Screening Assessment of Nutritional Status in School children.

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ABSTRACT

The research is aimed at the analysis of obesity prevalence, development of preventive measures and healthy school environment in Lipetsk Region, Russia. The study was based on the data of 561 schoolchildren collected in the screening survey of regional pilot project "Healthy Schoolchildren". The screening results demonstrated that 79.1% of schoolchildren were overweight or obese. There is a correlation between BMI and fat and muscle distribution in all schoolchildren with exception of overweight male teenagers in puberty period. The survey has also revealed a combination of several types of nutritional misbehavior and insufficient physical activity in overweight children. The research has presented results of the school menus' analysis. The authors have developed a program to introduce a school diet improvement, physical activity increase and a healthy diet education for schoolchildren and parents.

Keywords: overweight, obesity, nutritional behavior.

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INTRODUCTION

Childhood obesity is considered to be one of the most acute problems of the public healthcare in the 21st century [2, 3, 4, 8, 9, 11]. Childhood obesity is dramatically increasing.155 million schoolchildren are overweight and demonstrate insufficient physical activity [2, 3, 7, 8, 14]. The World Health Organization has called obesity a "global epidemics". In 2006 European Regional Bureau of WHO held the WHO European Ministerial Conference on Counteracting Obesity. Marc Danzon, WHO Regional Director for Europe, describes obesity as "…one of the most serious public health challenges,… a particular danger for the young…", which "…also contributes to so many other serious medical conditions"(*Conference Report, WHO European Ministerial Conference on Counteracting Obesity,2007, p.5*). This opinion is supported by the results of numerous research studies [3, 5, 6, 9]. World Health Assembly adopted a complex plan of measures for nutrition improvement. It was recommended to perform a review of the global basics for nutrition monitoring in 2020 [3, 4, 9, 11, 12, 13].

According to epidemiological research carried out in the Russian Federation the prevalence of childhood overweight in various regions of Russia ranges from 5.5 to 11.8%, and the number of children suffering from obesity amounts to about 5.5% in rural areas, 8.8% in urban areas. In Lipetsk region 9.8% of children suffer from obesity, which constitutes approximately 20335 children [4].

Almost 60% of people having had obesity in childhood still suffer from the diseases and its complications in adulthood. This condition has transformed into a "metabolic syndrome", which is reported in numerous screenings [1]. One in eight schoolchildren has three or more risk factors typical for metabolic syndrome [4, 10]. According to the data of the Federal State Budget Establishment "Endocrinology Research Centre" of Ministry of Health, Russian Federation, RAS, one in three adolescents suffering from obesity has a metabolic syndrome. Currently the world faces a double problem – an epidemics of obesity and diabetes type II in children and adolescents [8, 9, 14].

Regional pilot project "Healthy Schoolchildren" started in Lipetsk region in 2016 with the aim of introduction of healthy diets in schools. The present research has studied the prevalence of overweight and obesity in schoolchildren in Lipetsk Region, assessed risk factors of the given pathology and analyzed schoolchildren diets.

MATERIALS AND METHODS

The research design consists of 4 stages. At stage 1 in the framework of the pilot project "Healthy Schoolchildren" carried out in Lipetsk Region specialists of Yelets Health Centre and Endocrinology Centre of the Voronezh N.N. Burdenko Medical University (VSMU) examined 561 schoolchildren (271 males and 290 females) aged 7 to 17 from two urban and one rural schools . Having received an informed consent from the participants and their parents, medical practitioners performed anthropometric measurements including calculation of body mass index (BMI), BMI SDS (Standard Deviation Score), body composition measurement by bio-impedance technique.

At stage 2 researchers investigated predictors and triggers in 98 overweight children and 65 obese children; all other children were included in a control group. Inclusion criteria of the basic group are as follows: diagnosed obesity (BMI SDS ≥ 2,0), overweight (BMI SDS > 1,0 and < 2,0 SD). Exclusion criteria are as follows: underweight (BMI SDS < -2.0 SD) and genetic diseases. School menus analysis was also performed and an optimal menu for school canteens was developed according to the guidelines of the "Endocrinology Research Centre" of Ministry of Health, Russian Federation, Moscow.

Stage 3 included a "Healthy Diet School" – healthy eating education for participants of the project and their parents. This school consisted of 7 training sessions for children and 2 training sessions for parents. There was a discussion of causes of obesity and motivation of fighting obesity. The participants were introduced to basic principles of healthy eating, to suitable type and scheme of physical activity. They practiced a daily set of one-hour exercise session. Stage 3 also involved a new menu for a balanced school diet, and additional physical activity of moderate intensity.

Stage 4 (2017) is due to perform evaluation of diet and physical activity changes carried out at the previous stages of the project. Provided the results of the evaluation are positive, 'Healthy Schoolchildren' project will be implemented in all Lipetsk schools.

The participants' hereditary background was studied according to the survey, questionnaires and medical records of their parents."Obesity" and "overweight" were diagnosed according to standard deviation score of the body mass index (Ketle Index – BMI) (BMI SDS). if BMI is within -2 SD to +1 SD, it falls within the normal; if BMI is within +1 SD to +2 SD, it falls within the overweight range; if BMI is more than +2 SD, it falls within the obese range; if BMI was less than -2 SD, it falls with the underweight range. body mass was diagnosed. According to BMI SDS a degree of obesity was evaluated as follows: I degree – 2.0 – 2.5; II degree – 2.6 – 3.0; III degree – 3.1 – 3.9; IV degree ≥ 4.0 – morbid.

Statistical analysis

Statistical data analysis was performed using computer software SPSS 11.5 (SPSS Inc., США), Microsoft Excel 2010, Statistica 10, BIOSTAT. Statistical significance of rated values diversity in two compared groups was determined using Mann-Whitney U-test. Spearman's rank correlation coefficient (r) was used to define correlation between variables. When data described differed in their distribution from the normal law, a median line and quartiles were calculated. Hypothesis verification on data distribution according to the normal law was performed using Shapiro-Wilks test. In case of normal distribution data were given as a mean value and a standard mean square error (M±m). The statistical significance was registered at the following levels: 0.05; 0.01; 0.005 and 0.001.

RESULTS AND DISCUSSION

In the framework of the research 31 schoolchildren (5.5%) were defined as underweight, 367 (65.4%) as normal, 98 (17.55) as overweight and 65 (11.6%) as obese. These results correlate with the average statics in the Russian Federation [2, 5]. Regarding BMI SDS in obese schoolchildren I degree obesity was diagnosed in 40 (61.5%) children; II degree obesity – in 17 (26.2%0 of schoolchildren; III degree obesity – in 7 (10.8%) of children; morbid obesity was diagnosed in 1 (1.5%) schoolboy; the number of obese boys was statistically more significant (p<0.05).

For body composition and body fat calculation the authors have used a bio-impedance method. They have established high and moderate correlation between the BMI value and the value of body fat and muscle tissue distribution in all children with exception of overweight male teenagers in puberty period: the correlation of these values was slight (r=0.246) which might result from various degrees of muscle tissue development in puberty period.

Thus, calculation of BMI is reported to be an informative method to diagnose overweight and obesity in females of all ages as it has moderate and high correlation between BMI and body fat; BMI value is considered to be insufficiently informative to diagnose overweight and obesity in male teenagers in puberty period.

In succeeding years obesity risk (OR) is higher in children whose parents or close relatives have diabetes type II, whose parents are obese, whose mother has thyroid gland disorders, if a child was obese or overweight at 12 months, or if baby's weight at birth was more than 4000 g (Table 1) [3, 6, 9].

Table 1: Obesity risk (OR) in School children

Value	Level of significance *p*	Exponential coefficient of OR	95% confidence interval	
			Lower limit	Upper limit
SD of the II type in parents	0,001	8,442	-4,755	12,716
Obesity in parents	0,001	15,224	-34,430	26,876
Formula feeding	0,001	9,909	4,207	15,561
Obesity in children at 1-2 years of age	0,001	1,135	0,060	1,751

Overweight body mass in children at 1-2 years of age.	0,005	2,176	0,214	3,230
Body mass at birth 4 kg and more	0,005	4,250	-6,048	6,730
Thyroid gland disorders in mother	0,005	2,406	-0,320	3,565

Analysis of nutrition diaries of 65 obese children and 98 overweight children has revealed the following nutritional misbehavior: high-calorie evening meal (in 77.3% of children), lack of hot breakfast and two meals a day (in 75.1% of children), high-calorie snacks – sweets, chocolate, chips – as (in 64.3% of children).

Individual assessment of nutritional behavior was performed in 95 participants aged 7 – 15 (Table 2).

Table 2: Score of nutritional behavior in children

Type of nutritional behavior	Children with obesity, n = 65	Children with normal body mass, n = 30	Norm	*p*
Emotiogenic type	1,44±0,26	0,59±0,12	2,03	0,3888
External type	3,68±0,71	1,89±0,21	2,68	0,0213
Restrictive type	2,85±0,15	0,79±0,26	2,43	0,1213

Statistically significant diversity was obtained on external type of nutritional behavior in the group of schoolchildren with obesity comparing to the group of children with normal weight. Moreover, in the group of children with obesity more than half of children had two (34.6%) and even three (18.9%) types of nutritional misbehavior; this fact correlates with the data obtained by Smirnova S.G. et al (2013) [10].

The analysis of school menus has revealed incompliance with the formula of rational balanced diet 1:1:4 due to a double amount of carbohydrates – treacle cakes, wafers, cracker rings, biscuits, muffins, sausages, - and a limited amount of vegetables, lack of vitamin salads, dairy products, packaged vegetable and fruit juices with added vitamins, enriched dietary sorts of bread with increased biological value. Therefore, balanced food rations were developed and adopted for schools in 2017.

CONCLUSION

Obesity and overweight prevalence in children amounts to 29.1%, which correlates with the European statistics. Obesity in boys is significantly higher than in girls, BMI for boys in puberty period cannot be considered as an informative value to diagnose overweight and obesity. Nutritional misbehavior is registered in all groups of obesity and overweight schoolchildren (a combination of various types of misbehavior is common). The knowledge of nutritional misbehavior should be considered in "Healthy Diet School" programs and for obesity prevention at schools. Obesity risk in succeeding years is higher in children whose parents or close relatives have diabetes type II, whose parents are obese, whose mother has thyroid gland disorders, if a child was obese or overweight at 12 months, or if baby's weight at birth was more than 4000 g. Development of healthy school environment requires a complex approach including an improvement of nutritional behavior, an increase of physical activity, healthy diet education for children and parents, and introduction of evidence based principles for childhood diets and school food menus.

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