RISK FACTORS AND THEIR IMPLICATIONS IN THE EPIDEMIOLOGY OF PEDIATRIC OBESITY

Dana Elena Mîndru¹, Evelina Moraru²,³
1. Ph.D. student at University of Medicine and Pharmacy "Grigore T. Popa" - Iasi
   University of Medicine and Pharmacy "Grigore T. Popa" - Iasi
   School of Medicine
2. Discipline of Pediatrics
   "Sf. Maria” Emergency Children Hospital - Iasi
3. 2nd Pediatric Clinic

RISK FACTORS AND THEIR IMPLICATIONS IN THE EPIDEMIOLOGY OF PEDIATRIC OBESITY (Abstract): Obesity is the most common food disorder in children from developed countries, its frequency alarmingly increasing in Romania. Aim: To evaluate the epidemiological dynamics of obesity and associated risk factors. Material and methods: Retrospective and prospective study of 146 obese children admitted to the 2nd Iasi Pediatric Clinic between 2008-2012 aimed at evaluating the epidemiological dynamics of obesity and associated risk factors. Most subjects were teenagers (33%), followed by school age children (21%). Results: A growing tendency towards obesity in the study children was noticed during the 5-year follow up. Genetic factors, short breastfeeding, early onset of obesity, and eating disorders were the main obesity-associated risk factors, along with obesity in 1st degree relatives. Conclusions: Early infantile and juvenile obesity remains a medical and social problem in our geographic area, and unfortunately a neglected reality. Genetic factors, absence of breastfeeding, inappropriate food habits in the early years of life lead to permanent disorders, with serious consequences in adult life. Key words: OBESITY, CHILDREN, RISK FACTORS.

In the last century, there were major changes in the epidemiology of obesity: thus, if between 1950 and 1960 this condition occurred at older ages in Western and some Northern European countries, now its spread is pandemic, reason why scientists have named it "globesity". It has become the main health problem of the 21st century (1,2), mostly in the United States, population studies demonstrating the increasing prevalence of overweight and obesity in children.

Epidemiological data of pediatric obesity worldwide
Approximately 50% of the obese children grow up to become obese adults. WHO expectations for 2025 are over 300 million obese people worldwide (1). In Australia, China, Brazil, and United States, the growth rate of pediatric obesity highly exceeds that of adult obesity.

According to the NHANES study (1963-1995), the number of obese patients has doubled, increasing by 40% in the age group 12-17 years and by 54% in children aged 6-11 years. Prevalence of overweight in adolescents increased from 5% to 10.5%, and in children aged 6-11 from 6.5% to 11.3%. In the US, 1 of 4 children aged 6 to 17 years and 1 of 2 adults are overweight,
10% of preschool children are obese, many with decreased glucose tolerance (3). During the last two years, over 30% of the American children became obese, doubling the estimated percentage. The prevalence of obesity in the 6-14 years age group is increasing, from 4% during 1963-1965 to 13% in 1999, and in adolescents aged 12-19 years from 5% (1966-1970), to 14% in 1999 (4). Prevalence is growing rapidly being now 50% higher than in 1960. International Association for the Study of Obesity (IASO) estimated that, worldwide, 10% of school children, that is 120 millions, are overweight or obese. According to WHO, globally, obesity has exceeded the prevalence of malnutrition, 15-18% of children being affected by overweight and obesity. Clinical studies showed an increased prevalence of the metabolic syndrome associated with ageing (5,6), but also found in childhood.

At the end of the last decade, International Obesity Task Force (IOTF) was commissioned by WHO to coordinate anti-obesity measures worldwide and to submit a report on the prevention and management of global obesity (fig. 1).

In 2004-2005, in Iran an epidemiologic study on obesity was conducted in subjects aged 15 to 65 years; the aim was to estimate the prevalence of overweight in that area and to predict the future obesity rate. The results pointed out that the prevalence of overweight and obesity was 57% in women and 42.8% in males; underweight was 5.2% in women and 6.3% in male population (7). In Mexico, there was an increase of 50% of obesity prevalence in children and adults in the last ten years. The highest prevalence of overweight and obesity was reported in the Pacific Islands and Saudi Arabia. According to NHANES II study (1976-1980) there is an increased prevalence of overweight in all age groups: 2-5 years (preschool children), from 5% to

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Fig. 1. Prevalence of obesity and overweight in Europe (IOFT, October 2008).
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12.4%, 6-11 years, from 6.5% to 17%, and 12-19 years, from 5% to 17.6% (8). More recent data (NHANES 2003-2006) show a higher prevalence of obesity in the boys aged 12 -19 years (27.7%) than in age-matched girls (19.9%). African American and Hispanic children have a higher risk for developing overweight compared to Caucasian children. In 2008, the prevalence of obesity increased in children of American Indian, Alaskan native (21.2%) and Hispanic (18.5%) children, and decreased in Asian children (12.6%) (9). Even in developing countries there was an increased prevalence of obesity in children under 5 years, from 12.4% in 1998 to 14.5% in 2003 and only to 14.6% in 2008. The incidence is still increasing in all age groups including infants and preschool children. In England, childhood obesity rate is 7 %, and infantile obesity rate 27.7%. In the U.S., the frequency in preschool, and school children and teenagers is of 14.1%, 3-20% and 10-30%, respectively. In Chile, studies showed that 7% of preschool and 12% of school children are obese. In many other countries, more than half of people are overweight and obese. It is estimated that 97 million U.S. adults are overweight or obese. Most of them were obese as children. In the past decade, the prevalence of obesity increased by almost 40% in most European countries, especially in the male population (10) (fig. 2). Currently, it is estimated that about one quarter of the world’s population is overweight before the age of 20 years, and half will be obese by the age of 20. In 2000, in France, 16% of the children aged 5 to 16 years were obese, and in Italy 25% (6, 11).

Fig. 2. Prevalence of obesity (WHO, April 2008). Legend: Open white areas - lack of data, gray areas - the prevalence of 30-40% black areas – prevalence over >40%.

In Europe, childhood obesity has tripled in the past 20 years; in the Mediterranean and Eastern Europe countries, up to 40% of the women were obese In Western European countries, obesity is about 25%, in Northern Europe the prevalence of overweight chil-
Children is 10-20%, while in the Southern countries it is 35% and is increasing. It is alarming that the onset of overweight and obesity is at a young age, and in certain geographical areas, some preschool children have decreased glucose tolerance, being at higher risk for type 2 diabetes. The highest prevalence was recorded in Malta (31% boys and 28% in girls) and the lowest in Lithuania (10.3% boys and 4.7% in girls). In Belgium, between 1980 and 1990, the prevalence of obesity increased from 9.2% to 14.5% (12). Reports of the International Obesity Task Force (IOTF) showed the same trend in Southern Europe, where 1 out of 10 children are overweight. In England (1999), the prevalence of overweight increased from 22% at age 6, to 31% at 15 years, and obesity from 10% to 17% in the same age ranges (13). In Germany, a 20 year-study (1975-1995) showed an increase in overweight from 10% to 16.3%, more common in girls, and in obesity from 5.3% to 8.2% (9).

In France, a study conducted in children in the interval 2000-2001 showed a 3.8% prevalence of obesity and overweight of 3.8% and 14%, respectively (8). An Italian study (2000 – 2002) reported a higher prevalence of overweight of 27.2% in boys and 29.5% in girls aged 6 to 11 years, and obesity of 6.5% in boys and 7% in girls. Recent studies show that in Italy 36% of the 9-year-old children are overweight or obese, while in Greece the prevalence is 19% in the age group 6-17 years (14). In Spain, 27% of children and adolescents are obese. Epidemiologic studies carried out in the interval 1998-2000 showed a prevalence of overweight of 31.4% in boys and 32.4% in girls, and of obesity of 10.4% and 10.2% in boys and girls, respectively. Between 1998 and 2004, Bulgaria reported an increase in the prevalence of overweight from 19% to 22% in boys and from 16% to 18% in girls (15).

**Obesity in Romanian children**

There are few studies on obesity in Romanian children. In 1980, a group of children from 3 months to 16 years of age from Western Romania was measured for assessing the nutritional status; 14.7% were identified to be obese, with a slightly higher frequency of school-age girls. In the 5250 children, obesity had a prevalence of 18.62% in infants, 15.05% in preschool children, and 14.20% in school-age children (4). “Alfred Rusescu” Institute for Mother and Child Care (IOMC) in Bucharest launched the National Nutritional Surveillance Program (1993-2002). The epidemiological studies showed a prevalence of overweight in children aged 0 - 4 years of 6.4% in girls and 5.5% in boys. In 2008, in Cluj-Napoca, a study on 7904 schoolchildren, reported a prevalence of overweight of 12.8% and of obesity of 8.2%. The highest prevalence was recorded in the age group 6-10 years, both for overweight - 15.9%, and obesity-13.3%, and the lowest prevalence in adolescents: 7.6% for overweight and 3.8% for obesity (16).

**Risk factors that need to be identified and avoided**

Although the risk factors for obesity are clearly represented by heredity (90%), there are many phenomena that target feeding behavior, regulation of appetite and bad eating habits, which can be identified and avoided. Some authors noted that early adiposity rebound (at 3 years of age), high birth weight or prematurity (with a subsequent rapid growth rate), lack of physical activity, correlated with the occurrence of early obesity. The earlier the rebound is, the higher the adiposity will be at adult
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age. Thus, dynamic assessment and recording of BMI rebound may allow initiation of preventive measures. Rapid weight gain in the first six months of life is a predictor factor for developing obesity by the age of 3 years (17). Avoiding obesity both before pregnancy and after delivery is crucial for the future baby weight. Low birth weight for gestational age associated with a rapid weight gain after birth increases the risk of obesity, metabolic syndrome and diabetes. Newborns of obese mothers are often overweight and they can develop obesity on long term basis. Children with higher gestational age because of maternal insulin resistance and decreased glucose tolerance are at risk for obesity. Positive family history for obesity and early onset of overweight increase the risk of obesity up to 80% for those with both parents obese and up to 40% for children with one obese parent. Rapid weight gain during the first 4-6 months is associated with higher risk of childhood obesity and with its abdominal distribution in children (18). Breastfeeding should be recommended as a protective factor against obesity in adolescence. The risk of obesity decreases proportionally with the duration of breastfeeding (up to 9 months), each month of breastfeeding decreasing by 4% the risk of obesity. Artificial feeding and excess protein intake in the first year of life are considered risk factors for subsequent development of obesity, with pancreatic and kidney overload. Cow milk proteins specifically stimulate massive IGF-1 release (19). Impaired nutrition in pregnant woman has an important role in childhood obesity and its impact involves some risk factors such as: low birth weight, increased amount of insulin in the amniotic fluid, hypothalamic activity, stimulating and inhibitory peptides. The relationship between obesity and age involves alteration of appetite regulating systems (hunger/satiety balance), which develop in pregnancy and neonatal period. Fetal and neonatal life are critical for the maturation of the complex systems involved in the pathology of metabolic syndrome and obesity. Fetal malnutrition is the result of maternal malnutrition, placental insufficiency, which can add more maternal abnormalities. This leads from low birth weight to later overweight and therefore to obese adult. It has been suggested that genes play an important role, parental obesity being a major risk factor for childhood obesity (17).

MATERIALS AND METHODS
In this study, the authors evaluated a group of patients admitted to the Iasi "St. Mary" Children Hospital in the interval 2008-2012. The aim was to investigate retrospectively the epidemiological dynamic of obesity, age-group distribution, and the main risk factors involved in its occurrence.

RESULTS AND DISCUSSION
The study showed an annual increase in the incidence of obesity; thus, during the 52-month study interval, 146 new cases of obesity were detected. (fig. 3). Most children were from urban areas (77%) and 58 patients had first degree relatives with obesity. Age-distribution of the cases revealed a high obesity rate in teenagers (one third of the cases), with long-term severe consequences, followed by school-age and preschool children (8% of the study patients were obese infants) (fig. 4).

Most study children were from urban areas (71%), with some well-known predisposing factors: less strict meal plan, access to "fast food", large amounts of refined sugar consumption, and reduced
levels of physical activity. By contrast, rural area children had a more balanced diet, with a higher intake of fresh fruits and vegetables, along with more types of physical activity, (residential houses with a backyard, household and farming activities, entertaining activities).

History of the first year of life showed that one third of the children were not breastfed, and 15% were breastfed for a short period of time, because of low milk supply, early resumption of professional activity, appetite and satisfying weight gain after baby food diversification (fig. 5).

Fig. 3. Number of new obesity cases in the study children

Fig. 4. Distribution of obesity in the study children

Fig. 5. Nutrition in infancy.
CONCLUSIONS

Childhood and juvenile obesity remain an important medical and social problem worldwide, sadly an ignored reality. The major risk factors are food behavior, poor breakfast, heavy dinner, low fiber diet, lack of exercise. The onset is earlier and more obvious for overweight, as breastfeeding duration is shorter, so young mothers should be encouraged to breastfeed for a longer period despite some minor inconveniences. The higher the prevalence of obesity in the general population, the higher the health system costs. Implementation of prevention and curative measures will have a major impact on this epidemiological phenomenon and expansion of obesity worldwide.

REFERENCES