

Anna Stefanowicz<sup>1</sup>, Halina Kamińska<sup>2</sup>, Dorota Birkholz<sup>3</sup>, Maciej Niedźwiecki<sup>3</sup>, Anna Balcerska<sup>3</sup>

<sup>1</sup>Student of PhD, Paediatric, Haematology, Oncology, and Endocrinology Department of the Medical University of Gdańsk, Poland

<sup>2</sup>Institute of General Nursing, Faculty of Nursing of the Medical University of Gdańsk, Poland

<sup>3</sup>Paediatric, Haematology, Oncology, and Endocrinology Department of the Medical University of Gdańsk, Poland

# Obesity and overweight – current health problems of childhood

Otyłość i nadwaga – współczesne problemy zdrowotne wieku dziecięcego

## ABSTRACT

**INTRODUCTION.** Obesity is a present-day civilization disease of childhood. The treatment of obesity in children is challenging. Adequate diet, increased physical activity, behavioural therapy, and the change of habits form the basics of treatment.

The aim of this work was to assess the influence of various factors such as environmental, genetic, and social factors on the occurrence of obesity and overweight during childhood.

**MATERIAL AND METHODS.** Seventy-three children diagnosed as obese or overweight (aged 2–18 years, median 13 years) were included in this study. The studied population was divided into two groups (group I — obese, group II — overweight), which were statistically compared.

**RESULTS.** Statistically significant differences were noted between groups I and II in occupational activity of the parents and additional exercise of the children.

A moderate correlation was noted between the father's and the child's BMI.

**CONCLUSIONS.**

1. The revealed correlation between the father's and the child's BMI may indicate that obesity is genetically determined or is caused by an irregular lifestyle within the family.
2. The parents' involvement in occupational and private life influence the child's life and may secondarily predispose to obesity.

3. Lack of additional exercise plays an important role in the development of obesity.

**Key words:** diet, physical activity, overweight, obesity, childhood  
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## STRESZCZENIE

**WSTĘP.** Otyłość jest współczesną chorobą cywilizacyjną wieku dziecięcego. Leczenie otyłości u dzieci jest trudne. Podstawą leczenia jest właściwa dieta, wzmożony wysiłek fizyczny i terapia behawioralna.

Celem pracy było wykazanie wpływu różnych czynników: środowiskowych, genetycznych i społecznych na występowanie otyłości i nadwagi w wieku dziecięcym.

**MATERIAŁ I METODY.** Badaniem objęto 73 dzieci z rozpoznaniem nadwagi lub otyłości (zakres 2–18 lat, mediana 13 lat). Badaną populację podzielono na 2 grupy (grupa I — otyłość, grupa II — nadwaga), które porównano statystycznie.

**WYNIKI.** Stwierdzono różnice znamienne statystycznie pomiędzy grupą I i II w zakresie aktywności zawodowej rodziców oraz dodatkowego wysiłku fizycznego. Wykazano korelację o umiarkowanej sile między BMI ojca a BMI dziecka.

**WNIOSKI.**

1. Wykazana korelacja między BMI ojca a BMI dziecka może świadczyć o genetycznych uwarunkowaniach otyłości lub o nieprawidłowym stylu życia w rodzinie.
2. Zaangażowanie rodziców w życie zawodowe i osobiste wpływa na tryb życia dziecka i wtórnie może predysponować do występowania otyłości.
3. Brak dodatkowej aktywności fizycznej odgrywa znaczącą rolę w rozwoju otyłości.

**Słowa kluczowe:** dieta, wysiłek fizyczny, nadwaga, otyłość, wiek dziecięcy

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Address for correspondence: Anna Stefanowicz M.D.  
Paediatric, Haematology, Oncology, and Endocrinology Department  
Medical University  
7 Dębinki Street, 80–952 Gdańsk, Poland  
e-mail: ania-stefanowicz@amg.gda.pl  
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## Introduction

At present, obesity is one of the most commonly occurring conditions of civilization. Overweight and obesity occur most often in economically developed countries [1].

Over the past 30 years in most of the countries of the world, a significant increase in the prevalence of overweight and obesity has been observed. This problem affects not only adults but also youth. Currently 22% of American youth, 6–15% of European youth, and 2.5–12% of Polish youth are overweight. This higher incidence is caused mainly by a change in social behaviour: higher food intake and reduced physical activity [1, 2].

From everyday life, we know that obese children are very likely to suffer from obesity as adults. Obese infants continue to lose excess fatty tissue until the 2<sup>nd</sup> year of age, because until that time the child's physical activity increases. In later years of the child's development, an excessive accumulation of fatty tissue may occur once again. We call this the "adiposity rebound". At around the 8<sup>th</sup> year of life, a physiological increase in body mass occurs. After that time, most children maintain the same body mass until the end of growth. Almost all of the children who rapidly gain weight before the 6<sup>th</sup> year of life remain obese during puberty. Usually, the earlier "adiposity rebound" occurs, the higher the ultimate body mass. Our attention should turn to children between the ages of 3 and 5, who are rapidly gaining weight. The age at which "adiposity rebound" occurs allows us to predict the risk of developing obesity in later life [3, 4].

The aim of this study was to assess the influence of different environmental and social factors (child's sex, child's age, family residence, mother's and father's education, parental occupation, coexistence of chronic diseases in children, the child's nutrition during infancy, the child's diet during later years of life, consumption of sweets and soft drinks, vegetables and fruit in the child's diet, dining at fast-food restaurants, eating breakfast and lunch, eating a meal before going to sleep, PE participation at school, performance of additional physical activity, spending time outdoors, parental knowledge about overweight and obesity) on the development of obesity and overweight in childhood.

## Material and methods

Our study included 73 children (aged 2–18 years, median 13 years) diagnosed with obesity and treated in the Children's Endocrinology Outpatient Clinic of the Academic Clinical Centre of the Medical University of Gdańsk. The study included a questionnaire prepared

by us especially for this study that was filled out by the parents of the treated children.

The questionnaire included data concerning the child's sex and age, the parents' age, the place of residence, the parents' education, the parents' BMI and occupation, the coexistence of chronic diseases in children, type of nutrition during infancy (natural, mixed, artificial), the parents' knowledge about obesity and its treatment, the child's current diet including information about the regularity of meals (*i.e.* eating breakfast and lunch, late snacks before going to sleep, eating of sweets, vegetables, fruits, fast food, and soft drinks), the child's physical activity (*i.e.* attendance at obligatory physical education classes in school and additional physical exercise) as well as outdoor activities.

The questionnaire was anonymous and voluntary, and it was approved by the Academic Committee of Bioethics of the Medical University of Gdańsk.

The data obtained from this questionnaire has been thoroughly analyzed. The patients were divided into 2 groups according to their centile height-weight position. Group I consisted of children diagnosed with obesity, while group II consisted of children diagnosed as overweight. Five questionnaires were not included in the statistical analysis of the collected data, as they did not fulfil the criteria of obesity and overweight used in this study.

Charts with correlated body mass and height, prepared for the Polish population by the Child/Teenager Development Institute of the National Research Institute of Mother and Child in Warsaw, were used to assess excess body mass [5]. Consistent with the literature, we defined overweight as children with mass between the 90<sup>th</sup> and 97<sup>th</sup> centile, and obesity as above the 97<sup>th</sup> centile [6].

BMI was calculated for each youth participant. Figure 1 shows the values of BMI in overweight children compared to obese children.

Both groups were subdivided according to age: 0–6 years, 7–12 years, and 13–18 years.

## Statistical analyses

Statistical analyses were performed using the programme Statistica for Windows, version 7.0. The relationships between the quality scales were analyzed using the Yates-corrected Pearson's chi-square ( $\chi^2$ ) test. Differences were considered significant at  $p < 0.05$ .

## Results

In total, 73 questionnaires were collected. Overweight was diagnosed in 20 (29.4%) and obesity in 48 (70.6%) children. The results of comparisons between the two groups are shown in Table 1.

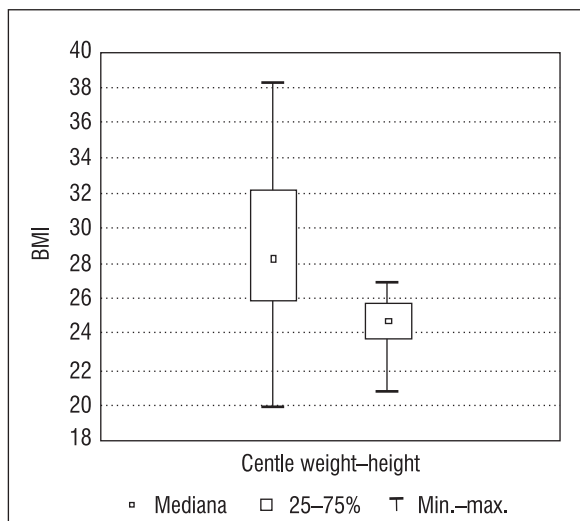


Figure 1. BMI of children by overweight and obesity status

We found no statistically significant differences in a comparison between overweight and obese youths regarding the children's age or sex; the parents' place of residence; the parents' education; a coexisting chronic disease in children; the child's nutrition in infancy or later years of life; the consumption of sweets, fruits and vegetables, soft drinks, breakfast and lunch, dining at fast-food restaurants, and eating before going to sleep; the child's basic physical activity, spending time outdoors; or the parents' knowledge about overweight and obesity.

However, statistically significant differences were observed when it came to parameters such as the parents' level of physical activity and performance of additional physical exercise by the children.

We found a moderate and significant correlation between the child's BMI and the father's BMI ( $R = 0.5$ ,  $p < 0.05$ ); however, the correlation between the child's BMI and the mother's BMI was not significant (Fig. 2).

## Discussion

In the last few years, the problem of overweight and obesity has become more significant in developed countries. It affects all age groups, including children and teenagers. Some have even termed this phenomenon as an obesity epidemic. It is estimated that nearly 100 million people are affected by this condition worldwide [7].

According to studies cited by the National Health and Nutrition Examination Survey Cycle III (NHANES III) that ended by 1994, 10% of children between ages 6 and 12 years and 20% of teenagers between the ages

12 and 17 years were diagnosed as overweight. In 8–17% of children in the age group of 12–17, obesity was diagnosed.

Since 1994, an increase in the prevalence of obesity and overweight has been observed in Great Britain. This disorder is developing in younger and younger children. In 1996, 22% of children aged 6 and 35% of children aged 15 were already diagnosed as overweight. Between 1989 and 1998 the percentage of preschool children who were overweight increased from 14.7% to 23.6%. Accordingly, the percentage of preschool children suffering from obesity rose from 5.4% to 9.2% [7].

In Poland, studies on the prevalence of overweight and obesity in schoolchildren were carried out by Anna Oblacinska [6]. In the school year 1994-1995, children with excess body mass were registered in a representative group of 2 098 170 pupils from 40 districts of Poland. Excess body mass was found in 8.7% of the studied children, and 3.4% were diagnosed with obesity. The study found that excess body mass occurred more often in girls, students living in cities, and in teenagers, particularly after puberty. Our age analysis is consistent with these results. About 50% of obese children were in the highest age subgroup of children, aged 12 to 18 years. We also observed a higher proportion of overweight and obese females.

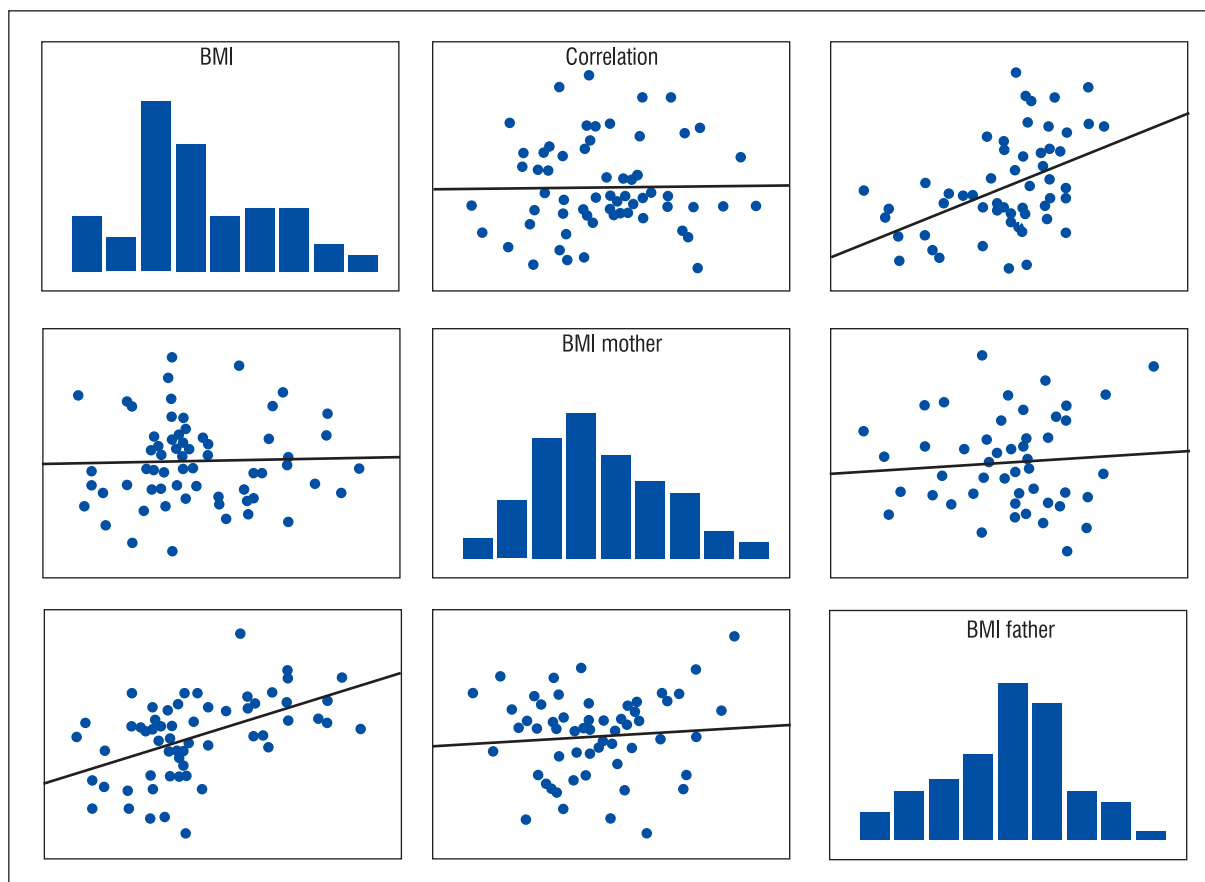
Incorrect nutrition plays one of the most important roles amongst the factors which influence the development of obesity and overweight in children, both during infancy and later in life. Children who are breastfed are less likely to be obese or overweight later in life. This protective role of the mother's milk has been described in studies carried out in Germany, which included ten thousand children aged 5–6 years. The studies showed that in children who had been breastfed for more than 6 months, the risk of developing overweight at the age of 5–6 was 30% lower, and the risk of developing obesity was 40% lower. Furthermore, the study found a dose-response effect; the longer a child is breastfed, the lower the risk of developing obesity in later life [8].

Artificially fed Infants are more susceptible to becoming overweight or obese in later life. All milk formulas, even humanized milk, are prepared using cow's milk. It has been shown that the quality and quantity of proteins in cow's milk is inadequate for human needs. In addition, these products contain additional carbohydrates, mainly maltodextrin, which has a high glycaemic index and causes a very strong insulin reaction [9].

After analyzing the results of our own study, we found that only 20.8% of obese children and 40% of overweight children were breastfed. The majority of children received mixed nutrition during their first year of

Table 1. Characteristics of youth with overweight and obesity

Characteristics		Group of overweight children (n = 20)	Group of children with obesity (n = 48)	Total number	p-value
		Number (%)	Number (%)		
Child's sex	Female	9 (45%)	27 (56%)	36	0.39
	Male	11 (55%)	21 (44%)	32	
Child's age	0–6 years	0 (0%)	7 (15%)	7	0.15
	7–12 years	8 (40%)	20 (41%)	28	
	13–18 years	12 (60%)	21 (44%)	33	
Family residence	City	15 (75%)	35 (73%)	50	0.85
	Countryside	5 (25%)	13 (27%)	18	
Mother's education	Elementary/Vocational	5 (25%)	18 (37.5%)	23	0.38
	Secondary	12 (60%)	20 (41.5%)	32	
	Higher	3 (15%)	10 (21%)	13	
Father's education	Elementary/Vocational	10 (50%)	33 (70%)	43	0.22
	Secondary	7 (35%)	8 (17%)	15	
	Higher	3 (15%)	6 (13%)	9	
Parental occupation	Both parents work	8 (40%)	27 (56%)	35	0.02
	One parent works	10 (50%)	9 (19%)	19	
	Both parents are unemployed	2 (10%)	12 (25%)	14	
Coexistence of chronic diseases in children	The child suffers from chronic diseases	10 (50%)	16 (33%)	26	0.19
The child's nutrition during infancy	Natural nutrition	8 (40%)	10 (21%)	18	0.23
	Mixed nutrition	9 (45%)	31 (65%)	40	
	Artificial nutrition	3 (15%)	7 (15%)	10	
The child's diet during later years of life	Correct diet	11 (55%)	20 (42%)	31	0.31
Consumption of sweets	Yes	17 (85%)	46 (96%)	63	0.11
Vegetables and fruit in the child's diet	Yes	19 (95%)	48 (100%)	67	0.11
Consumption of soft drinks	Yes	7 (35%)	27 (56%)	34	0.11
Dining at fast-food restaurants	Yes	7 (35%)	18 (37.5%)	25	0.84
Eating breakfast	Yes	16 (80%)	31 (65%)	47	0.41
Eating lunch	Yes	16 (80%)	33 (69%)	49	0.57
Eating a meal before going to sleep	Yes	6 (30%)	15 (31%)	21	0.91
PE participation at school	Yes	16 (80%)	31 (64.6%)	47	0.37
Performance of additional physical activity	Yes	12 (60%)	13 (27%)	25	0.02
Spending time outdoors	Yes	13 (65%)	29 (60%)	42	0.72
Parental knowledge about overweight and obesity	Yes	12 (60%)	33 (69%)	45	0.48



**Figure 2.** Correlations between child and parent BMI

life, while 14.58% of obese children and 15% of overweight children received exclusively artificial nutrition.

The diet received by children after the 1<sup>st</sup> year of life is crucial for the child's correct development. The correct nutritional composition meals and regular meals are of utmost importance.

The main nutritional goal during childhood is to deliver all the necessary micro- and macro-elements the body requires. When a child enters the phase of intense growth, he or she needs products which have not only structural but also energetic properties. An adequate diet should fulfil the child's daily need for all the nutritive elements mentioned above. The number and regularity of meals is of great importance. It is not advised to snack in between meals. The last meal of the day should not be eaten later than 6–7 pm.

Consumption of excess amounts of monosaccharides (fruits, sweets), animal fats, and soft drinks plays an important role in the development of obesity [10]. Our questionnaire included many detailed questions concerning the types of most commonly eaten foods, the regularity and place of meals, and frequency of

sweets and soft drinks consumption. We also asked about snacks in between meals, eating breakfast and lunch, and the time of the evening meal. In order to evaluate the diet quality of obese and overweight children based on the data obtained from our questionnaire, a few aspects had to be simplified. The children were classified into groups of correctly and incorrectly nourished. The second group included all children in whose questionnaires abnormalities concerning the basic rules of nutrition were found. We observed that 58% of obese and 45% of overweight children did not eat correctly. Additionally, 96% and 85%, respectively, of the children ate vast amounts of sweets, and 56% and 35% drank soft drinks. Only 35–37.5% of all children regularly ate at fast food restaurants such as McDonald's. This was due not only to the parents' inadequate nutrition knowledge, but also the family's location of residence.

We also assessed the parents' knowledge about the causes and treatment of obesity in children. Most parents knew the causes of obesity and were familiar with the available forms of treatment of this condition; 69% of parents of obese children and 60% of parents

of overweight children had the basic knowledge about these issues. Education, being a basic part of therapy, clearly plays an important role.

Low physical activity is rarely the direct cause of obesity, but greatly influences its development. Regular physical exercise is one of the ways to treat obesity, and is an important supplement to dietary changes. Physical activity is one of the best-known ways to prevent the accumulation of fatty tissue, especially in people who lead a sedentary lifestyle. It allows maintenance of the energy balance without the need of drastic dietary restrictions. It also plays an important role in the treatment of obesity and overweight in children and teenagers.

Physical activity influences body composition and the distribution of fatty tissue. Infrequent physical activity will not bring expected results, unlike regular and systematic physical exercise. Exercise increases physical efficiency and fitness, increases the efficiency of the respiratory and circulatory systems, and improves mood. This is due to increased levels of noradrenalin and  $\beta$ -endorphins. Aerobic exercise is the most recommended form of physical activity for every child and every adolescent. During aerobic exercise, the body's oxygen demand increases, oxygen being the other essential factor for food breakdown in the organism besides glucose. Aerobic exercise includes running, swimming, aerobics, cycling, etc. [11]. Anaerobic exercise (or static exercise) such as weightlifting or rope pulling is not recommended for every child and every adolescent, because it stimulates the sympathetic nervous system and significantly increases the blood pressure [12].

A program of physical exercise should be prepared individually for each child [2]. In our study, we tried to evaluate the influence of physical activity on the development of overweight and obesity in children. We found that 31% of children with obesity and 20% of children who were overweight did not attend obligatory physical education classes in school. Only 35% of obese children took part in any kind of additional physical exercise.

In the study the influence of various factors on the development of obesity in children were investigated.

The comparison of groups of children with overweight and obesity showed statistically significant differences only with reference to occupational activity of parents and additional exercise of the children. This may result from too few patients in the studied groups. An increase in the number of examined children would possibly show the influence of other factors.

It is believed that some people are genetically predisposed to obesity, but genetic factors have been found to be responsible for the development of obesity only in about 30–50%. Studies carried out in the 1980s on adopted children showed that a strong correlation exists between the child's weight group (thin, medium body weight, overweight, or obese) and the BMI of his or her biological parents (for mothers  $p < 0.0001$ , for fathers  $p < 0.02$ ). No correlation was shown with the BMI of the adoptive parents [13]. In our study, a moderate significant correlation was found between the BMI of the obese/overweight child and the BMI of its father. No relationship between the BMI of the child and the BMI of the mother was found.

The questionnaire we developed seemed to be simple and understandable. When analyzing data, we noticed that some of the questions were perceived as controversial. Problematic questions included information about the child's current diet and the parents' knowledge about obesity. Most parents perceived even extreme obesity as a mild health problem or a type of body build, and not an illness. In addition, parental knowledge about the effects and complications of obesity was very limited.

## Conclusions

1. The revealed correlation between the father's and child's BMI may indicate that obesity is genetically determined or is caused by an irregular lifestyle within the family.
2. The parent's involvement in occupational and private life influence the child's life and may secondarily predispose to obesity.
3. Lack of additional exercise plays an important role in the development of obesity.

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