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TEN YEARS OF SUCCESSFUL WORK OF A MULTIDISCIPLINARY CENTER FOR PREVENTION AND TREATMENT OF OBESITY IN CHILDREN AND ADOLESCENTS

Obesity in children can lead to insulin resistance, diabetes type 2 of a metabolic syndrome, hypertension, liver steatosis, accelerated growth and bone maturation, gynecomastia in boys, ovarian hyperandrogenism in girls and cholecystitis. Obese children have an increased risk of developing orthopedic and respiratory illnesses and numerous psychosocial problems. In response to the epidemic of obesity, the Center for the Prevention and Treatment of Obesity in Children and Adolescents was established in our country in 2008. The establishment of the Center has enabled multidisciplinary and individual treatment of obese adolescents, greater patients' satisfaction, better monitoring of results, better education of the employees, better control of the patients, increased involvement of a family and good multidisciplinary cooperation. Participation in the "Cigotica" program provides adolescents with the possibility of choosing between a healthy and unhealthy lifestyle. Short-term effects of the "Cigotica" program are weight reduction, normalization of blood pressure and metabolic risk factors, increased aerobic ability and self-confidence of adolescents. The great interest of children, parents, pediatricians and participation in the "Cigotica" program also indicate an increase in the awareness of the obesity risks and the importance of preserving health in the adolescent age in our environment. The efficiency of the "Cigotica" program and the multidisciplinary treatment of obese adolescents will be also assessed by the current research that considers the sustainability of the results achieved during the period of three and five years after treatment.

Key words: obesity, adolescents, body mass index, obesity treatment programs

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Obesity is a chronic condition caused by an excess fatty tissue that negatively affects physical and psychosocial health and well-being (1). The Latin name for this disease is *obesitas* which is derived from two Latin words: *ob* (excessive) and *edere* (eat). Because of the high prevalence, rapid increase and association with numerous chronic diseases, obesity today is the main public health and economic problem of global significance (2). According to the World Health Organization (WHO), obesity is one of 10 major risk factors and one of the five leading health problems of today that has taken on the global epidemic (3).

In children and adolescents, obesity is defined as an increase in body mass above the arbitrarily determined value, which takes into account the gender, chronological age and body height of the respondent, which is due to excessive fat content in the organism (4, 5).

The health damage degree of obese people is determined by: a) the quantity of fatty tissue, b) the distribution of fatty tissue and c) the presence of other risk factors.

According to the WHO data from 2014, 13% of those older than 18 years (11% of men and 15% of women) were obese, and 39% (38% of men and 40% of women) were overweight. It is estimated that 1.9 billion people over 18 years of age are overweight, and more than 600 million are obese. From 1980 to 2014, obesity prevalence was almost doubled, and prevalence of diabetes in 2014 was estimated to 9% (6). It is estimated that by 2025, approximately 2.3 billion adults will have been overweight, while 700 million will have been be obese. Overweight and obesity are the causes of 3.4 million deaths a year. For the optimal health, the recommendations of the WHO are that ITM for adults should be 21 to 23 kg / m² (7).

According to the WHO data from 2013, approximately 42 million children (6.3%) under 5 years of age are overweight and obese. The prevalence of overweight pre-school children is the highest in developing countries (8). Recent estimates show that the global prevalence of overweight and obesity in children up to 5 years of age increased from 5% in 2000 to 6% in 2010, and in 2013 it was 6.3%. The prevalence of obesity in children is increasing worldwide, but especially in Africa and Asia. Between 2000 and 2013, the prevalence of overweight in children under the age of 5 rose from 11% to 19% in some countries in South Africa and from 3% to 7% in Southeast Asia. It was estimated that in 2013 there were 18 million pre-war children under five in Asia, 11 million in Africa and 4 million in Latin America and the Caribbean. It is estimated that prevalence of obesity in children under 5 years of age will have been increased to 11% (70 million) in the world by 2025, if the current trend of obesity growth continues (9,10). It is thought that over 10% of school-age children and adolescents in the world are overweight (over 200 million), of which about 3% are obese 40-50 million) (11).

The incidence of obesity in adolescents is greatest in Western industrialized countries and is still low in some developing countries. Frequency varies with age

and gender. According to the WHO (38), America and the region of the Eastern Mediterranean have a higher incidence rate of pre-obesity and obesity (30-40%) than the European region (20-30%) and Southeastern Asia, the Western Pacific and the African region (10-20%).

In 2000, the incidence of overweight in children and adolescents aged 7 to 19 in Serbia was 8.2% and obesity was 4.4%, and 6 years later the prevalence of excessive weight increased to 11.6% and obesity to 6.4%. The results of the research conducted by the Ministry of Health of the Republic of Serbia in 2013 (12) pointed to the trend of obesity increase among the population of Serbia:

- Increase in prevalence from 17.3% to 22.1% from 2006 to 2013 in adults
- Increase in prevalence from 6.4% to 13.7% from 2006 to 2013 in children and adolescents aged from 7 to 14 (Chart 1).

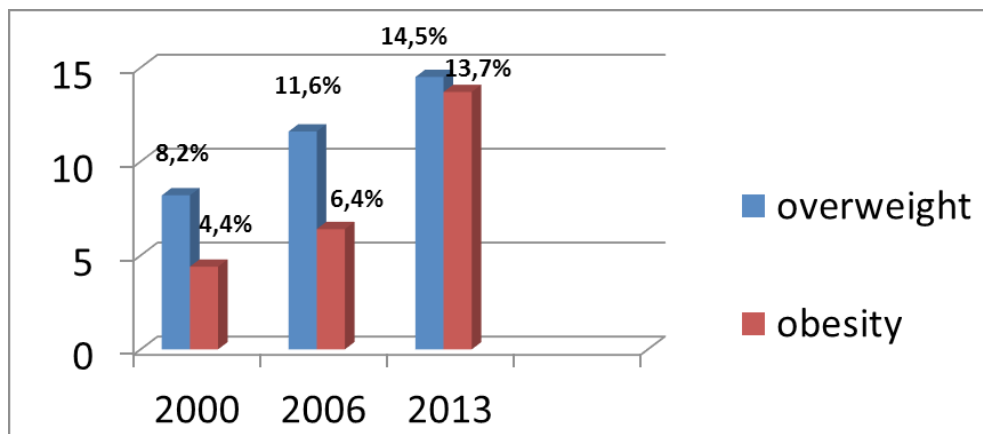


Chart 1. Research on the health status of the population of Serbia in 2000, 2006 and 2013

Based on the latest findings, in some countries the prevalence of obesity shows signs of stagnation, but it is still not entirely clear whether this change is a temporary or general trend and what causes this effect (13).

Obesity is the most common chronic disease in children and adolescents. The growing trend of the obesity prevalence in children leads to a risk increase for the formation of associated endocrinological, metabolic, cardiovascular, respiratory and other health disorders, a decrease in quality of life and the average life expectancy in the next generations of adults. In addition to numerous complications, obesity is a cause of a large economic burden and it accounts for 7-12% of all health care costs in Western countries. Since the results of treatment are largely unsatisfactory, the importance of measures to prevent obesity in childhood and adolescence (14) is growing.

In Serbia too, obesity is becoming an increasingly important problem whose resolution requires an urgent, comprehensive and long-term program of multidisciplinary measures and activities. In response to the epidemic of obesity in children and adolescents in our country, the Association of Pediatricians of Serbia in cooperation with the Special Hospital “Cigota”, which has many years of experience in the treatment and rehabilitation of obesity in adults, prepared in July 2007 the project “Prevention and treatment of obesity in children and adolescents in Serbia” (5). The authors of the Project are prof. Dragan Zdravkovic, Ph.D., prof. Milos Banicevic, Ph.D., prof. Radovan Bogdanovic, Ph.D. Nenad Crncevic, M.D. and Prof. Nedeljko Radlovic, Ph.D.(15).

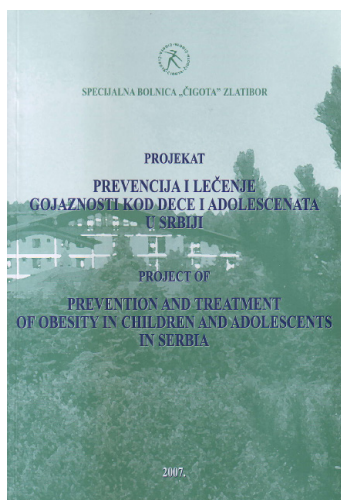


Fig.1 The Project “Prevention and treatment of obesity in children and adolescents in Serbia”

The Republic Institute for Health Insurance, with the patronage of the Ministry of Health, approved in the spring of 2008 the treatment and rehabilitation of obese children with $ITM \geq p97$, aged 12 to 18, in duration of 21 days a year, and the establishment of the Center for Prevention, Treatment of obese children adolescents in the complex of the Special Hospital “Cigota”. Due to the complex economic situation in our country, the rule book of the Republic Institute for Health Insurance has been changed, thus with the decision of the Republic Health Insurance Institute from August 2012 to August 2013 the treatment lasted for 10 days. From August 2013 to September 2016, the treatment of obese children in the Center lasted for 14 days, and since September 2016, the treatment again lasts for 21 days, and obese adolescents can only be treated in our Center twice in different calendar years. Obese adolescents whose body mass index (BMI) is $\geq P95$ are referred to the Center.



Fig.2 Medical rulebook of the Center

In accordance with the national guidelines for the treatment of obesity in the Center for Prevention and Treatment of Obesity, a health multidisciplinary program “Cigotica” was designed. The program is the promotion of a healthy lifestyle and includes dietary interventions with a decrease in total daily calorie intake, planned physical activity, other therapeutic measures (medicaments), educational and psychological support. Participation in the “Cigotica” program provides an adolescent for the possibility of choosing between a healthy and unhealthy lifestyle and helps to identify the key factors necessary for long-term behavioral changes and the adoption of healthy lifestyle habits. Treatment is more effective if obese children treatment is not delayed, and it is complex, comprehensive, multidisciplinary, individual, while respecting the developmental specifics of adolescents.

In the Center, diagnostic tests and treatment are performed in which the following staff participate: a pediatrician endocrinologist, specialist in physical medicine, psychologist, nutritionist, physical education teachers, physiotherapists, nurses and animators. Once in three months, professors-endocrinologists from Belgrade and Nis do consultations by visiting the Center. With professional supervision, the patients receive a diet plan and physical activity plan depending on their age, physical condition and health status, and if necessary, medicament therapy treatment is introduced. Hospitalization lasts for 21 days and is based on medical observation, monitoring and treatment of obesity and prevention of onset of obesity complications. The immediate treatment objective is to achieve long term -permanent body mass/weight reduction (16-18).

Treatment in the “Cigotica” program requires a multidisciplinary approach, team work with an individual approach and a program for the treatment of each patient. Treatment in our Center consists of:

1. Medical supervision

Clinical monitoring of obese adolescents includes anthropometric measurement, ECG, initial examination, anamnesis, and laboratory tests at the admission to the hospital. The patients with primary and secondary obesity and present complications of obesity are identified at the clinical examination. Then diagnostic procedures are planned, diet and physical activity are planned individually for each obese child.

Parents and children get acquainted with the basic principles of obesity treatment. An important part of our intensive treatment of obesity is setting goals individually for each patient. During the treatment, the health condition and participation in the program of each patient are monitored.

When releasing, the respondents have anthropometric parameters and laboratory analyses done. At the end of treatment, the achieved results are analyzed, and the children and their parents get the advice, instructions and recommendations for obesity treatment of (orally and in a written form), recipes of favorite meals, as well as the advice for further control examinations with the competent pediatrician, psychologist and nutritionist.

2. Hypo-caloric balanced diet

The diet is hypo-caloric (1,200-1,700 kcal), hyper-protein and balanced in accordance with the basic principles and instructions on the importance of proper diet in obesity prevention. Adolescents have five meals (breakfast, lunch, dinner and two snacks) that are always at the same time and are in line with their individual needs and physical activities. The menu is diverse, abundant in fresh vegetables, fruit, whole grains, lean meat and fish. Drinking water and tea are advised.

3. Physical activity

Based on a health status and assessment of anaerobic abilities, an activity program is planned for each child. The planned physical activities are: 2 walks (morning one and a walk before dinner, 60 minutes each), fast walking in nature, trim track walk or on cardio fitness training facilities; shaping exercises, strengthening of certain muscular groups without requisites and with requisites (a therapeutic ball, elastic strips...) for 60 minutes, exercises in water and training swimming (60 minutes) and open field activities and sports games. Physical activity is everyday, diverse, entertaining and adapted to obese children.

4. Psychological support

Working with a psychologist involves an interview with a psychologist, self-assessment questionnaire and psychological assistance, 6 workshops and support in understanding and solving of obesity problems. During the patient's

stay, a test with several psychological measuring instruments is planned (locus controls are tested related to excess weight, self-esteem, depression, symptoms of antisocial behavior).

5. Education

During the program, four lectures are delivered by a pediatrician, two lectures delivered by each of these: a nurse, a nutritionist and a physical education teacher, in duration of 45 minutes.

6. Corrective exercises

Under the supervision of a physiotherapist for adolescents with deformities of the spinal column, individual exercises are organized, and for other adolescents there are group exercises for the prevention of improper physical stature twice a week in a duration of 30 minutes.

7. Programs of social and entertainment activities

Educational, creative workshops and entertainment activities are held from 20:00 to 22:00 every evening with the supervision of animators and team members.

The patients who successfully complete the three-week Program of Prevention and Treatment of Obesity “Cigotica” will receive diplomas. When releasing, every child gets advice, instructions and recommendations (orally and in writing) for further monitoring with the competent pediatrician, psychologist and nutritionist (Figure 3).

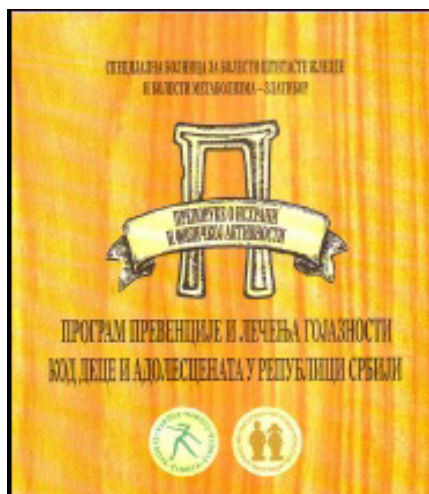


Fig.3. Recommendations for obesity treatment

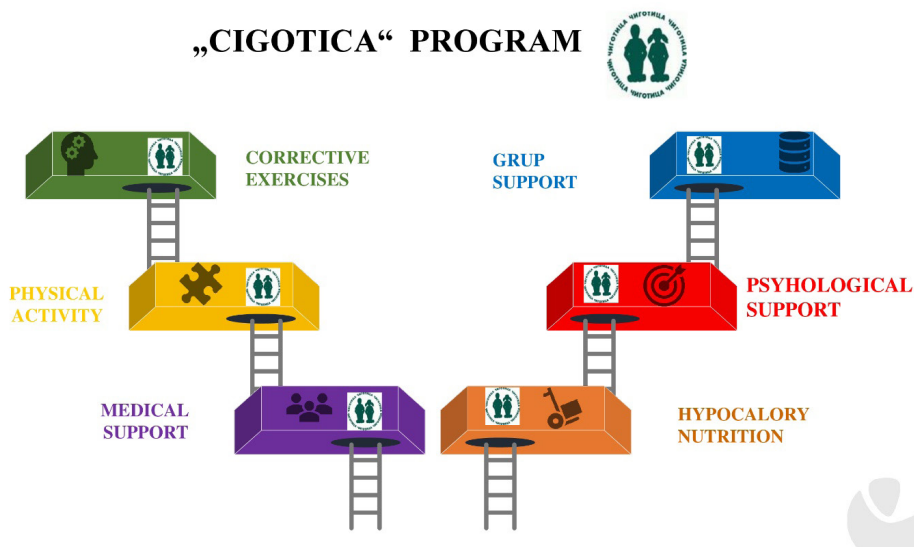


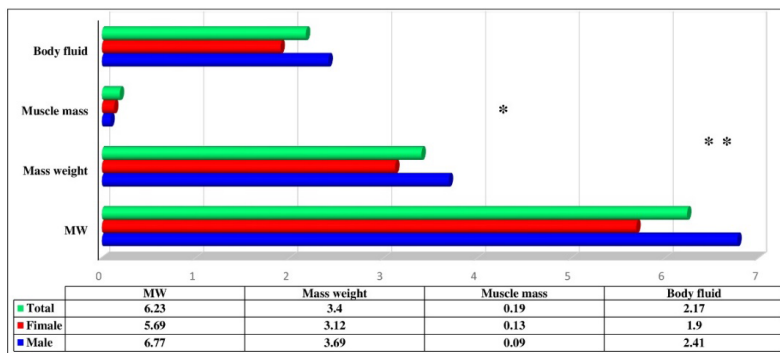
Fig.4 Program of „Cigotica“

Urbanization, industrialization, globalization of the market and economic development have influenced sudden changes in the lifestyle and diet (“nutritional transition”) in our country, too. Hyper-caloric diet and high fat consumption, especially saturated fat and insufficient intake of complex carbohydrates, vegetables and fruits with a sedentary lifestyle and lack of energy consumption, significantly have contributed to the increase in obesity in our environment, too.

An alarming spread of the obesity epidemic in children and adolescents, as well as the absence of proven and effective measures and programs of obesity prevention, indicate the necessity of forming the Center for Prevention and Treatment of Obesity in children adolescents and the “Cigotica” program at the “Cigota” Special Hospital. Obese children are referred to the Center from school dispensaries and Children’s departments from all over Serbia. During the past ten years, the Center has treated and educated 5,700 patients from more than 30 towns of the Republic of Serbia from different religious, national, linguistic and socioeconomic environments. 15-20% of patients financed themselves their treatment. Obesity complications are present in a large number of our patients. In addition to hypertension, dyslipidemia, metabolic syndrome, orthopedic problems, a growing number of children have glucose intolerance and serious disorders in the sphere of psycho-social functioning.

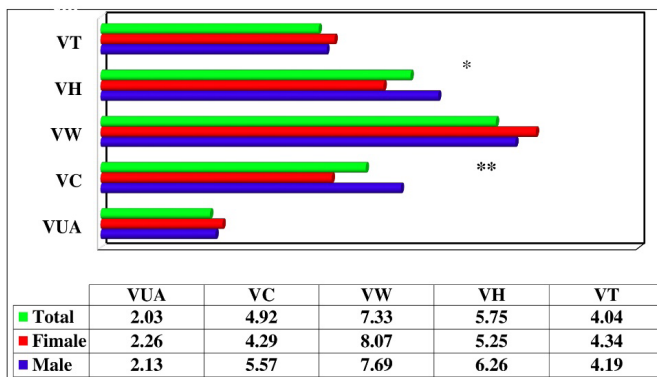
In a study involving 1030 respondents, the short-term effects of multidisciplinary treatment on anthropometric parameters and body composition of obese adolescents were analyzed (19). The average body mass/weight loss for all the subjects was 6.3 kg. The quantitatively high effect is has been registered in addition to the body mass and in the volume of the chest, hip volume, body mass index and body mass index for

age and gender (SSD). There were also significant changes in the body composition. Fat mass and amount of fluid were reduced at a high statistical significance level, where muscle mass was preserved in all the respondents (Charts 2 and 3).



Graph. 2. Short-term effects of treatment on TM and parameters of body composition in all subjects and in relation to sex

M:F Mas weight $p < 0,05$; TW $p < 0,01$



Graph. 3. Short-term effects of treatment on volume paramteres in all subjects and in relation to sex

M:F OH $p < 0,05$; OC $p < 0,01$

In addition to body mass/weight reduction, the short-term effects of treatment are also the improvement of metabolic risk factors, better physical condition and correction of the disorders in the psycho-social functioning sphere.

The advantage of our program is that it is short lasting, it is intensive and that all respondents have agreed voluntarily to the treatment. It is known that interventions that are relatively shorter in time, lead to greater effects than those that last longer.

Long-lasting interventions are characterized by the more frequent giving up of children from treatment. Children and young people are interested in fast and intensive interventions, which will give the desired results in a shorter period of time. Also, respondents who apply themselves and who are participants in the program, are more motivated to participate in the program and change their habits.

Our experience indicates that for success in the obesity treatment these are required: time, multidisciplinary team, good compliance and organization of the whole program. Patients themselves are a significant part of the team. The beneficial effect of work in the peer group has been shown to solve many obesity problems. Children give support and encouragement to each other during treatment. Working in a peer group helps an individual change unhealthy and chooses a healthy way of thinking and behavior, adopts new attitudes, improves interpersonal relationships, overcomes fears and problems. And after the program, they stay in touch and look upon each other as an external control regarding the eventual return to old habits.

As the influence of the family environment is one of the leading ones when adopting attitudes and behavior related to living habits, therapeutic interventions involve and are directed to the family as well. We have contacts with parents at the admission and release of children, but we try to keep in touch with them during and after the stay of children in the program, and after it. Cooperation with parents provides a common solving of current problems, and they receive guidelines for supporting children in the goal of a successful continuation of the treatment after the successful completion of the program.

The main objective and key element of the “Cigotica” program is to increase the awareness of adolescents about individual responsibility for their own health and the adoption of a healthy lifestyle, accepting their own responsibility and developing a high degree of motivation for the treatment. Extraordinary interest of children, adolescents and their parents, as well as primary health care physicians for participation in the prevention and treatment program of obesity, confirms the justification of the establishment of our Center.

During the past ten years, over 50 lectures and promotions of the “Cigotica” program were held in our country and neighboring countries. In our Special Hospital, three Symposia on Obesity, the First Serbian Congress of Endocrinologists and the First Serbian Congress of Pediatricians Endocrinologists were held, where the experiences of our work were presented. It is planned to build a facility - a new Center for the Prevention and Treatment of Obesity in children and adolescents, as well as a program of promotion and cooperation with similar centers for the treatment of obesity throughout Europe. We hope that our experiences and results will make a significant contribution to the continuation of the fight against this serious public health problem. The effectiveness of the “Cigotica” program in the treatment of obese children will be assessed by the ongoing research that considers the sustainability of the achieved results.

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