










ORIGINAL PAPER

Katarzyna Dereń <sup>1(AF)</sup>, Sara Jarmakiewicz <sup>1(FG)</sup>, Aneta Sokal <sup>1(FG)</sup>,  
Edyta Łuszczki <sup>1(FG)</sup>, Elżbieta Motyka <sup>1(FG)</sup>, Justyna Wyszyńska <sup>1(FG)</sup>,  
Regina Kowal <sup>1(BCEF)</sup>, Artur Mazur <sup>1(FG)</sup>

## Risk factors and the incidence of overweight and obesity in pre-school children from the southern part of Poland

<sup>1</sup> Medical Department, University of Rzeszów, Rzeszow, Poland

### ABSTRACT

**Introduction.** In recent years there has been a significant increase in the prevalence of overweight and obesity in humans. It turns out that the problem is not limited to adults; excessive body weight is occurring in children more often.

**Aim.** The main purpose of this work was to determine the prevalence of overweight and obesity in preschool children from the Rzeszów district, and to determine risk factors for occurrence.

**Materials and survey method.** The study was conducted among 200 preschool children (3 - 6 years of age) from the Rzeszów powiat area. Measurements of height, weight, and determination of BMI were performed and these values are standardized according to the WHO centile grids appropriate for each age group.

**Survey results.** Normal weight was observed in 58% of the respondents, 11% were overweight, and 10.5% were obese, whereas 20.5% of children had undernourishment. Obese children were the largest group among 6-year-olds. Among 4 year old children, abnormal body weight were more frequent in boys. On the other hand, in children aged 5 years, undernourishment or overweight was found more frequently in girls.

**Conclusions.** The study did not confirm a significant relationship between gender, place of residence and socio-economic situation of respondents, and the prevalence of overweight or obesity. The results of this study indicate that the problem of excessive body weight refers to the increasing number of children.

**Key words.** obesity, overweight, undernourishment, preschool children

### Introduction

According to the World Health Organization (WHO), obesity is a condition when the body accumulates too much body fat, which can negatively affect health.<sup>1</sup> Correct body mass is determined with respect to age, sex

and race. Body Mass Index (BMI) and Waist-Hip Ratio (WHR) are commonly used to diagnose and assess obesity. World Health Organization (WHO) centile charts were used for children in this study. According to the latest WHO recommendations, overweight is diagnosed

**Corresponding author:** Sara Jarmakiewicz, e-mail: sara.jarmakiewicz@gmail.com

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when BMI value falls within the range of the 85-95 percentile (cc) and obesity when this value is above 95 cc.<sup>2</sup>

Obesity in children is classified according to etio-pathogenesis. The following types of obesity can be distinguished:

- Simple obesity, also called primary (monosymptomatic) is one of the most common forms of obesity (90% of obesity cases).
- Secondary (pathological) obesity is associated with endocrine diseases, genetic defects, diseases of the nervous system or is a consequence of long-term treatment.

Obesity in adolescence is associated with a slower growth rate, which reduces the need for energy, the child's appetite clearly increases, in order to accumulate fat, which will become the main source of energy in the maturation phase.<sup>3,4</sup> In pre-school children, one of the factors predisposing development of overweight or obesity are biological e.g. genetic.<sup>5,6</sup> Social and environmental factors that predispose overweight in children are mainly mass media and advertisements displayed by them, where the average calorific value of advertised food products is from 1700 – 33,000 kcal per day.<sup>7,5</sup> One of the most important determinants is the social environment in which the child lives and develops. Parents influence the availability of food products at home, shaping the children's eating habits and the time devoted by children to physical activity.<sup>8,9</sup> Consequences of overweight or obesity may include endocrine, cardiovascular, gastroenterological and pulmonary complications and disorders of the motor system.<sup>10</sup> Another discussed effect of obesity is the metabolic syndrome, which is characterized by carbohydrate or fat metabolism disorders and hypertension.<sup>6</sup> Consequences of obesity may also be low self-esteem, anxiety or depression.

Preventing the occurrence of obesity and overweight in children should start from the first day of life through the introduction of breastfeeding. In later stages of life, a child should be given the chance to decide what amount of food to eat with respect to hunger experienced.<sup>11</sup>

The main form of prophylaxis of overweight and obesity is nutritional education in terms of changing eating behavior.<sup>12</sup> Children should also be encouraged to become more physically active.<sup>13</sup> The immediate surrounding of the child plays an important role in promoting and caring for the right amount of physical activity. Proper nutritional behavior and high level of physical activity should accompany children from the early age, thus conditioning their proper development.

## Aim

The aim of this study was to determine the prevalence of overweight and obesity and their risk factors (age, sex, place of residence) in pre-school children from the Rzeszów district.

## Materials and methods

This study was conducted in kindergartens across the Rzeszów district. The study lasted four months. The study group consisted of 200 children of pre-school age from 3 to 6 years. The boys constituted 51.5% of the study group, and girls 48.5%.

The first stage of the study was to obtain parental written consent to conduct measurements (height and weight) in children and to fill in a child nutrition questionnaire.

A Child Feeding Questionnaire (CFQ) was used, which is a subjective assessment of beliefs, attitudes and parenting practices concerning child nutrition with an emphasis on the tendency to obesity or overweight in children. This questionnaire consists of 7 domains, 4 of them relate to the beliefs of parents affecting the tendency to childhood obesity, and the remaining three groups concern attitudes, practices and parental control in the field of child nutrition.

The study consisted of performing a measurement of height and weight in children three times. The body height was measured with a SECA 213 stadiometer three times. The height was measured with 5 mm accuracy. Measurements were made in a standing, upright position and without shoes. The average value from three measurements was used for further analyzes. The base of the stadiometer was disinfected after each measurement. Body mass measurement with 100 g accuracy was also performed in triplicate using a Tanita BC-418 MA body composition analyzer. The measurement values were read from the printout from the analyzer. The body mass index (BMI) was calculated based on the measurements using the formula: body weight (kg) / height (m<sup>2</sup>). These values were standardized by WHO percentile grids for each age group, respectively (Fig. 1).

Children came mostly from four-person families (42.5% of the respondents), but also often from three-person families (23%) or five-person families (24.5%). About 40% of the mothers had secondary education, 36.0% had higher education, and 24% had primary, lower secondary or a vocational education. Accordingly, 22% of the fathers had secondary education, 13% had higher education, and 65% had primary, lower secondary or vocational education.

The criteria for inclusion in the study were the age and place of residence of the children and the written consent of the parents to carry out the measurement tests.

The results of the study were subjected to statistical analysis using the Pearson chi-square test. Statistical analysis was performed using Statistica 10.0 software.

## Results

Overweight was found in 14.6% of 3-year-olds, 17% of 4-year-olds, 7.8% of 5-year-olds and 5.5% of 6-year-

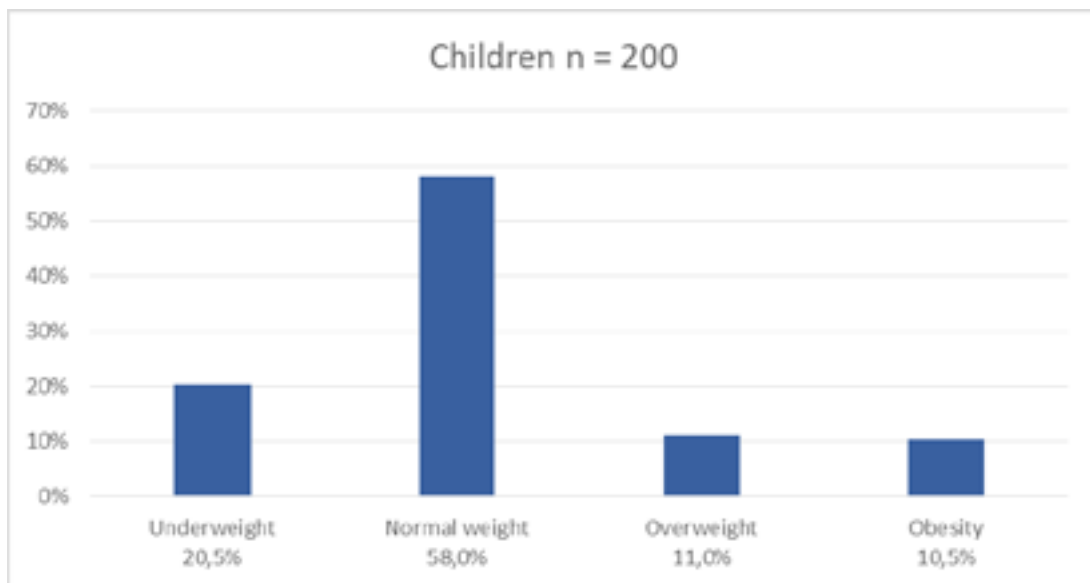


Fig. 1. A graph of BMI standardized by WHO percentile grids for each age group from the children sampled in this study

Table 1. Age of the children with respect to BMI

		Underweight	Normal weight	Overweight	Obesity	<i>p</i>
(n)		41	116	22	21	
Age	3 - years old	7	23	6	5	0.1544
		17.1%	56.1%	14.6%	12.2%	
	4 - years old	11	31	9	2	
		20.8%	58.5%	17.0%	3.8%	
	5 - years old	12	32	4	3	
		23.5%	62.7%	7.8%	5.9%	
	6 - years old	11	30	3	11	
		20.0%	54.5%	5.5%	20.0%	

Table 2. BMI in 4 and 5-year-old boys and girls

		Underweight	Normal weight	Overweight	Obesity	<i>p</i>
4 - year old	Boys	25.9%	40.7%	25.9%	7.4%	0.0422
	Girls	15.4%	76.9%	7.7%	0.0%	
5 - year old	Boys	10.7%	78.6%	0.0%	10.7%	0.0027
	Girls	39.1%	43.5%	17.4%	0.0%	

olds. Obesity was found to occur in 12.2% of 3-year-olds, 3.8% of 4-year-olds, 5.9% of 5-year-olds and 20% of 6-year-olds. Children with normal body mass dominated in each age group (Table 1). There were no statistically significant changes.

In the group of 4-year-olds, there was a statistically significant difference in the value of BMI among girls and boys ( $p = 0.0422$ ). Normal body mass was more frequently observed in girls (76.9%) among 4 year olds. Obesity was not found in the same group in girls. Boys, more often than girls, were underweight (25.9%) or overweight (25.9%) in the 4 year old group. In this group, there were also boys who were obese (7.4%). These dependencies were statistically significant.

Also statistically significant difference at the level of  $p < 0.01$  ( $p = 0.0027$ ) was confirmed in the BMI value

among girls and boys aged 5. Normal weight was significantly more frequently found in boys (78.6%) than in girls (43.5%). A similar relationship was found with respect to obesity: boys - 10.7%, girls - 0.0%. Girls, more often than boys, showed abnormal body mass, such as underweight, which accounted for 39.1%, compared to boys where 10.7% were underweight and 17.4% overweight. In the group of 5-year-old boys no overweight boys were found (Table 2).

Underweight children more often live in urban areas (23.4%) in comparison with children who live in the countryside (18.7%). The difference is also observed in children with obesity, which is associated with the place of residence: the city - 6.5%, the village - 13%.

Over 1/3 (37.5%) of parents never allow a child to eat a large amount of fast food. Typically, about 35% of

parents offer their child their favorite foods in exchange for good behavior; 27.5% of parents use this practice occasionally. Likewise, around 35% of parents usually offer sweets to children as a reward for good behavior. About 17.5% of parents keep some products out of reach of the child; 22.5% of the respondents do it usually and about 1/3 (30%) do this often. In the survey, we found that 20.5% of children usually do not eat high-fat products and 13% of children do not eat them at all. The statement “the child does not eat too much sweets” was fully accepted by only 14.5% parents and 33% agreed with it as usually the case.

Regarding the incidence of overweight or obesity, it is important that parents monitor children’s eating habits. Parents usually (44%) pay attention to how much sweets the child eats. Over 2/3 of the respondents watch how many snacks the child eats. On the other hand, 9.5% of the respondents rarely pay attention to the consumption of snacks by children, which may later be manifested by overweight or obesity.

## Discussion

Currently, both overweight and obesity are a global problem. Epidemiological studies show that the age of the overweight or obese population has been declining in recent years. The problem of abnormal body weight concerns increasingly younger generations. According to studies conducted worldwide, the number of children who were found to have excessive body mass increased threefold in the last decade of the 21<sup>st</sup> century.<sup>14</sup>

A meta-analysis conducted from data spanning the years 1980-2013 by Marie Ng et al. shows that there has been a significant increase in overweight and obesity among children, not only in developed countries, but also in developing countries, which indicates that this is a global problem.<sup>15</sup> A similar study was published in 2017 by the Lancet describing the increase in the incidence of overweight and obesity worldwide.<sup>16</sup> Studies carried out in this paper showed overweight in 10.7% of boys and 11.3% of girls, while obesity was found in 13.6% of boys and 7.2% of girls.

In the studies by Mazur et al. from 2008, over 9.9% of boys were overweight and 9.1% of girls, whereas obesity was found in 8.4% of boys and in 7.2% of girls. The authors draw attention to the high incidence of obesity among 3-year-old girls (19.1%) and 6-year-old boys (11.9%). In turn, researchers most often found overweight in 6-year-old girls (14.1%) and in 3 and 6-year-old boys: 12.5% and 12.9% respectively. Based on these results, the authors suggest the incidence of “rebound obesity” in these children, which increases the risk of excessive body weight in adolescence and adulthood.<sup>17</sup>

In studies conducted by Weres et al. in 2016, overweight was recorded in every age group in boys and girls. However, obesity was not reported in 3-year-

old, 4-year-old and 6-year-old girls and in 3-year-old boys.<sup>18</sup> When comparing the results obtained by the author with the results of this study, it is worth noting that the results obtained by us also did not show obesity in 4-year-old girls.

In the research of the Children’s Memorial Health Institute, Warsaw, Poland conducted in 2010 - 2012, overweight and obesity was found in a group of 3-year-olds in 9% of boys and 12.6% of girls, and in 14.8% of boys and 18% of girls in a group of 6-year-old children. Moreover, as in our study, correlation between place of residence and the risk of overweight or obesity was not found in these age groups.<sup>19</sup> However, in the studies conducted by Mielnik-Błaszczak et al., rural children were more likely to eat sweets compared to urban children, which may predispose them to abnormal (excessive) body weight.<sup>20</sup> Ligenza et al. in research carried out in 2010 found excessive body mass in 24% of children living in a big city and in 10.8% of children from a smaller town. However, obesity was observed in 12% of the examined children from a big city and 6.2% of children from a small town, respectively. In addition, the researchers showed that only 10.6% of the parents notice the problem of excessive body weight in their children, while overweight or obesity was found in over 20% of pre-school children.<sup>8</sup> Studies on the incidence of overweight and obesity in pre-school children from the Lublin area were carried out in 2013 under the supervision of Kostecka M. Due to the diversity of indicators applied, overweight and obesity cannot be compared with the results of our study. A total of 21% of the study group were children with excessive body mass.<sup>21</sup>

In the studies of Kułaga et al. among pre-school children, overweight or obesity was found in 12.2% of the examined boys and in 10% of girls according to the definition of overweight / obesity determined by WHO. The study also compared the incidence of abnormal body weight in Polish children and their American and Norwegian peers. Obesity was more frequently observed in Polish boys than in Norwegian. Among girls, excessive weight was observed in Polish women more often than in American women.<sup>22</sup> Similar results were obtained in our study. Overweight was found in 11% of the children, and obesity in 10.5% of the subjects.

In the years 2011-2012, nationwide studies were conducted in Poland regarding the incidence of overweight and obesity in children aged 3 to 5 supervised by H. Weker and Z. Chwojnowska. Overweight was found in 12.1% of children, and obesity in 8.1%. In addition, excessive body weight was more often found in children living in rural areas, which is also confirmed by the results of our study. Weker and Chwojnowska’s studies also showed a more frequent incidence of excessive body mass in children from families in which mothers had basic or vocational education. We found that the

higher the mother's education, the lower the percentage of children with normal body weight.<sup>23</sup>

Mazur et al. in their research, did not confirm a significant relationship between the material situation of the family and the incidence of overweight or obesity in children.<sup>9</sup> Likewise, no significant relationship was found between the economic status of the family and BMI of children in our study.

The results of research developed for the purposes of this paper, as well as reports from the studies cited above, suggest the need for prevention and prophylaxis of obesity or overweight in the youngest. One should also focus on research determining risk factors for excessive body mass among pre-school children from all over Poland, because this is not a problem related only to the Podkarpackie region.

All these activities will allow us to develop a detailed plan to prevent the incidence of excessive body mass in children. In addition, such a procedure will help to minimize risk factors conducive to this phenomenon, and, above all, will enable the implementation of individual programs promoting a healthy lifestyle.

## Conclusions

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

1. Overweight was found in 11% and obesity in 10.5% of the respondents. 58% of the examined children have normal body mass, while underweight was found in 20.5% of the subjects.
2. A statistically significant difference in the BMI value was found among girls and boys in the group of 4-year-olds.
3. A statistically significant difference was also confirmed in the BMI value among girls and boys aged 5, where girls were more often underweight. In contrast, boys were more likely to have normal body mass.

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