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ZLATIBOR

PEDIATRIC ASSOCIATION OF SERBIA

PROJECT
OF
"PREVENTION AND TREATMENT OF
OBESITY IN CHILDREN AND ADOLESCENTS
IN SERBIA"

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1. INTRODUCTORY REMARKS

„Societies which do not invest in health and development of children and adolescents today, are condemned to self-destruction in the future.“¹ Namely, the health of the young population does not have solely a great medical importance for a community, but also a remarkable economic and social, as well as crucial demographic impact on the future of any country.

The Regional Office of the World Health Organization (WHO) for Europe adopted in 2005 the *European Strategy for Child and Adolescent Health and Development*². The maintenance and promotion of health of adolescents, as a population group, has been emphasized in the Strategy and listed as one of the seven priority fields of activities of the healthcare systems in countries of the European region. In the structure of "new morbidity" of the young population in modern societies, obesity is, besides disorders of the reproductive health, drug abuse, injuries and violence, the leading cause of morbidity and mortality of adolescents. The epidemic of overweight and obesity is affecting up to 30% of the young population in some of the countries of the European region.

Obesity is in the structure of morbidity and mortality of children and adolescents in the Republic of Serbia growing into a major problem, the solving of which requires an urgent, overall and long-term programme of multidisciplinary measures and activities. Besides the health sector, such a programme should involve adolescents themselves, their parents and family and, given the complex ethiopathogenetic basis of this modern health disorder of the youth, both the education system and the system of social care of children and youth should be involved as well. The role and activities of the media, international (UNICEF) and non-governmental organizations, pharmaceutical industry and other subjects of the market economy are essential. Given the social and demographic importance of the youth population, the participation of relevant ministries and institutions in the sectors of health, culture, sports, youth, army and others are necessary.

¹ *An Appeal on Behalf of Children and Adolescents in Europe*, General Assembly of the UNEPSA, Rome, 28 September 2006

² *European Strategy for Child and Adolescent Health and Development*, WHO Regional Office for Europe, 2005

The role of the health sector in the prevention and treatment of obesity in children and adolescents, a socio-medical problem spreading into an epidemic in modern culture, is complex and essential. It includes promotion activities, education of different target groups (youth, parents, healthcare providers, media), providing of necessary diagnostic and therapeutic services to obese children and adolescents, as well as the leading role in the integration of activities of the health sector and of other systems and subjects into a unique multidisciplinary programme of health and social care of the youth population. In the prevention and treatment of obesity in children and adolescents, the health system can fulfill its professional obligations in our environment in the best way through the cooperation of the primary, secondary and tertiary level of pediatric care, of specialized centres for rehabilitation, centres of sports medicine and others.

The task that the physicians, other healthcare providers and all participants of this multidisciplinary programme are faced with is much more complex and difficult than it looks at first sight. Namely, youth health disorders belonging to the category of so called "new morbidity" are, besides significant hereditary and developmental etiologic factors, first of all, an expression of the modern materialistic culture, based on the dominance of profit as the basic economic mechanism in modern society. In a culture governed by alienation, egoism and individualism, sudden decomposition of the traditional family, children and adolescents grabbed by stormy puberty and youth are the ideal target group of marketing challenges and other illusions of the modern era. In spite of such a negative social environment, it is indispensable to make every personal and collective effort in order to preserve the family and its beneficial influence and protection of the young human being in course of its development and to encourage the restoration of universal moral norms and faith in the meaning and sanctity of life. After all, these noble goals have always been, since the very origin of medicine and all over time, a part of the professional and ethic codex of true followers of Hippocrates' oath.

I

1. DEMOGRAPHIC AND EPIDEMIOLOGIC DATA

The prevalence of obese children and adolescents is on the rise, both in developed and in developing countries. The increase in prevalence of obesity in children is particularly marked in economic developed countries of North America and Europe, that is amounts to 0,5% to 1% per year over the last two decades ⁽¹⁾. It is estimated that 10% out of the total number of school-aged children world-wide are overweight, out of which one quarter are obese ^(1,2,3). Experience from the USA show that, along with the increase in prevalence, obese children are affected by a more and more severe level of obesity ⁽⁴⁾.

Around 7% of world population is obese, while the number of overweight people is two to three times higher. It is estimated that the USA had 20% of obese adults (BMI ≥ 30 kg/m²) in 2000, while predictions for 2015 are 30% and 40% for 2025, respectively ⁽⁵⁾. In our country, according to data from 2000, 54% out of the total number of adults are overweight, while 36.7% out of that number are in the category of „at risk of obesity" and 17,3% in the category of obese ⁽⁶⁾.

Obesity in childhood has reached an epidemic scale in all industrialized countries. The highest rate of increase in obesity in children and adolescents has been reported in the USA (Table 1). Since 1960, the incidence of obesity in children aged 6-11 years increased by 54% and almost 40% in adolescents aged 12-17 years ^(2,8). Although the differences in prevalence of obesity among some countries and nations are significant, an increased frequency of obesity and associated metabolic complications are also reported in developing countries. The highest prevalence of obesity is reported in countries of the Middle East – 7%, North Africa – 8% and Latin America and Carraibes 4,5-7% ⁽³⁾.

The findings of the Bogalusa Heart Study (addressing the onset and development of cardiovascular diseases) show that the number of children with body mass index (BMI) above the 85th percentile has increased by 22% in the 1990 survey as compared to the number of children in the same category in a similar survey conducted in 1980. In addition, few changes occurred in the cohorts of children with BMI lesser than the 50th percentile, while a significant increase of BMI is reported in the children cohort with a

BMI above the 50th percentile. The conclusion of the study is that obese children become more obese over time ⁽⁴⁾.

Table 1. Global increase in prevalence of obesity in childhood ⁽³⁾					
Country	Criteria for obesity	Period of monitoring	Age group	Prevalence Increase	
				%	Index*
USA	BMI >P95	1971 – 1999	6 – 11	4 → 13	3,3
			12 – 19	6 → 14	2,3
England	BMI >30 kg/m ² adjusted to age	1984 – 1994	4 – 11	Boys 0,6 → 1,7	2,8
				Girls 1,3 → 2,6	2,0
Scotland	BMI >30 kg/m ² adjusted to age	1984 – 1994	4 – 11	Boys 0,9 → 2,1	2,3
				Girls 1,8 → 3,2	1,8
Japan	Weight >120% of standard	1970 – 1996	10	Boys <4 → 10	2,5
				Girls 4 → 9	2,3
Morocco	BM >2 SD	1987 – 1992	0 – 5	2,7 → 6,8	2,5
Ghana	Weight for height >2 SD	1988 – 1994	0 – 3	0,5 → 1,9	3,8
Egypt	Weight for height >2 SD	1978 – 1996	0 – 5	2,2 → 8,6	3,9
China	ITM >25 kg/m ² adjusted to age	1991 – 1997	6 – 9	10,5 → 11,3	1,1
			10 – 18	4,5 → 6,2	1,4

*Index = prevalence increase

Several studies indicate that the frequency of obesity in European countries has been continuously increasing over the last two to three decades^(9,10). The highest prevalence of overweight or obesity has been registered in Southern European countries, particularly in Spain (27% of children and adolescents), Italy (36% of children aged 9 years) and Greece (26% of boys, i.e. 19% of girls aged 6 – 17 years). The prevalence of overweight and obesity in countries of Northern Europe is somewhat lesser; 20% of children in Great Britain, 18% of children aged 10 years in Sweden and 13% of children in Finland ^(10, 11). Based on the results of a regional study, the frequency of obesity in children and adolescents in our country is estimated to be somewhat lesser than in other compared countries in Southern Europe ⁽¹⁰⁾. Causes for mentioned differences between northern and southern countries in Europe are not clear. These differences may not be

attributed to genetic factors since they are registered within the limits of one country as is the case in Italy ⁽¹²⁾.

The prevalence of overweight is higher in developed countries among people with higher poverty rate, while it is higher in wealthier segments of population in developing countries. In industrialized countries, children from lower socio-economic groups are at the highest risk of obesity. On the contrary, developing countries show a higher frequency of obesity in wealthier population groups, as well as in urban as compared to rural population ⁽¹³⁾.

Considering the fact that obesity is associated with a much higher frequency of a range of health problems in comparison to persons with normal body mass, the World Health Organization (WHO) designates obesity as one of the major issues of the public health ⁽¹⁴⁾.

2. ETHIOPATHOGENETIC FACTORS

The body mass is regulated by many physiological mechanisms which maintain the balance between the intake and output of energy. These regulation systems are, under normal conditions of nutrition, so precise that a positive energetic balance of only 500 kJ (120 kcal) per day (corresponds approximately to one glass of sweetened fruit juice) can cause an increase in body mass of five kilograms over a period of ten years. Therefore, any factor which even in a small amount increases energy intake or reduces energy expenditure can lead to obesity over a long period of time ⁽⁶⁾.

Obesity is caused by the imbalance between intake (calories from food) and expenditure of energy (calories indispensable for basal metabolism and physical activity). Although genetic factors have a great impact on individual predisposition for the development of obesity, it is quite clear that they can not change in a period of time lesser than one generation. That leads to the conclusion that the modern epidemic of obesity in the world, within a genetic stable population, is primarily the outcome of changes in the society – first of all nutrition pattern and lifestyle (along with lacking research of impact of prenatal factors on growth and development). Obesity in childhood is most likely the outcome of interactions between genetical, biological, psychological, socio-cultural and environmental factors ^(3,15).

A. Factors of the social and cultural environment

The connection between socio-economic and cultural factors with obesity in children and adolescents has not yet been thoroughly investigated, but incontestably the changes that have spread all over the world and that we designate as “modernization” and “globalization” have substantially contributed to the increasing trend of obesity in mentioned population groups.

The industrialization and closely associated urbanization, as well as general economic, technical and technological progress have led to enormous changes in nutrition patterns (“nutrition transition”) and to reduced physical activity and energy expenditure. It should be noted that half of the world population live in urban areas: about 75% in developed countries (in Serbia as well), about 40% in transition countries and around one quarter in developing countries. The traditional rural nutrition pattern with the domination of complex carbohydrates and legumes, along with relatively small participation of fats and proteins of animal origin is quite different from today’s nutrition of urban population dominated by high-energy food with relatively high participation of fats and proteins of animal origin ⁽¹⁶⁾.

The centralization and globalization of mass media have a great impact on the generation of influence and pressure regarding the selection of particular pattern of nutrition or type of food. The global marketing and systematical influence of the gigantic corporations have a central place in the creation and modeling of nutrition habits and in globalization of food industry. The globalization of the market and of the mass media make the nutrition pattern prevailing in the culture of Western Europe and North America rapidly expand in other parts of the world. Food and nutrition, as part of general culture, are unrestrainedly changing toward a unified fast food pattern. Food supply has been oriented from local sources to supermarkets offering processed food instead of preparing and taking meals at home. More and more meals are taken out of home, in high-energy fast food stores or in restaurants where one portion often covers daily need in energy. Besides, snacking between meals is already a common thing in all age groups, thus a large percentage of school-aged children (more than 90% in England) take snacks between meals ⁽¹⁷⁾.

Mentioned changes in lifestyle and nutrition pattern are reflecting on children and adolescents. The global change towards the “Western” way of nutrition, together with an aggressive marketing, is affecting school-aged children the most. Children live in an social environment which stimulates obesity – they are surrounded by

supermarkets, fast food stores, vending machines with sugar-added beverages and an abundant and attractive display of sweets, pasta and chips which they often relish between meals or when viewing TV, video or computer.

The radical change in the structure and in the relations within the family in modern industrial culture, with models of nuclear or incomplete family, along with one or both working parents, has influenced the nutrition status of children. Obesity is more frequent in children from incomplete families or from families where both parents are working. On the contrary, it is less likely that the child will be obese if he is living with both parents having a higher education level, which is all linked with the selection of healthier food and eating habits ⁽⁸⁾. In present conditions when relatively cheap food is globally available, especially food with high energy content, household incomes have no determinant impact, therefore obesity in developed countries is more frequent in population groups with high rate of poverty.

Social acceptance and self-perception of obesity in children and adolescents, especially girls, can differ depending on racial, ethnical and cultural factors. For example, white girls are very concerned with their appearances and social acceptance of overweight and therefore they modify their nutrition pattern, while obesity in girls of black race is socially more acceptable, so they care less and their nutrition patterns incline towards excessive intake of food ⁽⁸⁾.

B. Obesity and nutrition

Changes in nutrition in modern society significantly contribute to obesity in childhood. The size of average food portions has more than doubled over the past two decades. The choice of food is strongly influenced by TV commercials. Even children eligible for free-priced meals in school, spend their money on favorite food items with high amount of fats. In order to gain extra incomes, schools authorize the setting of vending machines with juices, biscuits and chips ⁽¹⁸⁾.

Yet, findings of all epidemiological studies do not show any connection between increase in fat consumption and frequency of obesity in children and young adults. Whatsoever, the prevalence of obesity has significantly increased despite apparent reduction of fat participation in total intake of calories ⁽¹⁸⁾. Therefore, potential effects of other factors in nutrition require careful observation ^(19,20).

Reduced intake of fats is followed by compensatory increased consumption of carbohydrates, especially refined ones – bread, cereals, potatoes, sweetened drinks,

biscuits and cakes. High glycemic index of these food items makes the postprandial concentrations of glucose in blood jump and induces a range of associated hormonal events which stimulate hunger and cause excessive intake of food. Intake of food with high glycemic index is associated with the risk of central obesity, cardiovascular diseases and type 2 diabetes in adults. Sweetened beverages, because of the rapid increase in their consumption by children, require special attention ⁽²⁰⁾. At the opposite, it seems that milk which has a low glycemic index may protect overweight young adults from obesity.

C. Hereditary and developmental factors

Results of twins studies show the importance of hereditary factors in the occurrence of obesity; at least 50-70% of predisposition for obesity is hereditary ⁽²¹⁾. Also, BMI of adopted children show a correlation with the BMI of their biological parents and not with the BMI of adoptive parents. Recent research emphasize the contribution of the interaction between genes and environment in the onset of obesity ⁽²²⁾. Children with both obese parents are at the highest risk of becoming obese ⁽²¹⁾. This is likely to be associated with the influence of genetic factors or family nutrition habits and physical activity, with an indirect impact on the balance of energy in the child.

The discovery of leptine and of its receptors, as the first specific genetic factor with a function in body mass control, has encouraged in-depth research of obesity ⁽⁷⁾. This hormone, produced in adipocytes and secreted in quantities which are proportional to the total amount of fat in the body, is included in a complex mechanism of several different hormones and neurotransmitters controlling the appetite ⁽⁷⁾.

According to Whitaker and Dietze hypothesis (1998), fetal nutrition, more precisely prenatal hypernutrition, can cause a long-life risk of development of obesity ⁽²³⁾. Namely, overnutrition and maternal obesity cause abundant flow of nutritive substances through the placenta, which can lead to permanent changes of appetite, of neuroendocrine functions or of energy metabolism. Results of observational studies show a direct relationship between maternal obesity, higher body mass at birth and higher frequency of obesity in later course of life. Though, it is difficult to differentiate the relative contribution of maternal genes from intrauterine factors ⁽⁷⁾. Implications of these findings are serious – the obesity epidemic is likely to gain speed through successive generations independantly of other environmental factors, i.e. genetic factors ⁽¹⁵⁾.

Also, under-nutrition in important stages of fetal development, leading to intrauterine stagnation in growth and followed by „catch-up“ growth during childhood, can cause permanent physiological changes resulting in higher incidence of health disorders associated with insuline resistance such as obesity, type 2 diabetes mellitus and cardiovascular diseases in adulthood⁽²⁴⁾. Namely, changes in metabolic „programing“ may occur as the result of detrimental activity of environmental factors *in utero*, that is of development of the so-called thrifty phenotype. The hypothesis of the „thrifty phenotype“ assumes that under-nutrition determines the development and functional capacities of β -cells and insuline-sensitive tissues, resulting in occurence of insuline resistance, that is metabolic syndrome in later course of life ⁽²⁵⁾.

The hypothesis of the „thrifty genotype“ was exposed forty years ago in order to explain the present increase in obesity and type 2 diabetes mellitus. The hypothesis assumes that human species has survived due to natural selection of individuals able to create metabolic reserves which enabled survival during fasting periods. Permanent availability of food results in accumulation of fats in today human, and lack of fasting periods results in body mass increase, that is obesity ⁽²⁵⁾.

Data from experiments performed on laboratory animals suggest that eating disorders at early age, such as abundant artificial dairy food and early introduction of food rich in carbohydrates, can contribute to metabolic programing which leads to the development of obesity, diabetes and early cardiovascular diseases in human as well ⁽⁷⁾. Experience from Netherland whose population has suddenly been exposed to food deprivation during five months in winter of 1944-45 gives evidence that nutritive factors *in utero* have an impact on the metabolic phenotype at later age. In the cohort of children who had been exposed to food deprivation *in utero*, a higher prevalence of glucose intolerance and type 2 diabetes has been ascertained at later age as compared to the cohort of children from pregnancies before or after fasting ⁽²⁶⁾.

Mentioned facts point out that (1) the right time for the prevention of obesity may already be the period before the conception and (2) that the nutrition transition in developing countries increases the risk of childhood obesity.

The composition of food in early age is supposed to exert influence on amount of body fat later in childhood. Experience show that infants on artificial food have a higher risk of obesity in childhood than those who were breastfed ⁽²⁷⁾, that is breastfeeding may protect from occurence of obesity in childhood. The potential mechanism of this protective effect includes metabolic programing or early acquisition of „self-regulation“

in food intake. Infants bottle-fed before the age of three months consistently show a higher BMI and skinfold thickness in the course of early childhood than infants who were breastfed more than three months. However, all studies that have been investigating the protection role of breastfeeding conclude that other factors as well, such as the body weight of the mother and her socio-economic status have an important role in the development of obesity in childhood ⁽²⁸⁾.

During early childhood BMI is normally decreasing up to the age of 4-5 years and then begins to increase and keeps on increasing during adolescence. The renewed increase of BMI has been called „adiposity rebound“. Several studies have described an increased risk of obesity at later age in persons who have had an «adiposity rebound» at an earlier age than it was usual ⁽²⁹⁾.

D. Importance of physical activity and sports

Few past decades have brought marked changes in lifestyle worldwide, both in adults and in children, resulting in reduced physical activity and in increase of calorie intake. Today, children use cars, elevators and escalators instead of walking, running or jumping up the stairs ^(2,30). They spend much lesser time playing out of home or participating in school physical education ^(2,30). In most families both parents are working. Concerned with their out-door stay without parental supervision, parents ask them to spend time at home after they come from school. Instead of playing out-door in sports activities, children spend more and more time watching television and using computer. A direct connection between prevalence of obesity and average daily time spent viewing television has been ascertained ⁽³⁰⁾.

Obesity is more frequent in children and adolescents who view television daily, due to reduced energy expenditure and simultaneous intake of food with high caloric content. The largest number of children in elementary schools have hours of physical education 2-3 times per week, and the number of children participating in regular physical activity in their leisure time is lesser and lesser.

3. DEFINITION, CLINICAL FINDINGS, DIAGNOSIS, COMORBIDITY AND PROGNOSIS

The definition of obesity in childhood and adolescence is not simple because:

- (1) total amount of body fat depends on age, sex and developmental stage of puberty,
- (2) there is no simple and precise method of measurement of the total amount of body fat,
- (3) there are no clear criteria for the identification of obese children who are at risk for metabolic, cardiovascular and other complications, both in childhood and in adulthood ^(7,8).

Overweight and obesity are caused by excessive accumulation of fat in the body. In daily practice, the obesity rate is assessed by measurement of body mass and body height and the calculation of the Body mass index – BMI. Body mass index shows a satisfactory correlation rate with considerably more precise methods of measurement of the total amount of body fat, both in children and adults ^(1,5,7).

The total amount of body fat, as well as BMI are changing with growth. In the course of early childhood the percentage of body fat is decreasing, reaching its lowest level at the age of 2 to 5 years. At the age of around six years, the amount of body fat begins to increase („adiposity rebound“) and continues to increase during school age and adolescence. Girls in the course of adolescence have a considerably higher percentage of fat than boys ⁽³¹⁾.

The weight level of examined subjects may be estimated by entering the calculated BMI into a chart of growth of body mass index which is specific for the sex of an examined subject (Chart 1 and Chart 2 – Part I, Chapter 6; charts display a range of curves indicating specific percentiles). Table 2 shows cut-off values of percentiles on the basis of which the diagnosis of under-weight, overweight (at risk of obesity) or obesity is made as per European and USA criteria, respectively ^(1,7,8).

Table 2. Weight categories expressed as percentiles (P) of body mass index (kg/m ²)		
Weight Category	European Countries	USA
• Underweight	< P3	< P5
• Normal weight	P3 – P90	P5 – P85
• Overweight	> P90	> P85
• Obesity	> P97	> P95
• Severe (morbid) obesity	>P99 (≥3 SD)	

A BMI in adults between 25 and 29,9 kg/m² is defined as overweight, while persons with a BMI equal or higher than 30 kg/m² are classified as obese. On the basis of BMI cut-off values in adults, Cole and his collaborators⁽³²⁾ have calculated BMI cut-off values for the diagnosis of overweight, i.e. obesity in children and adolescents of both sex and for all ages from 2 – 18 years (Table 12 – Part I, Chapter 6).

In certain cases, BMI gives an inaccurate picture of overall adiposity, for example in short and muscular persons. Also, BMI does not help in differentiating development of subcutaneous from visceral (abdominal) fatness. Intraabdominal obesity is associated with a more frequent occurrence of metabolic syndrome and cardiovascular complications in adults and children^(1,33). Today, standard data for waist circumference in childhood are available for only a limited number of countries⁽³⁴⁾.

The measurement of skinfold thickness is a quick and simple method used in daily work and in large surveys which provide information on body fat distribution, as it is performed on several spots on the body^(1,7).

Table 3. Causes of obesity in childhood	
I. Frequent causes	Nutritional (exogenous) obesity Psychosocial causes
II. Rare causes	
Endocrine disorders	<ul style="list-style-type: none"> • Cushing's syndrome • Hypothyroidism • Growth hormone deficiency • Hyperinsulinism • Pseudohypoparathyroidism (Albright hereditary osteodystrophy)
CNS Disorders	<ul style="list-style-type: none"> • Hypothalamic tumor • Trauma • Brain surgery • Inflammatory sequelae (meningitis, encephalitis) • Chemotherapy sequelae
Drugs	<ul style="list-style-type: none"> • Glucocorticoid excess
Genetic syndromes	<ul style="list-style-type: none"> • Prader-Willi syndrome • Alstrom syndrome • Carpenter syndrome • Bardet-Biedl syndrome • Cohen syndrome

It is very important to differentiate primary (synonyms: idiopathic, exogenous or nutritional obesity) from rare forms of secondary obesity which are caused by genetic disorders, endocrine diseases, lesions of the central nervous system and iatrogenic causes ⁽⁷⁾.

Table 4. Clinical evaluation of obese child	
<p>Personal and family history</p> <p>A. Data on evolution of obesity</p> <ul style="list-style-type: none"> • Body weight at birth • Nutrition at early age • Age at the beginning of obesity • Gradual or sudden onset of obesity • Nutrition habits regarding number and composition of meals • Level of physical activity • School performance • Sleep troubles and daytime somnolence • Pain in hip or knee • Menstrual irregularities • Symptoms of hypothyroidism <p>B. Evaluation of family risk (in first and second generation)</p> <ul style="list-style-type: none"> • Morbid obesity • Type 2 diabetes mellitus • Hypertension • Dyslipidemia • Polycystic ovarian syndrome • Cardiovascular diseases at early age (fifties or earlier) 	<p>Physical examination</p> <ul style="list-style-type: none"> • Measurement of body height, body weight, waist circumference and calculation of body mass index • Distribution of fat tissue – generalized obesity or mostly abdominal type of obesity • Measurement of blood pressure – using appropriately sized cuff, obligatory 2 times, in resting and standing position • Signs of dysmorphia – rare genetic obesity-related syndrome (Table 3) • Signs of hypothyroidism – short stature, goiter, yellowish skin, dry skin and hair • Signs of Cushing syndrome - striae, acne, teleangiectasis, hirsutism and signs of virilism • Acanthosis nigricans – brown-pigmented thickened skin on the neck, in the axillae or skin folds as non-specific sign of hyperinsulinism • Hirsutism • Acne

Nutritional (exogenous) obesity is the most frequent cause of obesity in childhood and adolescence. Morbid obesity, usually starting at early age, may be caused by monogenic disorders, different genetic syndromes, as well as by a range of other disorders such as hypothalamic tumors, other lesions of the brain and endocrine disorders (Table 3) ^(7,22). Nevertheless, all mentioned disorders can explain the cause of obesity in less than 5% of obese children ⁽³⁵⁾. Most of these causes of obesity can be recognized by clinical examination.

The initial evaluation of an overweight or obese child includes personal and family history and physical examination (Table 4).

Based on data from personal and family history and physical examination as well, it is possible to classify each obese child into one of the clinical types of obesity, displayed with their major characteristics in Table 8. (Part I, Chapter 4) ⁽³⁶⁾. Only after that, a plan of necessary laboratory tests should be made. Tests for the detection of insulin resistance (metabolic syndrome) are usually performed for obese children over the age of five years ⁽³⁶⁾. Tests for the evaluation of liver functions have to be considered in all obese children given the increasing frequency of „non-alcoholic fatty liver“ ⁽³⁷⁾.

Children with nutritional obesity are tall. However, that does not mean that all children will be tall in adult age, as obese children usually have an early puberty. Short stature is an indication of obesity within some of the mentioned genetic syndromes or hypothalamus-related causes among which the most frequent are Prader-Willi and Bardet-Biedl syndromes. The decreased growth speed associated with increase of body mass indicates an endocrine cause of obesity such as hypothyroidism, hypercortisolism or deficiency of growth hormone ⁽³⁸⁾. Clinical signs indicating that obesity is the consequence of a genetic syndrome are displayed in Table 5. ⁽³⁸⁾.

Table 5. Clinical signs indicating a genetic syndrome	
<ul style="list-style-type: none"> • Short stature • Severe permanent obesity • Onset of obesity at age below 2 years • Signs of dysmorphia • Microcephaly • Difficult learning 	<ul style="list-style-type: none"> • Hypotony • Hypogonadism • Eye abnormalities • Skeletal anomalies • Sensory neural deafness • Kidney anomalies • Heart anomalies

Obesity is associated with many serious health problems in childhood already (Table 6.) ⁽⁷⁾ and is an important early risk factor of total morbidity and mortality in adults ^(4,39)

Table 6. Obesity-related diseases and disorders in childhood and adolescence

<p>Psychosocial – psychiatric</p> <ul style="list-style-type: none">• Negative self-image• Social isolation• Self-aggression• Suicide• Promiscuity• Bulimie• Smoking• Enuresis <p>Cardiovascular and respiratory</p> <ul style="list-style-type: none">• Accelerated atherosclerosis• Hypertension• Hypoventilation• Sleep apnea and snoring• Reduced lung capacity	<p>Endocrine and gynecologic</p> <ul style="list-style-type: none">• Hiperinsulinemia• Insulin resistance• Precoce pubertety• Hyperandrogenism/polycystic ovaries• Dysmenorrhea <p>Metabolic</p> <ul style="list-style-type: none">• Dyslipidemia• Type 2 Diabetes mellitus <p>Orthopedic</p> <ul style="list-style-type: none">• Hip epiphysiolysis• Coxa vara• Blount disease• Legg-Calvé-Perthes disease <p>Other</p> <ul style="list-style-type: none">• Acanthosis nigricans• Striae
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Obesity in childhood and adolescence is followed by consequences affecting the cardiovascular system (hypercholesterolemia, dyslipidemia, hypertension)^(40,41), the endocrine system (hyperinsulinism, insulin resistance, glucose intolerance, type 2 diabetes mellitus, menstrual irregularities)^(42, 43) and mental health (depression, negative self-image)⁽⁴⁴⁾. In all obese adolescents, particularly in those with early beginning of type 2 diabetes in family history (less than 40 years of age), the physician should consider the probability of this disease, given the increase of its incidence and the risk of rapid occurrence of complications of diabetes in case of late establishing of diagnosis⁽⁴¹⁾. Besides the mentioned complications, obesity is associated with respiratory (asthma, obstructive sleep apnea), orthopedic (genua vara, hip epiphysiolysis) and gastrointestinal (steatohepatitis) complications^(39,40,45,46). Orthopedic troubles such as hip epiphysiolysis, Blount disease, as well as leg and backpain are relatively frequent. The polycystic ovarian syndrome manifests with menstrual irregularities (usually amenorrhea), hirsutism and acne⁽⁷⁾.

Psychological stress caused by social stigmatization of obese children can be a significant health issue. Psychosocial problems are without any doubt the most frequent,

thus the majority of children looking for physician's help suffers from violence (whether they are victims or aggressors), while the environment often consider them as being ill, unwitty and lazy. ^(44,47) Already at the age of five years, children can build up a negative self-image, while obese adolescents manifest loss of self-esteem accompanied by sadness, loneliness, nervousness and risky behavioural patterns.

Approximately 60-85% of obese school-aged children persist as obese in adulthood. The probability that the child aged four years will stay obese in adulthood amounts to 20% and for the obese adolescent even 80% ⁽⁴⁸⁾. It seems that obesity in childhood increases the risk of morbidity at later age whether it persists until adulthood or not ^(49, 50).

Obesity and metabolic syndrome. The latest epidemiologic data show that 4% of all adolescents and 30% of obese adolescents in the USA have the metabolic syndrome⁽⁵¹⁾. The prevalence of insulin resistance syndrome in children and adolescents with severe obesity amounts to 30-50% ^(51,52,53). Namely, it is well known that obesity in childhood is associated with greater frequency of dyslipidemia, glucose intolerance, type 2 diabetes and cardiovascular diseases in adulthood^(54,55). The findings of the Bogalusa Heart Study (USA) show that nearly 50% of obese adolescents have some of the components of the metabolic syndrome. In children and adolescents with a BMI above the 85th percentile for age and sex, the probability of presence of disorders in cholesterol concentration was 2,4 times, in LDL-cholesterol 3,0 times, in HDL-cholesterol 3,4 times, in triglycerides 7,1 times, and in blood pressure 4,5 times higher than in children with normal body mass ⁽⁴⁾. Characteristic lipid profile in blood includes hypertriglyceridemia, reduced concentration of cholesterol linked to high-density lipoproteins (HDL-cholesterol), i.e. elevated level of cholesterol linked to low-density lipoproteins (LDL-cholesterol).

In spite of the mentioned, it is necessary to point out that insulin resistance is not a universal phenomenon even in the children who are overweight at early age ^(51,56). Namely, in some children with extreme type of obesity there is not even one sign of insulin resistance syndrome nor signs indicating direct risk of development of type 2 diabetes. The risk of insulin resistance increases in puberty when sex and ethnic differences regarding insulin-sensitivity of tissues become more manifested. It is assumed that the risk rate of development of insulin resistance syndrome is also significantly influenced by differences in prenatal and postnatal growth speed, that is

weight gain which is particularly marked in children born with low, i.e. high body mass (52,53).

Obesity and type 2 diabetes mellitus. Until recently, type 2 diabetes mellitus has been considered as an adults' disease. The increase in frequency of this disease has been recorded over the past 10-20 years in adolescents as well, which is most often attributed to the increase in prevalence and severity of obesity (57).

In populations with low prevalence in diabetes, obese children are relatively protected from this type of diabetes. Such example is found in the survey of 710 obese children and adolescents conducted in Italy, where type 2 diabetes was detected in only 0,2% and the glucose intolerance in 4,5% (58). A much higher frequency of glucose intolerance, that is type 2 diabetes in obese children and adolescents in other parts of the world reflects, first of all, genetic differences, as well as differences in lifestyle among different populations and countries (59,60,61). Hence, this type of diabetes is particularly frequent in populations of Indian, black, Mexican and South-Asian origin, although increased frequency is being recorded in white adolescents as well (60,61). The increase in frequency of this type of diabetes is also described in other countries worldwide - Japan, Libia, Bangladesh, Australia and Canada (64).

A particular mystery is the frequency of pre-diabetes state, that is insulin resistance and glucose intolerance in children and adolescents with severe obesity. In a study published in the USA in 2002, 25% out of 55 obese children and 21% out of 112 obese adolescents had glucose intolerance, and 4% of examined subjects had type 2 diabetes (60). However, in obese children in Great Britain, the frequency of glucose intolerance was only around 11%, while no examined subject had type 2 diabetes (61). Results of earlier studies also indicate that the issue of glucose intolerance among obese children is not a new phenomenon, but it becomes more obvious due to higher awareness and screening measures (55).

Type 2 diabetes is a complex metabolic disorder of heterogenous etiology which is the result of complex interaction of genetic and environmental factors, both in youth and in adults (65). Recent increase in prevalence of diabetes occurred in a too short period of time to be attributed to the increased frequency of genetic disorders. Therefore, in the development of type 2 diabetes it is necessary to emphasize the importance of social factors, lifestyle and environmental factors which probably unveil the effects of genetic predisposition (64).

However, it is known that not all obese persons develop glucose intolerance, that is type 2 diabetes. Major factors leading to development of type 2 diabetes solely in certain obese persons are not yet known. Particularly significant among these factors are familial, ethnic and gender predispositions, diabetes of the mother during pregnancy, low that is high body mass at birth, puberty, nutrition and insufficient physical activity^(55,64).

Familial predisposition for this disease is particularly marked, which indicates the importance of family history in the evaluation of risk for this disease. Namely, 74% to 100% of obese children and adolescents with type 2 diabetes have relatives in the first and second generation with the same type of disease.

It is likely that puberty plays a significant role in the development of type 2 diabetes⁽⁵⁵⁾. In youth, it is much more frequent in girls than in boys – one study has shown that 80% of adolescents with this type of disease were girls⁽⁶⁶⁾. It is acknowledged that girls have in average 26% more subcutaneous fat than boys, which may contribute to relative insulin resistance in female population⁽⁶⁴⁾.

Type 2 diabetes is usually detected at 12-16 years of age. A positive family history of the same type of diabetes is a frequent finding in these adolescents. They are almost always obese with a BMI ranging from 26 to 38 kg/m², that is above the 85th percentile in the majority⁽⁶³⁾. Acanthosis nigricans (recognized by velvety hyperpigmented thickened patches, most frequently on back neck, in the armpits, groins, on elbows and knees and considered as a clinical sign of hyperinsulinemia) is found in 70% to 90% of children with type 2 diabetes⁽⁶⁷⁾. Also, other known risk factors for cardiovascular diseases are often found - the prevalence of high blood pressure varies in the range of 17% to 32%⁽⁶⁶⁾, and of hypertriglyceridemia from 4% to 32%⁽⁶³⁾. According to one study, in 6% of examined subjects with diabetes, sleep apnea has been clinically diagnosed⁽⁶⁴⁾.

Although obesity is frequently associated with insulin resistance, glucose intolerance and type 2 diabetes are still today rare diseases in children and adolescents. Therefore, examinations aimed at detection of disorders of glucose metabolism and other characteristic disorders for the insulin resistance syndrome are recommended to children and adolescents who have a higher risk of type 2 diabetes, that is who are⁽⁶⁵⁾ : (1) overweight or obese; (2) have type 2 diabetes in family history; (3) have a predisposition based on racial or ethnic origin (Indian-American, African-American, Hispanic-American and others); (4) have signs or conditions associated with insulin

resistance (e.g. acanthosis nigricans, hypertension, dyslipidemia, polycystic ovarian syndrome) (Table7.).

Table 7. Criteria and methods of early detection of children and adolescents with type 2 diabetes
<ul style="list-style-type: none"> • Criteria <ol style="list-style-type: none"> 1. Obesity <ul style="list-style-type: none"> • BMI >85th percentile for age and sex • BM >120% of ideal weight for height <p style="text-align: center;">Plus any of 2 mentioned risk factors</p> <ol style="list-style-type: none"> 2. Type 2 diabetes in relatives of 1st and 2nd degree 3. Acanthosis nigricans 4. Hypertension 5. Dyslipidemia 6. Polycystic ovarian syndrome (PCOS) • Age 10 years, or at the begining of puberty (if occurs at earlier age) • Frequency Every 2 years • Test Fasting glycemia or OGTT (oral glucose tolerance test)

Obesity and cardiovascular disorders. Obesity in children and adolescents is connected to a range of known risk factors of development of atherosclerotic cardiovascular disease, particularly in boys in course of adolescence and in young men (68,69,70). Major risk factors of atherosclerosis belonging to insulin resistance syndrome are: hypertension, dyslipidemia, chronic inflammation, increased tendency of blood coagulation, endothelial dysfunction and hyperinsulinemia. Some of these factors are found in children at age of 5 years, already (71). In adolescents and young adults who have died of injuries, asymptomatic coronary atherosclerosis was more expressed in obese ones. Data of the Framingham Heart Study have showed that the incidence of cardiovascular diseases increases along with the increase of body mass, both in men and women (72). These findings associated with present increase in prevalence of obesity in childhood indicate a possible increase in incidence of cardiovascular diseases in adults in the forthcoming period.

In already mentioned Bogalusa Heart Study, which was investigating risk factors for cardiovascular diseases in young population, findings showed that children with BMI above the 85th percentile, as compared to persons with normal BM, are more likely to have dyslipidemia and elevated blood pressure ⁽⁴⁾. In addition, obese children had elevated levels of hemostatics and inflammatory factors including fibrinogen, inhibitor of plasminogen 1 activation and C-reactive protein ⁽⁵⁵⁾. A full clinical expression of dyslipidemia, hypertension and diabetes generally occurs in middle to late adulthood and is related to a combination of genetic and environmental, i.e. lifestyle factors ⁽⁷³⁾.

The level of abdominal (visceral, central) obesity in childhood, as well as in adulthood, is a particular risk for the development of cardiovascular diseases ⁽⁷²⁾. Marked abdominal adiposity, evaluated on the basis of waist circumference or the waist-hip ratio, is closely connected with the frequency of disorders of lipids and lipoproteins, as well as with high blood pressure ^(4,74). The connection between the level of visceral adiposity and cardiovascular risk has also been ascertained by modern methods, such as ultrasonography or magnetic resonance imaging (MRI) ^(55,75). Recent research of youth population in Great Britain has indicated that the waist circumference has increased more rapidly than BMI over the past two decades ⁽⁷⁴⁾.

There are numerous similarities in causes and pathogenesis of type 2 diabetes and early cardiovascular disease in obese children and obese adults. The onset of type 2 diabetes in childhood and adolescence is a risk for the development of macrovascular (ischaemic heart diseases, cerebrovascular accident, extremity amputation) and microvascular (kidney failure, blindness) complications. Early occurrence of this type of diabetes suggests that these patients are at risk of cardiovascular disease at an earlier age than it is usual. In case that the secular trend of increase in prevalence and severity of obesity in childhood and adolescence persists, this is likely to make the issue of type 2 diabetes in pediatric age group even more significant.

4. LABORATORY DIAGNOSIS

Direct measurement of body fat amount using expensive and complex methods (hydrodensitometry, bioelectrical impedance, dual energy x-ray absorptiometry – DEXA) or the evaluation of fat tissue thickness by magnetic resonance imaging (MRI), i.e. computed tomography (CT) is being used in research studies or in rare clinical

indications ⁽⁷⁾. Mentioned methods may be used as „gold standard“ in the assessment of the value of anthropometric indicators of body adiposity ⁽¹⁾.

In obese children, and in accordance with findings of the clinical exam, certain laboratory tests have to be made for the detection of the most frequent associated disorders as per order shown in Table 8.

Table 8. Laboratory tests in children with different clinical types of obesity	
A. Simple obesity without symptoms or signs of secondary obesity or complications of obesity	<p>Blood samples are obligatory taken after night fasting!</p> <ul style="list-style-type: none"> • Glycemia • Insulinemia • Lipids - total and HDL-cholesterol, triglycerides • Liver function tests (bilirubin and SGPT)
B. Obesity with family history of type 2 diabetes mellitus or with marked abdominal obesity or acanthosis nigricans	<p>Analysis planned under A plus:</p> <ul style="list-style-type: none"> • Oral glucose tolerance test
C. Extreme obesity (BMI $\geq 3,0$ SD)	<p>Blood analysis under B plus:</p> <ul style="list-style-type: none"> • DNK analysis for known monogene types of obesity
D. Secondary obesity suspected	<p>Blood analysis under B plus:</p> <ul style="list-style-type: none"> • Karyotype • Cortisol at 8 and 23 h (or at 24 h) • Thyroid function tests (TSH, T4)

5. PREVENTION AND THERAPEUTIC CHOICES

A. Prevention of obesity

According to experience from numerous countries, the results of treatment are mainly not satisfying, which makes the significance of prevention measures of childhood and adolescence obesity even more increase. However, successful methods of prevention have not been developed yet ^(1,76).

A nutrition adapted to optimal energy needs represents the basis of the prevention of obesity and related complications. The respect of principles of healthy nutrition from early childhood, besides providing adequate growth, development and nutrition, leads to

the acquisition of appropriate habits which in most cases become permanent. Thus established habits have an essential significance, not only for a healthy, high-quality and long life but also for the prevention of obesity and other conditions affecting the modern human being ⁽⁷⁷⁾.

Table 9. Optimal daily energy needs of child*	
Age	kCal/kg
• 0,0-0,5	108
• 0,5-1,0	98
• 1-3	102
• 4-6	90
• 7-10	70
Boys	
• 11 – 14	55
• 15 – 18	45
Girls	
• 11 – 14	47
• 15 – 18	40

* with low-intensity or moderate-intensity activity; coefficient of variation $\pm 20\%$ ⁽⁷⁸⁾

Healthy eating means optimal intake of all necessary factors which are, as per their presence, classified as macronutrients and micronutrients. Macronutrients are proteins, fats, carbohydrates and water. Micronutrients include electrolytes, microelements and vitamins.

Proteins are primarily building substances and in normal diet they participate with 10-15% out of the total caloric value of food. These nutrients, i.e. amino acids as a product of their hydrolysis, enter in the composition of different structural and functional proteins in the body and are catabolized only in state of excessive intake or extreme fasting. Proteins provide intake of 20 different amino acids classified as essential and non-essential. Essential amino acids have to be taken from food, while non-essential are synthesized in the liver out of their precursors. Fats and carbohydrates are primarily a source of energy. Optimal daily needs are shown in Table 9 ⁽⁷⁸⁾. Besides their energetic value, fats are important as structural and functional factors of the body. During the first 2-3 years from birth, fats have to participate with 40-50% in total caloric value of food, and later up to 30% ^(79,80). More than 98% of fats are composed of triglycerides and the rest of phospholipides, cholesterolides, mono and diglycerides and others. Maximum 10% out of total calories taken from food have to belong to saturated

fatty acids and the rest to unsaturated fatty acids (Table 10). Essential fatty acids (linolic and alpha-linoleinic) belong to the group of unsaturated fatty acids and they are mainly used in the synthesis of long-chained poly-unsaturated fatty acids (n-3 and n-6 LCPUFA). According to present recommendations, essential fatty acids should participate in optimal diet with 3-10% in the total intake of calories ^(78,81,82). LCPUFA are precursors of eicosanoids (prostanoid, leucotrien, lipoxin) and phospholipids components of cellular and sub-cellular membranes, exceptionally important for the development of the central nervous system and the retine.

In the first 2-3 years from birth, carbohydrates should constitute 40-50% of total caloric value of food and later 55% ^(79,80). Besides their energy, carbohydrates are exceptionally important for the maintenance of metabolic balance in the body. These compounds, among other, provide a constant level of oxaloacetic acid which has a central role in adequate catabolism of fats. Nutrition with less than 10% of calories derived from carbohydrates leads to ketosis. The basic carbohydrate in infant's food is lactose, and in later age polysaccharides which are, anyway, a priority in a healthy eating.

Table 10. Basis of healthy eating of child aged $\geq 2-3$ years ⁽⁸⁰⁾	
Fats:	<ul style="list-style-type: none"> • Total fats: 30% calories • Saturated fatty acids: <10% calories • Essential fatty acids: 10% calories
Cholesterol:	<ul style="list-style-type: none"> • Below 300 mg daily (adults)
Carbohydrats:	<ul style="list-style-type: none"> • Total: 55% calories • Primarily polysaccharides • Lot of fiber
Salt:	<ul style="list-style-type: none"> • Low intake of natrium

Although there is no absolute consensus, many research indicate that healthy diet, that is prevention of obesity in early age, substantially reduces the risk of obesity in later age, including adulthood ⁽⁸³⁾. This is related, first of all, to the advantage of infant breastfeeding compared to adapted milk formulas, as well as to early introduction of non-dairy food, especially the one with excessive amount of polysaccharides and sugar ⁽⁸¹⁾. Taking care of healthy diet continues later in childhood, but besides avoiding excessive intake of calories from fats and carbohydrates, the emphasis is on optimal intake of proteins and greater participation of food rich in fiber ^(81,84).

Besides healthy diet, favoring appropriate physical activity and avoiding activities with low energy expenditure have an essential role in the prevention of obesity ^(85,86). For this goal, recommendations for children above two years of age are 30 minutes of intensive or moderately-intensive physical activities daily or at least 20-30 minutes three times a week, while TV watching, use of computer and similar should be limited to two hours per day the most. A very important role in encouraging physical activities are programmes organized by pre-school institutions, schools and various sports facilities.

Besides mentioned measures, the treatment of the primary disorder is the basis of the prevention of secondary obesity. For example, psychologic disorders accompanied by excessive intake of food require a psychologic and psychiatric treatment, hypothyreosis require compensation of deficient thyroid hormone etc.

It is clear that the decrease in incidence of obesity in infant age does not impact significantly the incidence of obesity in childhood. Disregarding this, infants above age of 6 months gaining body mass above the average (BM >75th percentile), especially if this is not followed by corresponding linear growth, as well as infants of obese parents should get diet recommendations along with regular monitoring of body mass ^(1,76).

Pre-school children should limit the intake of sugar, fried food, sugar-added fruit juices, soda-drinks and sweets. This is particularly important as obesity in many children occur between the first year of age and enrollment in school ⁽⁸⁷⁾.

It is well known that for long term success, it is indispensable to start the treatment at as early stage of development of obesity as possible. At the beginning, the excess of calories mainly leads to increase of adipocytes ("hypertrophic obesity"); when fat cells reach their highest volume, their number start to increase ("hyperplastic obesity"). This second level of obesity is much more difficult to treat ⁽⁸⁷⁾. Children should be encouraged to develop healthy diet habits and to involve into physical activities that are sufficient to prevent excessive progress of weight. This is particularly important for high-risk groups of children, that is children with obese parents or overweight children when they enrol in school⁽⁸⁷⁾.

Healthcare providers have to inform parents on potential risks of obesity and to provide instructions on prevention measures at early age. It is very important to detect, during the well-child examinations, children who are susceptible or already developing obesity. These children require appropriate recommendations regarding diet, as well as monitoring of their weight in intervals that are shorter than for regular exams. School-

based programmes of physical activities may have a significant role in preventing or stopping the progress of obesity.

B. Indication for treatment of obesity

Infant. After ceasing breastfeeding and introduction of various foods, infants often spontaneously reduce reserves of fat tissues. Certainly, this is due to greater physical activity in sitting and standing position. However, if the infant gains weight too rapidly, it is necessary to take his personal and family history and undertake corrections in case of excessive or inappropriate nutrition. This is especially important for children with obese parents.

In case of marked obesity in infant above age of six months, diet modifications have to ensure slower progress or maintenance of body weight. However, any limitation in nutrition, especially the one that is accompanied by weight loss, induces a risk of nutritional deficiency and delay of linear growth. Also, even the obese infant has to increase energy expenditure through increased physical activity. This can be realized by encouraging the infant to play in sitting position.

Main dietary interventions include elimination of sugar and fats, that is intake of sweets, chocolate and cakes between meals. Milk should be limited to half a liter per day. If the infant is not satisfied with the quantity, milk can be diluted with light tea or water. Some of the milk meals can be replaced by low-energy juices. Infants on "weight-loss" regimen should get supplements of A, C and D vitamins.

Children and adolescents. The essence in the treatment of obesity is the loss of body fat and, at the same time, the decrease of total body weight. It is obligatory in obese adolescents whose weight is above the expected one in adulthood⁽⁸⁸⁾. However, it is well known that boys becoming obese before the beginning of puberty, spontaneously loose excess of fat tissue in the period of accelerated growth in puberty, that is in the period of rapid development of muscular tissues. Some girls become moderately obese in menarche, but loose extra fat in late adolescence. Generally, prospect for successful treatment is much better in case that obesity is not long lasting or extreme.

C. Objectives of the therapy

The main objective in the treatment of obesity without complications in childhood is the **correction of eating habits** (introduction of "healthy food") and the **increase of**

physical activity, and not the “ideal body weight”. The therapy programme has to include informing the parents and children on possible complications and long-term risks of obesity. In the first place, present irregularities should be detected and parents should learn which food items to avoid⁽⁸⁷⁾.

A treatment of obesity without delay is necessary for children and adolescents with obesity-related complications (benign intracranial hypertension, sleep apnea, i.e. syndrome of obesity and hypoventilation, as well as mentioned orthopedic disorders). All of these disorders lead to severe morbidity. Children below two years of age and children with extreme obesity, even if without complications, should be referred to a pediatric centre where a multidisciplinary approach in the treatment can be provided^(1, 87,88).

Gradual reduction of body weight is necessary for children with mentioned obesity-related complications. Reduction of body weight is accompanied by the withdrawal of subjective troubles caused by overweight, such as intolerance of physical effort. This is very important as children and their parents become aware that the monitoring of weight contributes to the feeling of good health even without reaching the “ideal body weight”^(76,87,88).

When secondary complications are not present, the first step in the treatment of obesity in all children aged over 2 years is to **stop further rapid progressing**, i.e. **maintenance of attained body weight**. This goal can be attained with moderate interventions in nutrition and physical activity. The maintenance of attained body weight in child who is growing leads to gradual reduction of BMI, that is reduction of obesity level^(77,89).

In any case, parents and children first have to show that they are ready to maintain the weight. Only after that can the physician give additional recommendations for diet and physical activity in order to reduce body weight by around 0,5 kg per month. The long-term goal for all obese children is a permanent reduction of BMI to the levels below the 90th percentile.

D. General principles of treatment of obesity

The most important condition for a successful treatment of obesity is the **motivation of the child and its family**. In this regard, it is very useful **to explain the problem of obesity**. The majority of obese children can be treated as out-patients. A longer hospitalization is sometimes necessary in cases of extreme obesity, in order to

induce weight loss. Long-term results of hospital treatment are not better than in the case of out-patients therapy ^(87,88,89).

The key of treatment of obesity is a permanent change of energy balance through lifestyle modifications. They include modifications in nutrition and the increase in physical activity. The therapy of obese children and adolescents include modifications in lifestyle of all family members. The majority of adolescents prefer food with high amount of carbohydrates, sweetened drinks and limited selection of items. Recommendations for nutrition (Part I, Chapter 6) give detailed information on healthy eating and procedures to follow in order to avoid progressing of obesity and to provide a gradual reduction of weight. Children and youth should be encouraged to take meals at home and not in 'fast food' stores. Besides family members, the treatment programme should involve all persons who permanently or periodically take care of the child (pedagogue, teachers, grandparents), which is necessary for a long-term success ⁽⁹⁰⁾. The treatment is based on the introduction and adoption of permanent modifications in eating habits and physical activity.

Methodic, gradual and long-term modifications are much more effective than repeated and short-term efforts of weight loss. The physician should, at first, recommend only two or three specific modifications in eating habits or physical activity, and once he is ascertained that they are fully adopted he should undertake the introduction of additional recommendations ^(87,89). He should encourage and not only criticize; he should be continuously involved, more in the promotion of eating habits and increase in physical activity than in the reduction of weight.

The attitude of the parents toward the child is also very important. They should always offer the child the possibility to choose from two options which are useful, instead of offering useful ones on one side and undesirable ones on the other side (e.g. choice between apple or popcorns compared to choice between apple or cookie; or choice between playing in the yard or going in the parc, but not out-door play or viewing television). It is well known that the child, if in position to choose, will always choose the more attractive option ⁽⁹⁰⁾.

Adolescents often start smoking with the idea that they will more easily monitor their weight. It is well known that adults after quitting smoking gain 3-5 kg in weight. In any case, it is necessary to stop smoking as it increases the risk of obesity-related complications, such as hyperlipidemia and increase in visceral obesity.

E. Diet

A low-energy diet is the basic measure for the reduction of weight. According to some authors, it is better to start with a strict low-energy diet because the initial weight loss improves the child's motivation to continue with the treatment ⁽⁹⁰⁾. Girls in adolescence have sometimes difficulties to accomplish initial weight loss even with significant reduction of total daily intake of energy (regimen with 800 kCal). However, boys during the period of accelerated growth in puberty are usually able to maintain weight loss even with much greater intake (1200-1500 kCal per day). Requirements in energy for growth of boys in adolescence are so great that simple limitations such as ban of sugars, sweets and sweetened drinks with almost the same composition of main meals can still lead to weight loss ^(87,88).

The basic principle of diet for obese children and their families are intake of balanced meals which provide nutritive needs for the body to develop and grow. The total intake of fats should be limited to 30% the most out of the total caloric intake, proteins should participate with 15% and carbohydrates (primarily complex ones) with 55% or more.

The major form of dietetic treatment of obesity in childhood and adolescence is a **balanced low-caloric diet**. In this diet the total intake of calories is limited, but no food item or group of food items prevails in daily menu. The total reduction of energy intake amounts to one third out of the usual daily intake. **In order to attain recommended reduction of calorie intake, daily measuring and counting of the caloric value of food items is not necessary.** Recommended diet can be realized if general instructions, which include following measures are respected:

- To avoid eating high calorie food between meals. If child is hungry, *low-energy food* is allowed (carrots, raw celery, black coffee, low-caloric fruit juices, pop corns). Chewing gum should be avoided as the child gets used to have always a full mouth.
- To avoid adding sugar whenever it is possible. Cereals and beverages should be taken without sugar. Fruit compotes can be sweetened with artificial sweeteners (rather aspartam, diluted in warm water and added after cooking).
- It is necessary to reduce intake of all fats (pork lard, bacon, smoked and dry-cured meat, raw sausages, butter, margarine, oils). All kinds of fats have an

equal energy amount of around 9 kCal per gram. Meat should be cooked, roasted on the grill or in aluminium foil, but not fried on oil or lard. Salads should be taken without oil or dressings (mayonaise). It should be noted that vegetable oils exposed to heat (cooked or fried) have no advantage over animal fats regarding the amount of unsaturated fatty acids.

- The goal is to get the feeling of satiety with the least energy intake. In this regard, dark bread is better than white bread. Whole bread and other food with high content of fiber (grains, vegetables) slow the absorption of food and likely contribute to weight loss, although there is no strong evidence for that.
- The intake of bread, pasta, potatoes (especially fried and chips) and other starches should be limited. Three thin slices of bread daily are sufficient for most children. Half liter of skim milk provides sufficient intake of calcium.
- Intake of green and coloured vegetables should be encouraged. Generally, increased intake of fruits, vegetables, whole grains (food containing fiber) and dairy products derived from skim milk reduce the intake of fats in the diet.

Diet modifications should be permanent. The reduction or elimination of specific food may reduce calorie intake without creating a feeling of hunger or depression. For example, elimination from daily diet of only one or two high-calorie food items, such as chips, ice-cream or fried food leads only to a very small caloric deficit. However, even such a small caloric deficit can lead to a considerable weight loss over a long period of time. A lack of only 100 calories (kCal) daily theoretically can lead to a 5 kg weight loss in one year.

F. Physical activity

Physical activity helps in weight loss by increasing the expenditure of energy. It is important that children and parents understand that movement includes both walking and bicycle riding. Exercising with equipment at home is rarely sufficiently practiced to impact on weight loss. Many children spontaneously become more active when they lose weight. Sometimes increased physical activity does not lead to weight loss because the loss of fat reserves is connected with the increase of muscular tissue. Muscular activity has a positive effect in the process of weight loss, as it increases insulin sensitivity and reduces lipogenesis. Finally, physical activity reduces the appetite although there is no evidence that it is the case in obese persons⁽⁸⁷⁾.

The time spent in sedentary activities should be limited and regular physical activity introduced (walking, biking, swimming, etc). It is mandatory for a young person

to spend 30-60 minutes five days a week in exercises which intensively engage larger groups of skeletal muscles.

G. Psychologic support

Frequent visits to the physician are useful for the purpose of education aiming at adequate diet and physical activity. Such support is most often sufficient for the majority of children.

H. Other measures

Drugs have no great significance in the treatment of obesity. Experience with their use is limited in the treatment of children obesity. If used, drug therapy should be in accordance with above mentioned recommendations.

There are some known surgery techniques used in the treatment of obesity which aim at limiting the intake, that is absorption of food. They are not significant in childhood age because they are invasive and mutilant and are any more effective than adequate diet.

I. Complications occurring in the course of treatment

After sudden weight loss in adults and adolescents, occurrence of gallbladder calculus is registered. A second potential risk is an unadequate nutritive intake for a growing and developing child or adolescent. This risk may be reduced by the reduction of calorie intake through the elimination of high-calorie food and by supporting a balanced diet. It is known that growth rate can be slowed during the weight loss period. Though, most obese children are taller than is the average for age, so the impact on height of this slowing down in adulthood may be neglected. Also, during weight loss, there may be occurrence of loss of lean body mass, i.e. muscles, especially if diet is lacking in proteins of animal origin. Weight-loss programmes may cause psychologic and emotional problems⁽⁸⁷⁾.

Given that obesity is a chronic disorder, undertaking of mentioned measures in diet and physical activity is necessary throughout life and both parents and children have to take care more actively. Regular visits to the physician in charge are recommended to parents and child even when the goal of weight reduction is reached⁽⁸⁷⁾.

According to present knowledge, it is obvious that lifestyle changes and maintenance of normal weight in childhood may reduce the risk of development of

insulin resistance syndrome, type 2 diabetes and cardiovascular diseases in adulthood⁽⁷³⁾. The reduction of obesity level in childhood leads to a reduction of hyperinsulinemia and blood pressure level and improvement of lipid abnormalities⁽⁹¹⁾. Studies in adults have shown that a weight loss of 10 to 15% which has been maintained over a longer period is connected with permanent reduction of risk of cardiovascular diseases⁽⁷³⁾.

DIETARY RECOMMENDATIONS FOR OVERWEIGHT AND OBESE CHILDREN AND ADOLESCENTS

Name, Surname: _____, Date of Birth _____.

Age: _____ years, BM: _____ kg, BH: _____ cm

Body Mass Index (BMI) = _____ kg/m² (BMI percentile for age and sex = _____)

Diagnosis of cause of obesity: _____

I – General recommendations

1. Recommended food !

- Dark, whole grain or rye bread – up to 4 slices daily (1 slice = 30 g)
- Cereals - oat, barley, millet, wheat germs
- Brown rice
- Vegetables – steamed or raw, in salads
- Fresh fruits – as part of a meal or as snack
- Skim milk (1,6% of milk fat), yogurt (1% of milk fat) – up to two cups, i.e. maximum ½ of a liter daily, cottage cheese
- Low-fat meats (fish, skinless poultry, veal) - cooked, grilled, cooked in teflon pan or in oven in foil
- Cold cuts - ham, roast, poultry
- Alternatives for meat – legumes (bean, lentils, peas, soya, chick peas)
- Eggs – 4 pcs per week
- Water, mineral water with lemon or unsweetened tea instead of juice
- Limited intake of oils (only one tablespoon daily)
- Limited intake of salt (do not add salt)
- Vegetable condiments - persil, dill, onion and garlic, mustard etc

2. Food to avoid !

- Sugars and all food containing sugar: cakes, sweets, chocolate, ice-cream, biscuits and similar food
- Fruit juices and sweetened soda drinks
- Pastries, pizza, flaky dough
- Snacks (crackers, chips, salty sticks)
- Fatty cheese, kaimak (Serbian sour cream), butter, sour cream
- Pork meat and lard, giblets, fatty meats, smoked and dry-cured meat
- Pâtés, mayonaise and canned products
- Panned and fried meat, browned flour and sauces in preparation of vegetables
- Walnut, almond, hazelnut, peanut and pumpkin seed – because of high caloric value and amount of fats
- All alcohol drinks

3. Number of meals and distribution of calories per meals

The total daily quantity of food should be distributed on 5-6 meals: breakfast, lunch, dinner and 2-3 snacks. It is recommended to distribute the total quantity of calories as follows:

- 30% for breakfast
- 10% for morning snack
- 30% for lunch
- 5% for afternoon snack
- 25% for dinner

4. Other important recommendations

- **Do not skip meals.** Regular meals influence satiety and stimulate metabolism and consequently expenditure of calories!
- **Meals should always be taken at home, and if possible with other family members.** Thus, mistakes in diet are avoided!
- **Avoid meals out of home, especially meals from fast food stores as they are high in calories.** Thus, excessive intake of calories of low nutritive value is avoided !

5. How to provide healthy eating which can satisfy needs in all nutrients, vitamins and minerals?

- Healthy eating is provided by daily intake of meals which contain food from all main groups according to Food Pyramid.

- The number of needed servings from specific food groups depends on total amount of calories needed daily. Recommended servings for each food group are showed in Table 11.

Table 11. Different daily needs in calories expressed as approximate number of servings from each food group according to Pyramid of healthy diet					
	Daily energy needs				
	1200 kcal	1400 kcal	1600 kcal	1800 kcal	2000 kcal
Food group	Number of servings				
Bread and cereals	5	6	9	10	11
Vegetables	3	3	4	5	5
Fruits	2	2	3	4	4
Milk	2-3	2-3	2-3	2-3	2-3
Meat	2	2	2	3	3

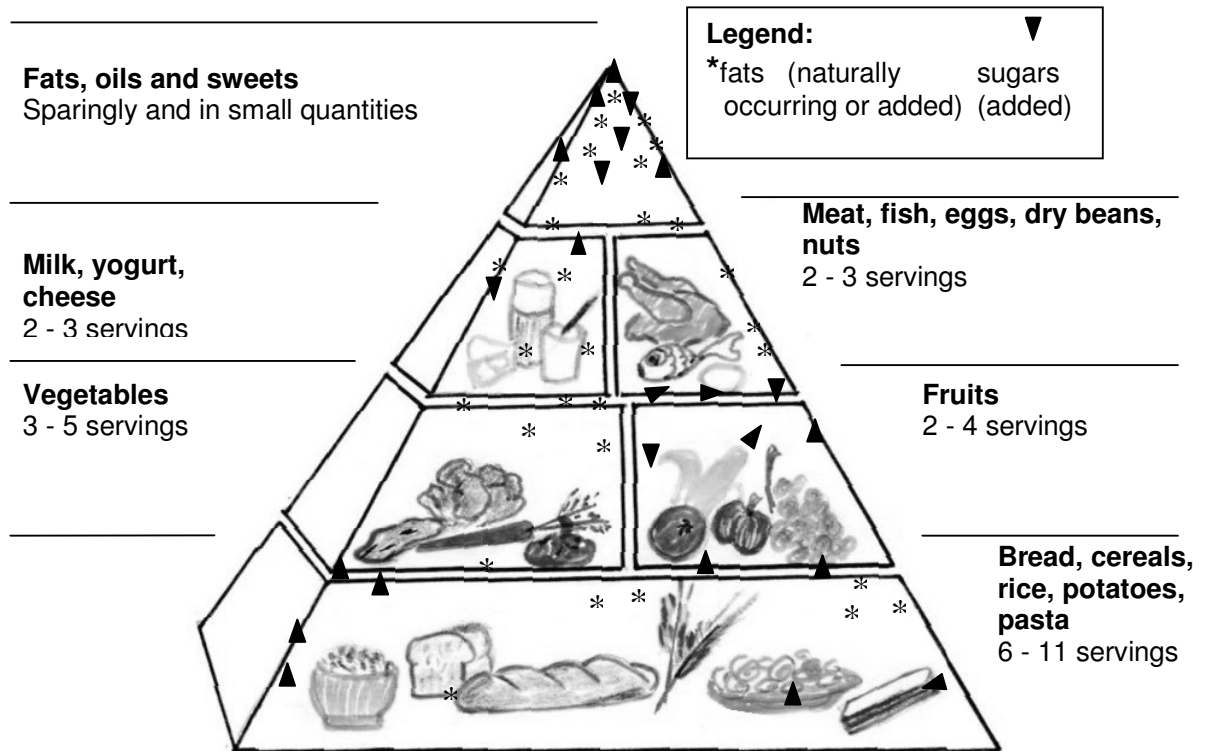
6. How to create a daily menu intended to prevent the development of obesity, i.e. provide gradual weight loss ?

- Recommended daily amount of calories is established by the physician and is mentioned in the part addressing Individual recommendations.

II – Individual recommendations

1. Recommended daily intake _____ kCal.
2. Recommended number of servings as per column _____ kCal in **Table 11**.
3. Weight measuring at home recommended each _____ day.
4. Regular exam in _____ months.
5. Don't forget regular, daily physical activity. You are recommended high-intensity walking of at least _____ minutes daily.
6. Television watching or computer games should be limited to maximum two hours daily
7. Other important recommendations:

Food pyramid – guide for a healthy daily menu



What makes one serving?

Bread, cereals, rice, pasta

- 1 slice of bread (30 g)
- ½ cup of cooked rice or pasta
- ½ cup of cooked cereals
- 30 g of ready-to-eat cereals

Vegetables

- ½ cup of chopped raw or cooked vegetables
- 1 cup of fresh leafy vegetables

Milk, yogurt, cheese

- 1 cup of milk or yogurt
- 45 - 60 g of cheese

Fruits

- 1 fruit or slice of melon
- ¾ cup of fruit
- ½ cup of canned fruit
- ¼ cup of dried fruit

Fats, oils and sweets

- **Limit intake** from this group if weight reduction is needed

Meat, beans, eggs

- 75-90 g of cooked unfatty meat, poultry or fish
- ½ cup of cooked beans or 1 egg

6. FACTS AND RECOMMENDATIONS

Classification of recommendations

Recommendations stated in this Project are evidence-based while adopted criteria have been mentioned in references ⁽⁹²⁾. Each recommendation is leveled by letters A, B, C, D depending on the strength of evidence that it is supporting. This sign √ has been used in cases when the authors wished to emphasize specific aspects of adopted clinical practice.

MANAGEMENT OF OBESITY IN CHILDREN AND YOUTH

Key messages

- **The frequency of obesity in children and adolescents is greater and greater.**
- **Obesity itself is a health issue and besides it increases the risk of development of other severe health disorders, such as high blood pressure, diabetes mellitus and psychologic disorders.**

Diagnosis of obesity

C Daily practice, in diagnosis and monitoring of obesity level in children and adolescents uses percentile values of **Body Mass Index – BMI**, which is calculated when body weight (BW) in kilograms is divided by the square of body height (BH) in meters.

$$\text{BMI} = - \frac{\text{Body Weight (kg)}}{\text{Body Height (m)}^2}$$

D **Body Mass Index (BMI) of obese children is $\geq 97^{\text{th}}$ percentile.**

√ **Body Mass Index (BMI) of overweight children is $\geq 90^{\text{th}}$ percentile**

A Values of Body Mass Index (BMI) are age- and sex-specific.

C BMI values displayed in Table 10 are internationally acceptable as they are calculated from data given for six countries from different continents and may be used to define overweight, i.e. obesity in children and adolescents.

✓ In each exam of obese child or adolescent, it is obligatory to measure body height (BH) and body weight (BW), waist circumference, to calculate body mass index (BMI) and enter values in chart with percentiles.

C Measurement of waist circumference is a good indicator of abdominal (visceral) obesity which is a particular risk of development of metabolic and cardiovascular complications of obesity. (At present, standard data for waist circumference in childhood and youth are available only for limited number of populations).

CAUSES OF OBESITY

A **The most frequent cause of obesity in childhood is primary or nutritional obesity.**

C The distinction between primary and rare secondary forms of obesity is based on detailed personal and family history, physical examination and laboratory tests.

IMPACT OF OBESITY ON CHILD

✓ Healthcare providers should be acquainted with relatively frequent existence of risk factors for coronary artery disease and atherosclerosis in children and adolescents which include:

- high blood pressure
- unfavorable lipid profile
- changes in left ventricular mass
- hyperinsulinemia

C Findings of numerous studies show that obesity has significant psychosocial consequences.

✓ Obese children and their families with signs of psychological disorders should be referred to psychologist for exam and treatment.

POTENTIAL IMPACT OF OBESITY ON HEALTH STATUS IN ADULTHOOD

- ✓
- **Prevention and treatment of obesity should start in childhood.**
 - **Parental obesity is a risk factor for obesity persistence in adulthood.**

Treatment of obesity

D Treatment should be considered only in following cases:

- **Obesity in child is established (BMI \geq 97th percentile)**
- **When child and parents are ready and willing to undertake necessary changes in lifestyle.**

✓ Major measures in treatment of obesity are modifications of lifestyle which include:

- increased physical activity
- reduced energy intake
- reduced sedentary behaviour

WEIGHT MAINTENANCE

D In majority of obese children (BMI \geq 97th percentile) **maintenance of weight is an acceptable goal.**

✓ The benefit of body weight maintenance should be periodically illustrated by displaying it in a chart of BMI percentile values.

D Maintenance or loss of weight can be attained only if permanently sticking to modifications of lifestyle such as:

- **healthy eating**
- **increase of usual physical activity (eg. high-intensity walking) up to minimum 30 minutes daily. Healthy children are recommended 60 minutes of moderately intensive physical activity daily.**
- **reduction of sedentary behaviour (e.g. watching television or playing computer games) to <2 hours daily in average or a total of 14 hours weekly.**

C In overweight children (BMI $\geq 90^{\text{th}}$ percentile) maintenance of weight is an acceptable goal. Recording of weight in growth charts of body mass index-for-age percentiles may be a sufficient support in maintenance of body weight and reduction of risk of obesity.

INDICATIONS FOR HOSPITAL INVESTIGATION

D To hospital investigations following children should be referred:

- **children with severe obesity-related disorders which require adequate measures aimed at reducing body mass (e.g. benign intracranial hypertension, syndrome of hypoventilation and sleep apnea, orthopedic and psychologic disorders),**
- **children suspected of having a pathologic (e.g. endocrine) cause of obesity, and all extremely obese (BMI > 99th percentile) children below 2 years of age**
- **all children with BMI >99th percentile with potential obesity-related disorders.**

✓ A pathologic (secondary) cause of obesity should be suspected if the child is obese and short for age.

C Monitoring of body height in growthchart is one of the major methods for the distinction of nutritional from pathologic form of obesity.

KEY MESSAGES FOR OBESE CHILDREN AND PARENTS

- **Obesity in children and adolescents is more and more frequent.**
- **Obesity is caused by an imbalance between intake and expenditure of energy.**
- **Obese children do not have low energetic needs, i.e. they have high energetic needs necessary for the maintenance of high body mass.**
- **Obesity *per se* is a medical problem; it increases the risk of other severe medical problems such as high blood pressure, diabetes and psychologic disorders.**
- **Obese child is frequently susceptible to persist as obese in adulthood.**
- **There is no evidence for effectiveness of any drug therapy in treatment of obesity in children.**
- **Obesity in children may be prevented and treated: by increasing physical activity, by limiting sedentary behaviour (e.g. watching television) and by adopting healthy and balanced diet.**
- **Changes in lifestyle should be realized by reasonable and gradual measures in physical activity and eating pattern.**
- **The support of the family is necessary for a successful treatment of obesity.**
- **The general objective and principle of treatment of obesity in children and adolescents in the process of growing and development is weight maintenance.**
- **The likelihood of secondary (pathologic) obesity is greater in children who are obese and have a short stature.**
- **The majority of children is not obese because of some other disease or health disorder; their obesity is the result of lifestyle, their eating pattern and physical activity.**

Tabela 12. Cut-off values of body mass index (BMI) for overweight (25 kg/m²) and obesity (30 kg/m²) in children and adolescents				
Age (years)	Overweight		Obesity	
	Boys	Girls	Boys	Girls
2	18,4	18,0	20,1	20,1
2,5	18,1	17,8	19,8	19,5
3	17,9	17,6	19,6	19,4
3,5	17,7	17,4	19,4	19,2
4	17,6	17,3	19,3	19,1
4,5	17,5	17,2	19,3	19,1
5	17,4	17,1	19,3	19,2
5,5	17,5	17,2	19,5	19,3
6	17,6	17,3	19,8	19,7
6,5	17,7	17,5	20,2	20,1
7	17,9	17,8	20,6	20,5
7,5	18,2	18,0	21,1	21,0
8	18,4	18,3	21,6	21,6
8,5	18,8	18,7	22,2	22,2
9	19,1	19,1	22,8	22,8
9,5	19,5	19,5	23,4	23,5
10	19,8	19,9	24,0	24,1
10,5	20,2	20,3	24,6	24,8
11	20,6	20,7	25,1	25,4
11,5	20,9	21,2	25,6	26,1
12	21,2	21,7	26,0	26,7
12,5	21,6	22,1	26,4	27,2
13	21,9	22,6	26,8	27,8
13,5	22,3	23,0	27,2	28,2
14	22,6	23,3	27,6	28,6
14,5	23,0	23,7	28,0	28,9
15	23,3	23,9	28,3	29,1
15,5	23,6	24,2	28,6	29,3
16	23,9	24,4	28,9	29,4
16,5	24,2	24,5	29,1	29,6
17	24,5	24,7	29,4	29,7
17,5	24,7	24,8	29,7	29,8
18	25	25	30	30

Chart 1. BMI-for-age percentiles in boys aged 2–20 years (downloaded from: <http://www.cdc.gov/growthcharts>)

Ime i prezime deteta _____

Datum rođenja _____

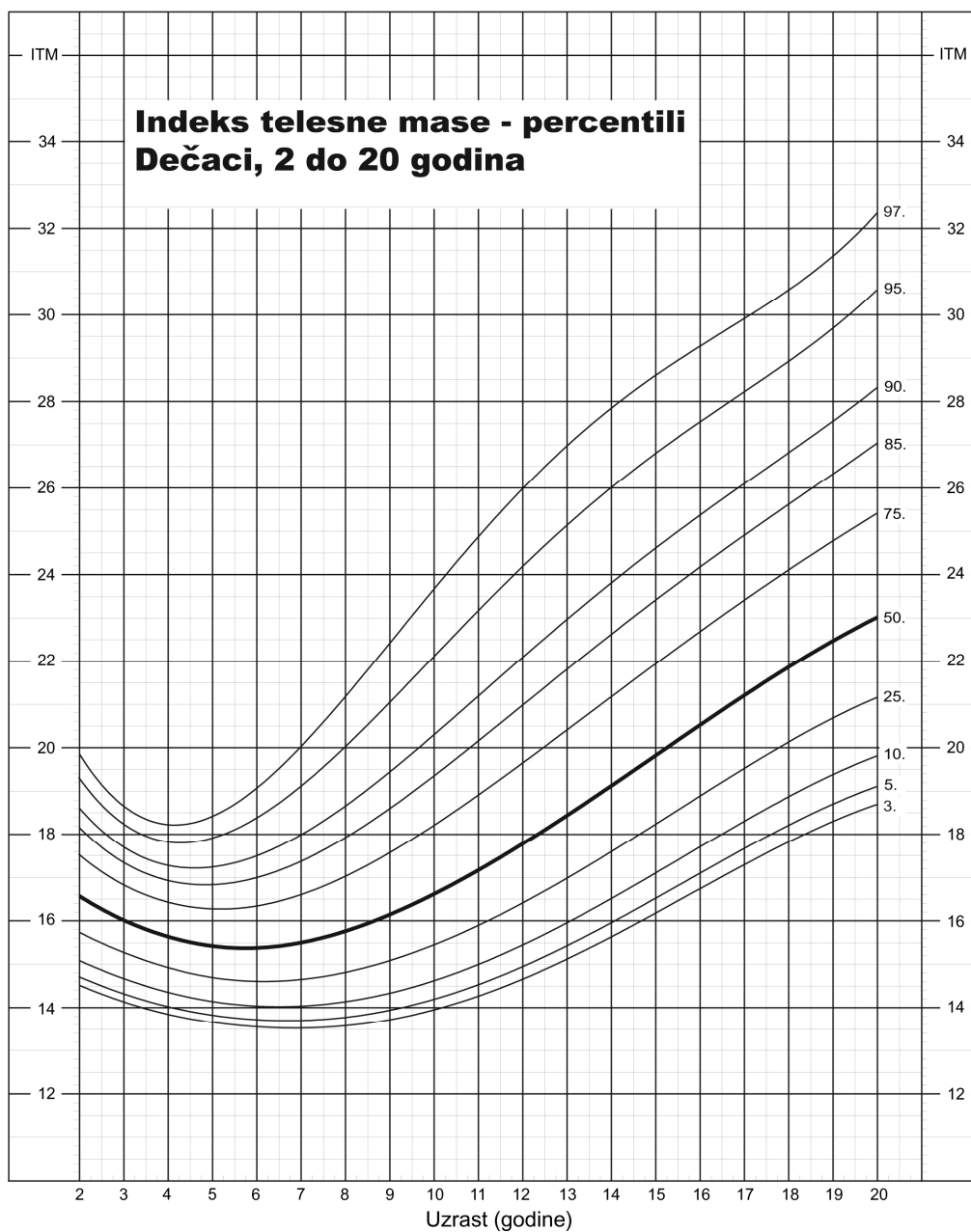
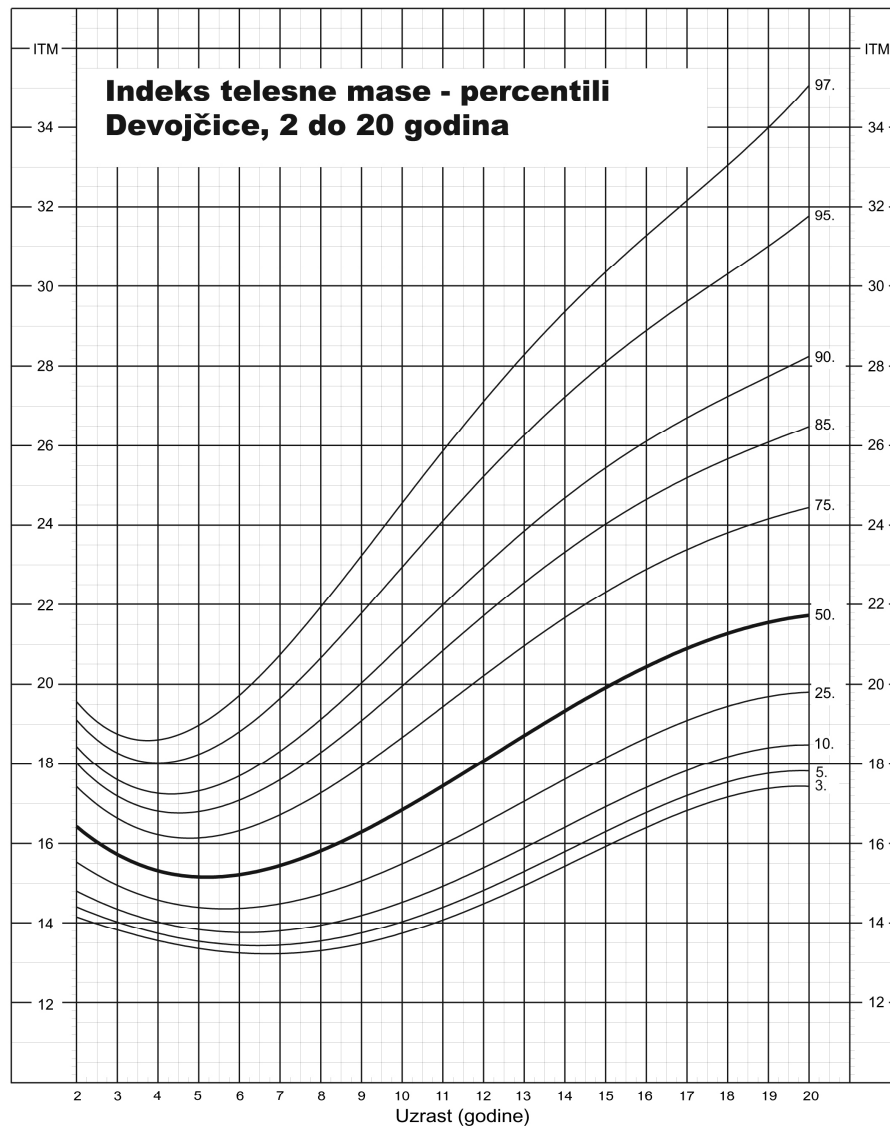


Chart 2. BMI-for-age percentiles in girls aged 2–20 years Downloaded from: <http://www.cdc.gov/growthcharts>

Ime i prezime deteta _____

Datum rođenja _____



II

1. PROJECT'S GOALS

- Promotion of the medical and social justification of the prevention and treatment of obesity in children and adolescents in public and professional circles;
- Education of healthcare providers, youth population and parents (seminars and publishing of brochures and leaflets);
- Realization of promotion and education seminars intended for media and non-governmental organizations addressing health and development of children and adolescents,
- Creation of doctrine and guidelines for pediatricians and other healthcare providers in cooperation with UNICEF;
- Introduction of programmes of prevention and treatment of obesity in children and adolescents in obligatory scope of activities of health and education systems;
- Founding of the Centre for prevention and treatment of obesity in children and adolescents within the Institute for thyroid gland and metabolism, Zlatibor.

2. PARTICIPANTS ON THE PROJECT

Medical measures and activities composing the Project „Prevention and treatment of obesity in children and adolescents in Serbia“ represent a significant segment of the overall engagement of the health sector in the realization of the national programme of prevention of obesity in the Republic of Serbia. The Pediatric Association of Serbia and the Institute for thyroid gland and metabolism, Zlatibor have a great experience in the organization of programmes of health care and dispose of human and other resources which may provide a successful realization of the Project. Mutual relations, rights and obligations of the participants on the Project are regulated by the Cooperation Agreement.

The Pediatric Association of Serbia, representing more than 1700 specialists in pediatrics who live in the Republic of Serbia, was founded at the Assembly which was held on 11th November 2006 in Zaječar and registered in the Register of associations on registration page no. 3977, under ordinal number 11352, based on the Decision of the Ministry of state administration and local self-management No.130-024-00-01063/2006-07 dated 1 December 2006. The Association is the legal and professional successor of the previous Pediatric Association of Serbia and Montenegro, i.e. Federal Republic of Yugoslavia, and is continuing the long-term and successful tradition of educational pediatric activities intended to physicians in health care of children and youth. The Association organized in the first week of June 2007, in the Congress centre „Srbija“ at Zlatibor, the largest pediatric expert meeting in our environment – the 10th seminar of traditional Pediatric school of Serbia, with the participation of 574 pediatricians from Serbia, Montenegro, Republic of Srpska and Republic of Macedonia.

Registered members of the Association are mainly pediatricians of the primary healthcare of children and youth, with a significant number of prominent experts and leading authorities in Serbia – professors at medical faculties in Belgrade, Novi Sad, Nis, Kragujevac and Pristina. The Pediatric Association of Serbia is member of the Union of National European Pediatric Societies and Associations (UNEPSA) and of the International Pediatric Associations (IPA) in whose activities (congresses, assemblies etc.) it is actively and successfully participating.

In accordance with the Constitution (Article 6), the goals and tasks of the Association include among other:

1. The participation in establishment and realization of health policies in the country and the realization of health care measures in accordance with the needs of children and youth;
2. The development and promotion of health care of children and youth in accordance with the accomplishments of medicine and other sciences, needs of children and youth and the capacities of the state;
3. Cooperation with relevant organs and organizations in the development of medical doctrine of health care of children and youth and in the realization of plans and programmes of undergraduate studies and postgraduate training of healthcare providers related to children and youth;

7. The development of correct and mutually useful relations with economic subjects, especially with enterprises in the pharmaceutical and food industry, as well as with media in order to realize the goals of promotion of health of children and youth and of the professional and social position of pediatricians.

The Association is a legal person with rights, obligations and responsibilities deriving from the Constitution of the Republic of Serbia, the law and its Constitution (Article 7). The President of the Association represents the Association in the country and abroad and gives the initiative to bring up and resolve actual issues related to health care of children and youth and the professional and social position of pediatricians (Article 15 of the Constitution).

Taking into consideration mentioned provisions of the Constitution of the Pediatric Association of Serbia, the fact that experienced pediatricians in primary health care represent a guarantee for a successful realization of care programme for children and youth, as well as recognized professional competence of engaged consultants, the participation of the Pediatric Association of Serbia in the implementation of the Project "Prevention and treatment of obesity in children and adolescents in Serbia" inspire confidence in the successful outcome of the programme.

A Specialized health resort for hyperthyreosis was founded upon the decision of the Government of Serbia and started to function on 1 June 1964 as part of the Health centre in Čajetina, and from 1 April 1966 as an independent health institution. The activities of this medical institution included treatment of endocrine, allergy-related and neurovegetative diseases and general body disorders.

The original health resort has been renamed to Institute for the prevention, treatment and rehabilitation of thyroid gland disorders. The results of treatment have been incomparably better than with the previous exclusively drug treatment, thus the Institute has grown into a unique centre for the treatment of thyroid gland disorders in the Balkans.

The Institute has developed into the Institute for thyroid gland and metabolism, Zlatibor in 1999 upon the regulation of the Government of the Republic of Serbia. From its founding to present days, striving for scientific and professional development has been the main concern. In order to accomplish scientific and professional activities the Institute started to cooperate with the Institute for endocrinology, diabetes and

metabolism-related diseases of the Clinical Centre of Serbia in Belgrade, which enabled the Institute to become a base of the Faculty of Medicine.

Besides the primary activity of study and treatment of thyroid gland diseases, physicians of the Institute and the collaborators of the Faculty of medicine from Belgrade have also been investigating other forms of metabolic disorders, particularly obesity which has been designated as a disease by the World Health Organization. In November 1989, Čigota Programme started to function within the Institute. At the beginning, conceived as a programme intending to fight against excessive weight, Čigota Programme grew over time into a modern programme with new conceptions in the field of preventive medicine. The goal of the programme was to reduce the prevalence of obesity and related diseases in general population, as well as the reduction of morbidity and mortality of obese persons. The goal has been successfully carried out for years in Čigota, Zlatibor. Since that time, we have been recognized as the leaders in that field.

3. PROJECT'S DYNAMICS

The Project "Prevention and treatment of obesity in children and adolescents in Serbia" will be carried out in stages lasting 9 – 12 months, depending on the dynamics of fulfilling of obligations of the participants on the Project in the first two stages. The Project will be considered successfully implemented if the Institute for thyroid gland and metabolism, Zlatibor is ready, after 9-12 months, to realize a complete medical programme of prevention, diagnosis, treatment and rehabilitation of obesity in children and adolescents, in premises exclusively designated for children and adolescents, with healthcare providers trained to work with children and youth, together with continued engagement of a multidisciplinary team of consultants and the respect of adopted doctrine and guidelines.

Phase 1

In the first stage lasting three months, after the Cooperation Agreement has been signed, the obligation of the Pediatric Association of Serbia will be to prepare a Report containing scientific, professional and doctrine positions and recommendations necessary for the implementation of health measures and activities of the Project. In the

same period of time, the obligation of the Institute for thyroid gland and etabolism, Zlatibor will be to undertake, in cooperation with the Association of Pediatrics of Serbia, promotion activities in order to popularize the Project, as well as to undertake necessary personnel and premises adjustments to new scope of activities to deal with. Namely, it is necessary that the Institute engages healthcare providers trained to work with the pediatric age, and to assign premises within own space for out-patient (polyclinic) and in-patient (hospital) with a separate entrance for children and their guides.

Phase 2

This stage, which will last six months, has been primarily planned for the realization of education seminars for healthcare providers and collaborators from the primary pediatric care from all the regions of Serbia in order to introduce and involve them into the activities for the realization of the Project. Except for healthcare providers, seminars are also planned for the education of adolescents and their parents. During this stage, promotion seminars for media and non-governmental organizations interested in the promotion of health of the young population are planned, as well as the creation of recommendations, brochures and leaflets in cooperation with UNICEF. Promotion and education activities will be taking place in the premises of the Institute in order to directly introduce all interested subjects with its therapeutic and recreational potentials. If all personel and premises conditions are provided, the out-patient (poly-clinic) treatment for obese children and adolescents will be launched in especially designated premises of the Institute.

Phase 3

The duration of this stage will depend on the successful accomplishment of tasks from the the first two stages. Plans in this stage are the continuation of promotion and education activities, as well as the launching of complete medical programme of prevention, diagnosis, treatment and rehabilitation of obese children and adolescents in designated in-patient and out-patient premises within the Institute, which will mark the successfull realization of the Project. In this phase, the Pediatric Association of Serbia will finally constitute and permanently engage a multidisciplinary team of consultants who will be providing expert services within the prevention and treatment of obese children and adolescents, necessary for continued activity of the future Centre of

prevention and treatment of obesity in children and adolescents within the Institute for thyroid gland and metabolism, Zlatibor.

4. Commercial use of the Project and international cooperation

Obesity in childhood and adolescence, both in our country and in the majority of European countries, represents a serious and rising risk factor for people's health. Important characteristics show that childhood obesity is on the rise and that there is a direct correlation between some diseases and obesity. The clear conclusion is that the time is right for the creation of a wider national plan headed by the Ministry of health, as well as for the involvement of competent health institutions and media in solving this arising problem which may impact the health condition of the nation in a long term.

Therefore, the idea for the work out and implementation of the Project, originated from Čigota Institute and the Pediatric Association of Serbia, emerges at the right time. It is very important that the Pediatric Association of Serbia has qualified and competent collaborators for a professional realization of the Project, while Čigota Institute has excellent conditions (Zlatibor as one of our most interesting mountains with excellent bio-climatic characteristics, well-trained personnel with practical experience in dealing with the issue of obesity in adults over the last 18 years).

It is important to emphasize that the problem has been recognized by both the Ministry of health and the Republic Institute of health insurance, and that it has been listed into official indications for extended rehabilitation. This means that a number of children will be eligible to enjoy the benefit of this Project at the expense of the state. The children would be referred by the relevant Health Fund. The size of this mode of referring would be subject to a contract made between the Republic Institute of health insurance and the Čigota Institute, and practically it would be contracted for a period of one year. In order to perform this part of activity on a satisfying level, it is necessary to first realize continued education of pediatricians from all over the country, that is to realize the promotion of the Project with an expert analysis of the obesity issue. The role of the Pediatric Association of Serbia would be very important. Seminars should be held in the Čigota Institute so that colleagues may be introduced on the spot with the conditions and technology of work. Given the fact that pediatricians from primary healthcare are the most involved into this issue, their participation would be a priority.

The education seminar and the promotion of the Project should be realized under the sponsorship of the Ministry of health of the Republic of Serbia. That would be the occasion to invite all health and non-governmental organizations such as WHO branch, UNICEF, representatives of healthy food manufacturers, as well as interested representatives of pharmaceutical firms which could certainly find their own place in the implementation of the Project. Besides other possibilities, they could be offered to involve in the organization of summer camps within the Institute, which would help in gathering a significant number of children during holidays. For example, the summer camp could start at the end of June, in 10-days shifts for around 50 children of certain age and would end at the end of August. The professional supervision in the realization of the Project would be provided by a group of consultants who would come in agreed intervals, and they would be appointed in accordance with both the legal regulations of the Institute and the agreement of the Pediatric Association of Serbia.

Certainly, a considerable number of participants in the Project would come under commercial conditions. A great role in the realization of arrivals would be assigned to tourist agencies "Čigota" and "Smart" which already have a great experience and means to organize transfers all the way to "Čigota". Practically, they would also have the function of main information centres in which interested people could get brochures and good oral information on main characteristics of the programme, the price of the programme and all other relevant details concerning conditions of stay. Also, it is necessary to mention the possibility to have a professional, a pediatrician, who would come at least once a week and in direct contact give suggestions to parents or consult over the phone. Mentioned agencies would have a significant role in the continued promotion of the programme, which will be included with more details in the marketing plan of the Project; this will be the obligation of the Institute because its significant experience in that area.

During the sojourn of children, the obligation of the Institute marketing department would be to define and fulfil their leisure time by organizing tours in Zlatibor and its surroundings (visit to ethno-village Sirogojno, Šargan railway, Mećavnik and cultural-historic places with the assistance of qualified guides). Interesting team competitions (in the swimming pool, at the sports fields of Čigota) with award of diplomas and prizes to the winners could be organized. Education seminars for children and their parents could be organized during the stay along with testings and prizes from sponsors.

Expectations are that the programme, given its high professional quality, outstanding location at Zlatibor mountain and exceptional quality of the team implementing it, will attract the attention of the public out of the limits of our country. The attained quality and popularity of the programme together with continuous improvement will be the best recommendation for foreign beneficiaries. In this context, the Pediatric Association of Serbia will have the obligation to establish contacts with similar associations all over Europe. It is indispensable that physicians present the results of the programme in their workshops at international meetings. The obligation of the Institute will be to promote the programme abroad with the help of consultants, as well as to invite for cooperation insurance systems from all over Europe. Our chance and competitiveness is in a quality programme, a good location and affordable prices which should all be used as significant advantages.

III

CONCLUSION

Obesity in children and adolescents represents, both in Serbia and in all countries of modern culture, a serious socio-medical problem which has not only a health, but also a social and demographic importance. In the European Strategy which WHO Regional office adopted in 2005, the maintenance and improvement of health of adolescents has been listed in the seven priority fields of activity of the health systems in countries of the European region.

The prevalence of obesity in children and adolescents is rising worldwide, especially in developed industrialized countries, but also in many developing countries. In many countries, the prevalence of obesity in children and adolescents surpasses the prevalence of allergy-related diseases including asthma and eczema. Obesity in childhood is connected with numerous diseases and disorders such as hypertension, asthma, obstructive sleep apnea, type 2 diabetes mellitus, polycystic ovarian syndrome, hyperlipidemia, early atherosclerosis and psycho-social disorders, and it is also a significant risk of obesity and obesity-associated health disorders in adulthood.

Clinical criteria for early detection and assessment of obesity level in children of different age are well defined. Children with body mass index above the 90th percentile

are considered overweight, that is at risk of obesity, while children with body mass index exceeding the 97th percentile are considered obese. In the group of obese children, besides in-depth clinical examinations, especially regarding the detection of frequent comorbidities – hypertension, orthopedic problems, obstructive sleep apnea, it is necessary and indispensable to make laboratory tests including: measurement of glucose concentration in the blood and determination of lipide profile in blood and serum transaminases. In children who, according to previous tests, show elements of the metabolic syndrome and in children with diabetes in close familial history, it is necessary to undertake periodically an oral glucose tolerance test starting at the age above 10 years.

Given the complex etiopathogenetic base of obesity in children and adolescents and the frequency which gains epidemic character, the solving of this modern health disorder of young people requires an urgent, thorough and long-term programme of multidisciplinary measures and activities. The Project „Prevention and treatment of obesity in children and adolescents in Serbia“ includes the participation of education and health systems with the strong support of relevant state institutions in the sectors of culture, sports and youth, and above all a continuous and positive impact of the media, as well as the cooperation of pharmaceutical and food industries and other subjects of the market economy. The health system has to take over the leading role in the integration of efforts of all factors of the society. Adolescents, parents and family have to be in the heart of the programme, as their full engagement is the presupposition of a successful outcome of programme measures.

It is necessary to dedicate more attention to the development and obligatory application of measures to prevent obesity at all ages, from prenatal period to adulthood. It is recommended to start with the prevention of obesity in the prenatal period already and to continue in early infant period. The task of pediatricians and other physicians participating in primary health care of children and youth is first of all, the promotion of breastfeeding in the first 4-6 months of infant's life, counseling and interventions in the selection and use of healthy food and regular physical activity, regular monitoring of staturponderal development from early infant age and all the way during childhood and adolescence with obligatory monitoring of body mass index. The therapy of obesity remains a difficult and unresolved problem which often results in disappointment of obese child, parents, physicians and other professionals involved in the treatment of obesity in childhood. Children with body mass index above the 90th percentile require

usual advice regarding the correction of lifestyle, especially concerning nutrition and physical activity. In the treatment of severe types of obesity, especially among children with secondary forms of obesity who already show different associated health disorders, it seems that the multidisciplinary approach is the best. It should include pediatricians of different subspecialties – endocrinologist, cardiologist, pulmonologist, nephrologist as well as nutritionist, psychologist and physicist. In order to accomplish a successful treatment of obesity, regular and frequent examinations of the obese child by the pediatrician in charge has an exceptional and irreplaceable role.

The participants on the Project – the Pediatric Association of Serbia and the Institute for thyroid gland and metabolism, Zlatibor - as competent representatives of the health sector have - a great experience in the organization and implementation of programmes of health care, and dispose of human, facilities and other resources which is promising a successful accomplishment of set Project's goals. The Report brings a synthesis of contemporary scientific knowledge on obesity in children and adolescents and of doctrine and guidelines necessary for the successful functioning of the health service. The positions stated in the Report will be the foundations for the programmes of promotion of this important socio-medical problem of the youth, as well as for the education of target groups (adolescents, parents, healthcare providers, media etc) through seminars, brochures and leaflets.

The successful realization of the project will be marked by (1) the founding and functioning of the Centre for prevention and treatment of obesity in children and adolescents within the Institute for thyroid gland and metabolism, Zlatibor and (2) the introduction of programmes of prevention and treatment of obese children in obligatory scope of activities of the education and health system. Finally, the Project gives the possibility to compare and exchange our activities with other countries with the goal to solve this serious health, social and demographic problem of the young population in Serbia.

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