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FIRST EXPERIENCES OF THE CIGOTICA PROGRAMME

INTRODUCTION

The alarming spread of obesity epidemic in children and adolescents, as well as the lack of varified and efficient measures and programmes for obesity prevention, indicates the necessity to establish the Centre for the prevention, treatment and rehabilitation of obesity in children and adolescents and the Cigotica programme at the Special Hospital 'Zlatibor'. The advantage of the Cigotica programme is the multidisciplinary approach to treating obese children, which involves specific education, dietetic interventions with the decrease in the total amount of daily calorie intake, physical activity, clinical, educational and psychological support, change of behaviour and lifestyle.

OBJECTIVE

To present the effect of the multidisciplinary treatment of obese adolescents, participants in the Cigotica programme, and evaluate the weight of the examinees upon admittance and upon release. To establish the risk factors of nutritive obesity, obesity complications and biochemical risk factors.

METHODOLOGY

580 adolescens were examined (291 girls and 289 boys) aged from 12 to 18, of the average age of 15.25 with diagnosed primary obesity, hospitalised at the Centre for prevention and treatment of obesity in children and adolescents at the Special hos-

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pital 'Zlatibor' in the period from July 27, 2008 to March 7, 2010. The hospitalisation lasted 21 days. The obesity criterion was the body mass index (BMI) $> +2$ SD. The body mass, BMI, the percentage of fat was obtained by means of the tanita scales for determining body composition by impedance method. Apart from clinical examination, the blood pressure was also measured. The levels of tryglicerides, total and both HDL and LDL cholesterol as well as glycemia were determined on the second and twenty-first days of fasting.

RESULTS

After the multidisciplinary treatment, the average body mass loss ($p < 0.05$) in all adolescents was 6.12 ± 2.91 kg, in boys -6.47 ± 3.24 kg, and in girls -5.76 ± 2.41 . During the 21 days of hospitalisation, the average BMI ($p < 0.05$) was reduced by -2.32 ± 0.31 in all examinees, in boys by -2.53 ± 0.48 and in girls by -2.08 ± 0.41 kg/m². BMI z-score is considerably lower in all examinees by ($p < 0.05$) -0.29 ± 0.08 , in girls it is lower by 0.28 ± 0.06 and in boys 0.32 ± 0.08 . The percentage of fat is considerably reduced ($p < 0.05$) in all examinees -1.65 ± 0.23 , in girls 1.82 ± 0.31 and in boys $1.48\% \pm 0.20$. The waist circumference is reduced in all examinees by -7.98 ± 3.01 , in girls -8.99 ± 4.1 and in boys -6.97 ± 2.8 .

The analyses of the weight of the examinees upon admittance and upon release, estimated on the bases of average BMI values, indicates that the multidisciplinary approach lasting for 21 days resulted in the considerable initial mass reduction, so that 19.14% examinees were of average weight, 50.68% were overweight and 30.18% were obese.

CONCLUSION

The effects of the Cigotica programme encourage and show that the multidisciplinary approach directed towards the reduction in energy intake, education, change of lifestyle and beliefs related to diet and physical activity lead to the considerable reduction in body mass, improvement in blood pressure and laboratory parameters, aerobic abilities and self-confidence in obese adolescents. A great interest of children, parents and doctors in the participation in the Cigotica programme indicates the rise of awareness about obesity risks and importance of health prevention at the adolescent age in our region. The participation in the Cigotica programme gives an adolescent an opportunity to choose between a healthy and unhealthy lifestyle. The efficiency of the Cigotica programme and the multidisciplinary treatment of obese adolescents will be evaluated in the current research that deals with the sustainability of the achieved results.

INTRODUCTION

Obesity in children has turned into an epidemic and is becoming one of the commonest chronic diseases. It is estimated that about 30% of obese people were obese as children, but in these people, obesity is of a more serious type than in those who were not obese in childhood. Obesity in children affects morbidity and mortality of adults, irrespectively of the body mass at the adult age. A series of endocrinological and metabolic disorders have been observed in obese children, which can later cause diseases that occur more often together with obesity. These diseases are increasingly becoming a serious cause of morbidity in children's and adolescent population, including the disorders which used to be associated only with adults (1). The attention that obesity deserves is justified particularly by the possibility to prevent the disorders whose treatment is demanding, painstaking and not so successful. Obesity is one of the most complex and least analysed clinical syndromes (2).

Obesity in children is connected with the increased risk of developing numerous metabolic complications such as insulin resistance, impaired glucose tolerance and diabetes type 2. The increased BMI (body mass index) in childhood is the key generator of the metabolic syndrome characterized by: abdominal obesity, glucose intolerance, insulin resistance, dyslipidemia (low HDL cholesterol and hypertriglyceridemia), hypertension, chronic inflammation and prothrombotic condition (3). The metabolic syndrome increases the risk of diabetes and cardiovascular mortality. About 24-51% of obese children, aged from 12 to 19, has the metabolic syndrome. The metabolic syndrome prevalence is much lower in adolescents of the normal body mass (1-3%) in comparison with obese adolescents. Obese children are at a greater risk of developing orthopedic and respiratory disorders and psychological problems (4).

The occurrence of primary (polygenic, constitutional, simple, monosymptomatic) obesity is conditioned by different genetic, metabolic and environmental factors. The most common cause of obesity (95%) is an inadequate diet and physical inactivity.

Obesity prevalence in Serbia for the children aged up to five is 19% according to the data of the UNICEF Office from 2005. In 2007, it was estimated that overweight and obesity would occur in 18% of adolescents, which was a 50% increase in comparison with the prevalence in 2000. Due to the constant increase in the number of obese children in Serbia and with the aim to prevent obesity and change the eating habits and lifestyles, the Pediatric association of Serbia, in cooperation with the Special hospital 'Zlatibor', which has a long experience in obesity treatment and rehabilitation of adults, designed a project 'Prevention and treatment of obesity in children and adolescents in Serbia' in July 2007. In the spring of 2008, the Republic agency for health care under the auspices of the Ministry of health, granted the treatment and rehabilitation of obese children aged 12-18 for 21 days once a year as

well as the foundation of the Centre for the prevention, treatment and rehabilitation of overweight and obese children and adolescents within the complex of the Special hospital 'Zlatibor'.

At the Centre, diagnostic examinations and treatment are performed by: a pediatrician endocrinologist, a specialist in psychiatric medicine, a psychologist, a nutritionist, teachers of physical education and nurses. Together with the professional supervision, the patients are given a diet plan and the plan of physical activities depending on their age, fitness level and health condition, and, if necessary, a medication treatment is introduced as well. The hospitalization lasts for 21 days and it is based on medical observation, supervision and obesity treatment. The immediate objective of the treatment is to achieve a long-term reduction in body mass. That this is hard to achieve is best illustrated by the fact that 80% of the children who have acquired an adequate and desirable reduction of body mass regain their body mass in 9 years (5).

The treatment in the Cigotica programme demands a multidisciplinary approach that involves specific education, dietetic intervention with the reduction in the total calorie intake, physical activity, psychological support and the change of behavior and lifestyle.

1. Hypocaloric balanced diet

The basic principles and the main treatment of obesity in childhood and adolescence are comprised in the balanced hypocaloric diet. The total amount of calories is limited, but there is no type of food or food group that prevails on the everyday menu. The basic principle of the diet for obese children and their families is to have balanced meals that fulfill the nutritive needs of an organism that is developing and growing. In the total daily menu, 55% of calories should consist of carbohydrates, about 30% of fat and nearly 15% of proteins. The restriction of calorie intake in children is individualized and carefully monitored so that the normal growth and development would not be compromised (6).

The total daily amount of food is divided into 5 meals (breakfast, lunch, dinner and 2 snacks). All the food is prepared at the Special hospital 'Zlatibor' under the surveillance of an experienced cook and a nutritionist. The food is prepared according to the basic principles and instructions on the importance of a healthy diet in the prevention of obesity, and on the basis of initial daily calorie needs and physical activity of children.

The nutritionist's lectures and workshops are devoted to the topic of an adequate choice of food, food preparation, estimates of the nutritive and caloric values of meals, and upon release, children and their parents are given written instructions and recommendations on the diet of obese children and adolescents.

2. Physical activity

The programme consists of six types of physical activities, lectures and entertainment activities. On the basis of the test of anaerobic abilities and health condition, programme activities are planned. The planned physical activities are:

- Walking, fast walking in the countryside, along the trim path or using cardio fitness training simulators. The paths are 3-7 km long and the activities last between 40-60 minutes.

- Moulding exercises, strengthening particular muscle groups with or without equipment (a therapeutic ball, elastic bands, ...), exercises in the water, swimming, field games, activities in the open.

- Sports games.

The physical activity is organized on the daily basis, it is versatile, entertaining and adjusted to obese children. The activities are graded from the first to the last day in terms of lengthening the path, increasing the speed of walking, changing terrain configuration.

Physical activity, together with the hypocaloric diet, contributes to the body mass reduction, increases physical abilities, children are ready to take part in the standard physical education curriculum, they are motivated to improve their health, and its key role is in the sustainability of the initially reduced body mass (7).

3. Psychological support

Obesity is not only a medical problem but also an important psychological problem so that the treatment needs to provide psychological assistance and support. The programme of psychological preparation involves an interview with the psychologist, a questionnaire for self-evaluation and psychological help, 6 workshops and the support in understanding and dealing with the problem of obesity. It is shown that the programme involving a change of lifestyle has much better results and that a long-term success can be achieved only with the change of lifestyle. That is why the successful and long-term effects of therapy in children depend on the psychological approach directed towards a change of attitude, beliefs and behavior related to diet and physical activity (8).

4. Education

The lectures and workshops of the pediatrician, nutritionist, psychologist and physical education teacher together with the exchange of experiences of obese children, contribute to the adoption of new knowledge and opinions in terms of a healthy

diet (adopting healthy habits in selecting food, reducing meals), physical activity, improvement in interpersonal relationships and solving emotional problems in obese adolescents

STUDY OBJECTIVE

To present the effect of the multidisciplinary treatment of obese adolescents, participants in the Cigotica programme, and evaluate the nourishment of the examinees upon admittance and upon release. To establish the risk factors of nutritive obesity, obesity complications and biochemical risk factors. To estimate the weight of examinees upon admittance and upon release.

METHODOLOGY

580 adolescents (291 girls and 289 boys), aged from 12 to 18, were treated in a multidisciplinary way at the Centre for prevention and treatment of obesity in children and adolescents within the Cigotica programme in the period from July 27, 2008 to March 7, 2010. All the adolescents were diagnosed with nutritive obesity. Adolescents diagnosed with secondary obesity, non-motivated adolescents and adolescents hospitalised for less than 21 days were excluded from the examination. Clinical monitoring of obese adolescents involved initial examination, a survey on the diet and level of physical activity, anthropometric examination, ECG, after which there was an introduction to the basic principles of treatment and continuous monitoring of the patient.

Body mass, BMI, the percentage of fat was obtained by means of the tanita scales for determining body composition by impedance method. When measured, a child needs to be in his underwear. Measuring is performed in the morning before breakfast and after the intestinal cleanse and bladder emptying. The obtained value is observed to the nearest 0.1kg and is expressed in kilograms (up to one decimal), and then the weight of underwear is subtracted from it. Body mass index is obtained when the value of body mass expressed in kilograms is divided by the square value of body mass expressed in metres. The obtained results are presented in discrepancies of the number of standard deviations (SD) from the referential values for a particular age, shown as the z-score and recommended by the WHO (National Center for Health Statistics-NCHS) Growth Reference. According to the recommendations, the values of the z-score that indicate overweight and obesity range from +2 SD to +3 SD and higher than +3 SD (9,10). Body height is measured with the anthropometre with a stand. When measured, a child needs to be bareheaded and barefoot, with his back against the antropometre pole and with his head raised in such a way as to have the lower edge of the orbit and tragus in the same horizontal plane. The horizontal slider

of the antropometre is lowered to the crown of the head, and the height is read to the nearest 0.5 cm, and is expressed in centimetres (to one decimal). Circumferences are measured with a plastic non-elastic metre. The values are read to the nearest 0.1 centimetre and are expressed in centimetres. Blood pressure is measured in the sitting position on the right arm. The levels of tryglicerides, total, HDL and LDL cholesterols, as well as glycemia are determined on the second and twenty-first days of hospitalisation after 12 hours of fasting. The type and duration of each activity in the Cigotica programme are monitored on a daily basis.

RESULTS AND DISCUSSION

Within the national strategy for preventing obesity in children and adolescents, for the first time in our country, the project 'Prevention and treatment of obesity in children and adolescents in Serbia' is being implemented with the support of the Ministry of health and the Agency for health care of the Republic of Serbia. The alarming spread of obesity epidemic in children and adolescents, as well as the lack of tested and efficient measures and programmes for obesity prevention, emphasise the necessity to found the Centre for the prevention, treatment and rehabilitation of obesity in children and adolescents and the Cigotica programme at the Special Hospital 'Zlatibor'. Overweight and obese children aged from 12 to 18 are sent to the Centre from school health centres and pediatric wards from all over Serbia. From July 27, 2008 to March 7, 2010, 604 patients were hospitalised at the Centre. Primary obesity was diagnosed in 580 adolescents (291 girls and 289 boys) of the average age of 15.39 ± 1.57 (12,1-18). Hospitalisation lasted for 21 days..

Age and sex of the participants of the Cigotica programme

| Sex | No. | % | Age ($\bar{x} \pm SD$) | min | max |
|--------|-----|---------|-----------------------------|------|------|
| Female | 291 | 50.17% | 15.25 \pm 1.56 | 12.1 | 18.0 |
| Male | 289 | 49.83% | 15.34 \pm 1.59 | 12.9 | 18.0 |
| Total | 580 | 100.00% | 15.29 \pm 1.57 | 12.1 | 18.0 |

Similarly to most European countries, there has been a change in the diet and lifestyle here as well, which reflects on the increase in the number of obese children, especially in urban areas. The analysis of the eating habits of our ado-

lescents shows that children are reluctant to have meals and that they do not eat in school canteens. It has also been observed that, due to overwork of their parents and generation gap in the families, children do not regularly have cooked meals at home made from various types of food. Most participants buy food at nearby shops and kiosks, mostly fast food, sweets and fizzy drinks. These are mainly refined food products rich in energy because they contain high quantities of fat and sugar. WHO points out that urbanization, industrialization, market globalization and economic development in the last decade have caused sudden changes of lifestyle and diet ('nutrition transition') in terms of the increased consumption of food with high energy density and high fat consumption, particularly saturated fats, and insufficient intake of complex carbohydrates, vegetables and fruit together with a sedentary way of life and lower energy consumption, have considerably contributed to obesity increase (11).

The analysis of sports activities shows that only 130 adolescents (22.03%), 46 girls (7.79%) and 86 boys (14.23%) take up sport recreationally. The average time the examinees spend watching television is 3.5 h, and the number of hours they spend in front of a computer is 2.8 h (from 1-8 h). According to the recommendations of the American Heart Association (AHA), for the primary obesity and atherosclerosis prevention, free time spent sedentarily (in front of television sets and computers) should be limited to maximum 2 hours a day. An average American child spends 47 hours a week on the media, 17 with his parents and 30 in school. The total amount of time the examinees spend passively is a way beyond AHA recommendations (12,13,14). After the multidisciplinary hospital treatment involving education on the change of lifestyle, balanced hypocaloric diet, regular physical activity, psychological, educational and clinical support, there is a considerable loss in the initial BM. The average loss of BM ($p < 0.05$) in all adolescents is 6.12 ± 2.91 kg, in boys -6.47 ± 3.24 kg, and in girls -5.76 ± 2.41 . During those 21 days of hospitalisation, the average BMI ($p < 0.05$) is reduced by -2.32 ± 0.31 in all examinees, in boys by -2.53 ± 0.48 and in girls by -2.08 ± 0.41 kg/m². BMI z-score is considerably lower in all examinees upon release and ($p < 0.05$) -0.29 ± 0.08 , in girls 0.28 ± 0.06 and in boys 0.32 ± 0.08 . % of fat is much lower ($p < 0.05$) in all examinees -1.65 ± 0.23 , in girls 1.82 ± 0.31 and in boys 1.48 ± 0.20 . waist circumference is smaller by -7.98 ± 3.01 in all examinees, in girls -8.99 ± 4.1 and in boys -6.97 ± 2.8 . The loss in body mass and the reduction in BMI is considerably higher in boys than in girls.

The analysis of weight of the examinees upon admittance and upon release estimated on the basis of average BMI values, indicates that the multidisciplinary therapy approach lasting for 21 days resulted in the considerable initial reduction in body mass, so that 19.14% examinees were of average weight, 50.68% were overweight and 30.18% were obese.

Weight status (BMI) of the participants of the Cigotica programme upon admittance and upon release

| BMI | Average weight | Overweight | Obese | Total |
|-------------------------------------|----------------|-------------|------------|----------|
| Weight status (BMI) upon admittance | 0/0% | 328/ 56.55% | 252/43.45% | 580/100% |
| Weight status (BMI) upon release | 111/19.14% | 294/50.68% | 175/30.18% | 580/100% |

Blood pressure was high in 105 examinees (18.10%). Systolic hypertension was observed in 72 adolescents (12.41 %), and diastolic in 33 (5.69%). The link between hypertensin and obesity was observed a long time ago. Both diseases are characterised by similar disorders in the regulation of blood pressure which can initiate or sustain hypertension. Children with hypertension may have a disbalanced glucose tolerance, preprandial and postprandrial hyperinsulinemia or insulin resistance. Insulin acts stimulatively on the activation of sympathetic nervous system, renin-angiotensin-aldosterone system and enhances reabsorbtion of natrium in proximal tubuli of the kidneys (15). A short-term therapy intervention resulted in the reduction of systolic and diastlic blood pressure (15.8 ± 8.4 and 10.8 ± 5.5 mm Hg) and evident normalisation of blood pressure in 43 (7.4%) examinees.

Obesity os one of the key risk factors in the development of cardiovascular diseases at the adult age. Undesirable effect of obesity can be observed in childhood in the changes in the lipidogram. Among the participants of the Cigotica programme, the level of tryclerides was high in 31 examinees (5.34%). Low HDL cholesterol level was observed in 147 examinees (25.34%). High level of cholesterol was observed in 24 adolescents (4.13%). The loss in body mass achieved during the three-week hospitalisation resulted in the reduction of the trygloceride level and total cholesterol level in the serum with an increase in the level of HDL cholesterol in 45 (7.7%) adolescents.

Increased obesity prevalence in children and adolescents is connected with the higher risk of developing diabetes melitus type 2. The disorders in the regulation of glucose were observed in 42 (7.2%) examinees, of whom 25 (4.3%) suffered from an isolated disorder of glucose tolerance, whereas 9 (1.5%) had an isolated impaired fasting glycemia, and 8 (1.3%) had both disorders simultaneously. Diabetes type 2 was not registered. Although no case of diabetes melitus type 2 was not observed in the examined group, the observed glucose disorder indicates a higher risk of developing the disease (16).

The criteria for the diagnosis of the metabolic syndrome were met in 89 examinees (15.34%). Two risk factors for the metabolic syndrome were observed in 164

examinees (28.27%). These patients are at a high risk of developing cardiovascular diseases and diabetes type 2 at the adult age (17).

Apart from the above-mentioned obesity complications, our examinees suffered from liver steatosis, steatohepatitis, fastened growth, ovarian hyperandrogenism in girls and gynecomastia in boys, cholecystitis, pancreatitis, apnea during sleep, stress, incontinence. The obvious obesity complications in childhood are orthopedic disorders such as knee varus, valgus deformity, epiphyseolysis of femur. Menstrual disorders together with insulin resistance, acne, hirsutism and acanthosis nigricans characterise the syndrome of polycystic ovaries which occurs in our obese adolescent girls as well (18).

Psychological problems and the commonest psychological consequences of obesity such as anxiety, various phobias, depression, aggressiveness, tobacco abuse, observed in our examinees, all indicate the fact that psychological help and support are also needed in the treatment (19).

Obesity is connected with serious health problems in pediatric population and it is an important risk factor of morbidity and mortality at the adult age. Therefore, devising methods that might reduce the growing prevalence of their sequels in children and adults is a challenge. Obesity prevention should start in early childhood, focusing on a healthy diet and physical activity. There are various ways of addressing the problem: family, population (by means of media, social events, schools and individual), but the complexity of the problem still demands a multidisciplinary approach (20).

CONCLUSION

It the building of the Centre for children's and adolescents' obesity and the Cigotica programme, successful cooperation with school health centres is in full accordance with the the doctrine of pediatric rehabilitation in our country (21). The results of the Cigotica programme encourage and show that the multidisciplinary approach directed towards the reduction of energy intake, education, change of lifestyle and beliefs related to diet and physical activity have resulted in a considerable reduction in body mass, improvement of blood pressure and laboratory parameters, aerobic abilities and self-confidence. Since family environment has one of the major influences on the formation of opinions and behaviour related to habits, therapy interventions involve and are directed towards the family. Exceptional interest of children, adolescents and their parents as well as doctors from the primary health care in the participation in the programme of prevention, treatment and rehabilitation of obesity, confirms the justifiability of building the Centre. This interest also indicates the rise of awareness about obesity risks and importance of health care at the adolescent age in our country. Participation in the Cigotica programme gives adolescents an oppor-

tunity to choose between a healthy and unhealthy lifestyle. The effectiveness of the Cigotica programme and the multidisciplinary treatment of obese adolescents will be evaluated in the current research on the sustainability of achieved results

The experience of the Cigotica programme, the members of the multidisciplinary team, as well as specialists of different profiles and family members, bearing in mind the difficulties on the way to achieving a satisfactory body mass and to its painstaking sustainability, emphasise the need for a efficient obesity prevention and justify every effort directed towards this goal.

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