing the survey questionnaire to this study. They remain rather a domain of individual medical histories and broader research inventories, going beyond the possibilities offered by a screening questionnaire. Nevertheless, some questions aimed at obtaining basic information on relations within families. A vast majority – as many as 89% of the respondents – confirmed good family relations, believing that their parents are not indifferent to their problems. Identical results were observed by other authors, examining relations of 18-year-old female students of secondary schools with their parents, and

concluding that 89% of the respondents assessed them as good [17].

No statistically significant relation between the dominance of one of the parents, or a better relation with one of the parent, and the body weight of the respondents was demonstrated. The answers obtained rather suggest a confirmation of the traditional model of a Silesian family, where the father has a dominating role, whereas children have better relations with their mothers. Perhaps, this state of affairs is connected with more frequent contacts of children with their mothers, who are often full-time house-wives, always present at home, unlike fathers, who are home much less frequently due to their work commitments, and often doing shift work (the mining in the metals industry).

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## Conclusions

1. Most girls in the examined population of Ruda Śląska aged 14 and 18 present a normal state of nutrition. Obesity in the girls reaches 15% at the age of 14 and 17% at the age of 18, whereas 5% of the girls are underweight at the age of 14 and 6% at the age of 18.

2. In the period of four years – from early to late adolescence – the tendency to persistent variabilities of nutritional status in girls is observed.

3. Obesity in girls aged 14 is a predictive factor of obesity at the age of 18, and perhaps in the adult life.

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