EDITORIAL

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RATES OF OVERWEIGHT AND OBESITY IN CHILDREN AND ADOLESCENTS IN ST. PETERSBURG: ASSESSMENT OF THE RISKS OF DEVELOPING METABOLIC SYNDROME

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Background. It is known that the earlier a person's body weight exceeds the normal range, the metabolic disorders associated with obesity will form at an earlier age. The progressive increase in the prevalence of obesity and metabolic syndrome in different countries is primarily associated with the so-called "human risk factors", which include: physical inactivity, excessive consumption of food rich in fats and carbohydrates, stress, smoking. In this regard, it is extremely important to regularly monitor the body weight of children and adolescents in order to early identify a tendency to increase body weight for the making recommendations for maintaining weight within the normal range.

Aim. To evaluate the frequency of obesity and overweight in children, adolescents and adults from among the residents of St. Petersburg, to conduct a comparative assessment of the data obtained.

Materials and methods. The work was attended by students of St. Petersburg schools (children and adolescents) and patients (adults) who are being treated in St. Petersburg State Medical Institution "Elizavetinskaya Hospital". The sample was random: when collecting data from children and adolescents, data from one of the classes in each parallel from 4th to 11th grade were taken into account, when collecting data from adults – 2 people from each ward of the gastroenterology department of the St. Petersburg State Medical Institution "Elizavetinskaya Hospital". Data collection was carried out in the period: August–December 2020. Statistical processing was performed out using the computer software package SPSS 8.0. Estimation of anthropometric parameters (age, body weight, height) and calculation of body mass index (BMI) were performed in 74 children (age 9–12 years), 137 adolescents (age 13–18 years) and 55 adults (mean age 49.12 ± 17.03).

Results. An increase in body weight was detected in 6.8% of children (5.4% – overweight and 1.4% – obese of the 1st degree), 14.6 % of adolescents (11.7% – overweight and 2.9% – obese of the 1st degree) and 62% of adults (36% – overweight, 13% – obese of the 1st degree, 7% – obese of the 2nd degree, 6% – obese of the 3rd degree). During the correlation analysis, it was observed that the proportion of overweight people in the observed age categories increased with age ($p < 0.05$).

Conclusions. Overweight and obesity begin to be detected already in children, in a fairly large percentage of cases already occur in adolescents and are observed in more than half of the adults surveyed in St. Petersburg. Therefore, it is necessary to carry out activities among parents of preschoolers and schoolchildren, as well as, if possible, the children themselves, to form motivation to maintain a healthy lifestyle in order to prevent the early development of overweight.

Keywords: obesity; overweight; body mass index.

РАСПРОСТРАНЕННОСТЬ ИЗБЫТОЧНОЙ МАССЫ ТЕЛА И ОЖИРЕНИЯ У ДЕТЕЙ И ПОДРОСТКОВ В САНКТ-ПЕТЕРБУРГЕ: ОЦЕНКА РИСКОВ РАЗВИТИЯ МЕТАБОЛИЧЕСКОГО СИНДРОМА

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Актуальность. Известно, что чем раньше масса тела человека превысит нормативные показатели, тем в более раннем возрасте сформируются метаболические нарушения, сопряженные с ожирением. Прогрессирующее увеличение распространенности ожирения и метаболического синдрома в разных странах в первую очередь связано с так называемыми человеческими факторами риска, к которым относятся: гиподинамия, избыточное потребление пищи, богатой жирами и углеводами, стресс, курение. В связи с этим крайне необходим регулярный мониторинг массы тела детей и подростков с целью раннего выявления тенденции к повышению массы тела для последующей разработки рекомендаций по сохранению веса в пределах нормативных показателей.

Цель – оценить частоту встречаемости ожирения и избыточной массы тела у детей, подростков и взрослых из числа жителей Санкт-Петербурга, провести сравнительную оценку полученных данных.

Материалы и методы. В работе приняли участие учащиеся школ Санкт-Петербурга (дети и подростки) и пациенты (взрослые), находящиеся на лечении в СПб ГБУЗ «Елизаветинская больница». Выборка носила случайный характер: при сборе данных детей и подростков учитывались показатели одного из классов в каждой параллели (с 4-го по 11-й класс), при сборе данных взрослых – двух пациентов из каждой палаты гастроэнтерологического отделения. Сбор данных проводили в период с августа по декабрь 2020 г. Статистическая обработка проведена с помощью пакета компьютерных программ SPSS 8.0. Определены антропометрические показатели (возраст, масса тела, рост) и рассчитан индекс массы тела у 74 детей (возраст 9–12 лет), 137 подростков (возраст 13–18 лет) и 55 взрослых (средний возраст 49,12 ± 17,03).

Результаты. Повышение массы тела было выявлено у 6,8 % детей (5,4 % – избыточная масса тела и 1,4 % – ожирение I степени), 14,6 % подростков (11,7 % – избыточная масса тела и 2,9 % – ожирение I степени) и 62 % взрослых (36 % – избыточная масса тела, 13 % – ожирение I степени, 7 % – ожирение II степени, 6 % – ожирение III степени). При корреляционном анализе установили, что с возрастом увеличивалась доля лиц с избыточной массой тела в наблюдаемых возрастных категориях ($p < 0,05$).

Заключение. Избыточная масса тела и ожирение в достаточно большом проценте случаев уже встречаются у подростков и наблюдаются более чем у половины взрослых обследуемых в Санкт-Петербурге. Следовательно, необходимо проводить среди родителей дошкольников и школьников, а по возможности и самих детей мероприятия по формированию мотивации к поддержанию здорового образа жизни в целях предупреждения раннего развития избыточной массы тела.

Ключевые слова: ожирение; избыточная масса тела; индекс массы тела.

BACKGROUND

Changes in the lifestyle and nutrition among the population have led to an increase in the number of people who are overweight. Obesity is called a “disease of civilization” and is additionally one of the non-infectious pandemics of the 21st century, which poses a threat to the life and health of the people irrespective of their social, professional, geographical identity, as well as the age and gender. Overweight and obesity are associated with an increased risk of many diseases, the possible occurrence of anxiety-depressive disorders, threat of the patient disability, and a decrease in the life expectancy.

One of the severe negative consequences of obesity is the metabolic syndrome in the pathogenesis where the process starts with an accumulation of visceral fat and insulin resistance. This leads subsequently to the development of carbohydrate and lipid metabolism disorders, non-alcoholic fatty liver disease, and further leading to the development of cardiovascular complications.

Scientists and medical practitioners began to increase their attention toward the problem of obesity in children and adolescents since early metabolic obesity-associated disorders occur as a result of the human body weight increasing above normal. The progressive increase in the prevalence of the metabolic syndrome in different countries is primarily associated with human risk factors, which includes the physical inactivity, excessive consumption of the food rich in fats and carbohydrates, as well as stress, and smoking [2, 6].

Regarding the pediatric practice, children of the following categories constitute as the risk group for obesity and metabolic disorders [6,7,11]:

1) Overweight or obese parents.

2) Relatives having (or had) diabetes mellitus or other endocrine pathology.

3) Children who early transferred to formula feeding (especially unbalanced high-calorie mixtures).

4) Premature and low birth weight children.

5) Children with hereditary diseases and endocrine pathology.

Therefore, it is extremely important to identify children with risk factors for being overweight and perform a case follow-up of those at a risk for early recognition, prevention, and the development of the metabolic syndrome.

Previous studies in various regions of the Russian Federation have estimated the incidence of overweight and obesity among the children and adolescents. According to an epidemiological study conducted in Russia (2005–2006), which included data on 10,223 adolescents aged 12–17 years old, the incidence of overweight among the students in grades 6–11 was 12% [5]. In Saratov, according to A.P. Averyanov, overweight is registered in 10.7%, including obesity in 4.1% of school children aged 6–16 years old [1]. In Orenburg, the prevalence of the obesity in children aged 7–17 years old was 7% [8]. In 2013, data from the examination of 10,000 children of the Republic of Bashkortostan aged 10–16 years old were published, where overweight was diagnosed in 14.8%, including obesity in 6.3% of the cases [9]. The prevalence of obesity in children and adolescents in the northern territories in 2011 was 18.0% [3]. According to the scientists from Perm, in 2005, the prevalence of overweight in the adolescents was 9.4% and that of obesity was 3.1%, whereas in 2013, these were 14.8% and 5.5%, respectively ($p = 0.023$ and 0.140 compared with the 2005 cohorts) [12]. When analyzing the statistics of the obesity in children for 2014–2018, the overall incidence of obesity in the Russian Federation among children aged 0–17 years increased by 21.4%. In the dynamic for the years 2014–2018, the primary incidence of obesity among children aged 0–17 years in the Russian Federation increased by 8.7% [10]. Metabolic syndrome in children is less common compared to overweight and obesity; however, while maintaining the tendency of increase in the incidence of obesity, the frequency of metabolic disorders in these age categories may also increase. Regular epidemiological studies are required to monitor the dynamics of the obesity and metabolic syndrome in children and adolescents. Several medical specialties, when detecting the obesity and suspected development of the metabolic syndrome in a child, to establish the diagnosis, should be guided by the criteria of the metabolic syndrome of the International Diabetes Association (2007) where abdominal (visceral) obesity is the main diagnostic factor (Table 1 and Table 2) [13–15].

The presence of the abdominal obesity was determined in accordance with the height-normalized indicators of the waist circumference in children aged 6–18 years, established by A.P. Averyanov, because of an examination of a representative sample of children and adolescents with the determination of the mass of the adipose tissue using an electrical impedance analysis (Table 2) [1].

In the treatment of the metabolic syndrome, especially in children and adolescents, in addition to the pharmacological correction, it is necessary to introduce the measures to form food preferences in accordance with the principles of conscious nutrition, as well as to maintain an active lifestyle. In this case, the doctor aims to develop a stable motivation and attitude toward the success in children, adolescents, and their parents. Additionally, it aims at long-term implementation of recommendations on nutrition, physical activity, taking medications, psychotherapy, as well as problem-targeted training and self-control training [6].

The specifics of correcting the problem of obesity are the following:

1) A short period for the influence on patients and their families.

2) The complexity of the formation of positive motivation in patients and their families to normalize body weight.

3) The rigidity of patients, adherence to family, and social stereotypes (“midlife spread,” “everyone in our family was like that,” “this is our metabolism”).

4) The cost of a healthy lifestyle compared with the patterns of “traditional” behavior for the population.

This study aimed to determine the incidence of obesity and overweight in children, adolescents,

Table 1 / Таблица 1

Criteria for the diagnosis of metabolic syndrome in children and adolescents depending on age by International Diabetes Association, 2007 [14, 15]

Критерии диагностики метаболического синдрома у детей и подростков в зависимости от возраста по данным Международной диабетической ассоциации, 2007 г. [14, 15]

Age / Возраст	Obesity (waist circumference, cm) / Ожирение (окружность талии, см)	Triglycerides, mmol/l / Триглицериды, ммоль/л	LDLP, mmol/l / ЛПВП, ммоль/л	Blood pressure / Артериальное давление, мм рт. ст.	Glucose in blood, mmol/l / Глюкоза крови, ммоль/л
Under 6 years / До 6 лет	Metabolic syndrome is not formed / Метаболический синдром не формируется				
6–10 years / 6–10 лет	≥ 90th percentile (table 2) / ≥90-го процентиля (табл. 2)	The diagnosis of metabolic syndrome in this age group is not established, but if, in addition to abdominal obesity, there is a burdened family history of metabolic syndrome, type 2 diabetes mellitus, cardiovascular diseases, including hypertension and/or obesity, then it is necessary to investigate other indicators / Диагноз метаболического синдрома в данной возрастной группе не устанавливается, но если помимо абдоминального ожирения имеется отягощенный семейный анамнез по метаболическому синдрому, сахарному диабету 2-го типа, сердечно-сосудистые заболевания, включая артериальную гипертензию и/или ожирение, то необходимо исследовать и другие показатели			
10–16 years / 10–16 лет	>90th percentile or adult criteria, if lower (table 2) / >90-го процентиля или критерии для взрослых, если ниже (табл. 2)	>1.7 mmol/l / ммоль/л	<1.03 mmol/l / ммоль/л	SBP >130 and/or DBP ≥85 mmHg / САД >130 и/или ДАД ≥85 мм рт. ст.	>5.6 mmol/l [if ≥5.6 mmol /l (or the presence of type II diabetes mellitus) conduct a glucose tolerance test] / >5,6 ммоль/л [если ≥5,6 ммоль/л (или наличие сахарного диабета 2-го типа) провести тест толерантности к глюкозе]
≥ 16 years / ≥16 лет	in men ≥ 94 cm, in women ≥ 80 cm / у мужчин ≥94 см, у женщин ≥80 см	≥1.7 mmol/L (≥150 mg/dl) / ≥1,7 ммоль/л (≥150 мг/дл)	in men <1.03 mmol/l (<40 mg/dl), in women <1.29 mmol/l (<50 mg/dl) or, if specific treatment of these lipid disorders is carried out / у мужчин <1,03 ммоль/л (<40 мг/дл), у женщин <1,29 ммоль/л (<50 мг/дл) или специфическое лечение этих липидных нарушений	SBP ≥130 and/or DBP ≥85 mm Hg or, if antihypertensive drugs are taken / САД ≥130 и/или ДАД ≥85 мм рт. ст. или прием антигипертензивных препаратов	≥5.6 mmol/L (100 mg/dl) or previously established type 2 diabetes mellitus / ≥5,6 ммоль/л (100 мг/дл) или ранее установленный сахарный диабет 2-го типа

Note. LDLP – low-density lipoprotein; SBP – systolic blood pressure; DBP – diastolic blood pressure.

Примечание. ЛПВП — липопротеины высокой плотности; САД — систолическое артериальное давление; ДАД — диастолическое артериальное давление.

Table 2 / Таблица 2

Percentile distribution of waist circumference in boys and girls aged 6 to 18 years (cm), used to assess obesity as a criterion for the diagnosis of metabolic syndrome [1, 4, 14, 15]
Процентильное распределение окружности талии у мальчиков и девочек в возрасте от 6 до 18 лет (см), используемое для оценки ожирения как критерия диагностики метаболического синдрома [1, 4, 14, 15]

Age, years / Возраст, годы	Boys / Мальчики					Girls / Девочки				
	10	25	50	75	90	10	25	50	75	90
6	50.1	54.3	55.4	59.1	64.2	49.5	51.8	55	58.8	64
7	51.9	56.2	57.5	61.7	67.6	51.1	53.5	56.9	61.1	66.8
8	53.7	58.1	59.6	64.3	71	52.7	55.2	58.8	63.4	69.7
9	55.5	59.9	61.7	67	74.3	54.3	56.9	60.7	65.7	72.6
10	57.3	61.8	63.7	69.6	77.7	55.9	58.6	62.5	68	75.5
11	59.1	63.6	65.8	72.2	81.1	57.5	60.2	64.4	70.3	78.3
12	60.9	65.5	67.9	74.9	84.5	59.1	61.9	66.3	72.6	81.2
13	62.7	67.4	70	77.5	87.9	60.7	63.6	68.2	74.9	84.1
14	64.5	69.2	72.1	80.1	91.3	62.3	65.3	70.1	77.2	86.9
15	66.3	71.1	74.1	82.8	94.7	63.9	67	72	79.5	89.8
16	68.1	72.9	76.2	85.4	98.1	65.5	68.5	73.9	81.8	92.7
17	69.9	74.8	78.3	88	101.5	67.1	70.3	75.8	84.1	95.5
18	71.7	76.7	80.4	90.6	104.9	68.7	72	77.7	86.4	98.4

and adults among the residents of St. Petersburg, as well as a comparative assessment of the data obtained.

MATERIALS AND METHODS

The students of St. Petersburg (children and adolescents) and patients (adults) being treated in St. Petersburg Elizavetinskaya Hospital were involved in this work. A random sample was collected for data from children and adolescents. Data from one of the classes in each grade level (grade 4–11) were considered. For adults, the data was collected from two patients from each ward of the gastroenterology department for four months. Data collection was performed from August to December 2020. Anthropometric indicators (age, body weight, and height) were determined, and the body mass index (BMI) was calculated in 74 children (9–12 years old), 137 adolescents (13–18 years old), and 55 adults (mean age 49.12 ± 17.03). BMI was calculated using the equation of weight, kg/ (height, m)^2. Depending on the BMI (the indicator is used in children >2 years old and adults), the subjects were distributed into groups, where <25 kg/m^2 indicated no excess body weight; 25–30 kg/m^2 implied overweight; 30–34.9 kg/m^2 indicated degree I obesity; 35–39.9 kg/m^2 indicated degree II obesity; and ≥40 kg/m^2 was indicated degree III obesity.

Statistical processing was performed using a SPSS 8.0 software package. The distribution of data in the sample was assessed using Pearson's χ^2 test and Kolmogorov–Smirnov test with Lilliefors correction. Since the distribution of age and BMI indicators in the sample was different from the normal, the Spearman rank correlation coefficient was used to assess the presence of a correlation between them. The value of the criterion of a statistical significance (p) was set at the error probability level of 0.05.

RESULTS

The increase in the body weight compared with standard indicators in varying degrees of severity was determined in all age groups. The groups of children and adolescents included subjects with both overweight and degree I obesity, and in the group of adults, there were subjects with the obesity of all III degrees (Table 3).

Correlation analysis revealed a direct dependence of BMI on age in the age categories, namely $r = 0.360$ ($p = 0.001$) in the group of children and adolescents (Figure 1), and $r = 0.329$ ($p = 0.014$) in the group of adults.

DISCUSSION OF RESULTS

The results obtained in persons <18 years of age (in children, overweight was 5.4% and obesity I degree

Table 3 / Таблица 3

The frequency of overweight and obesity in children, adolescents and adults
Частота встречаемости избыточной массы тела и ожирения у детей, подростков и взрослых

Groups of patients examined / Группы обследуемых	Normal body weight, % / Нормальная масса тела, %	Overweight, % / Избыточная масса тела, %	Obesity I, % / Ожирение I степени, %	Obesity II, % / Ожирение II степени, %	Obesity III, % / Ожирение III степени, %
Children / Дети	93.2	5.4	1.4	0	0
Adolescents / Подростки	85.4	11.7	2.9	0	0
Adults / Взрослые	38	36	13	7	6

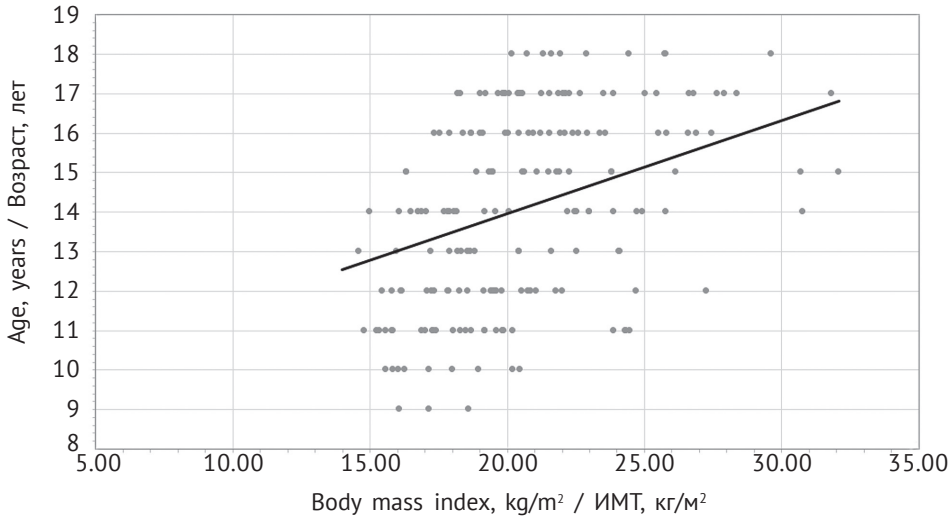

Figure. Correlation between age and body mass index
Рисунок. Корреляционная связь между возрастом и индексом массы тела

was 1.4%; in adolescents, overweight was 11.7% and obesity I degree was 2.9%) revealed that in St. Petersburg among the patients examined, there was a certain percentage of children and adolescents with overweight and obesity, and in adolescents, both indicators were higher than the children. We compared the indicators obtained with the results of studies of other Russian scientists for this category of individuals [1,3,5,8–10,12], in which the incidence of overweight in children and adolescents varies from 9.4%–14.8% and that of obesity was 3.1%–7.0%. When comparing data, it was established that in children examined in St. Petersburg, the percentage of overweight and obesity was slightly lower than the results of studies conducted in the other regions of Russia, whereas for adolescents examined in St. Petersburg, the indicators generally coincided with the data obtained by the other researchers in various regions of Russia.

When analyzing the data of adult patients, it was revealed that overweight and obesity were registered in more than half of them (36% and 26%, respectively). The increase in body weight with age is primarily associated with a slowdown in the basal metabolism.

The increased body weight in groups of children and adolescents is an alarming signal for the development of visceral obesity in adulthood with the formation of metabolic complications and cardiovascular accidents in the future. Therefore, it is necessary to perform activities among parents of preschoolers and schoolchildren to form motivation to maintain a healthy lifestyle to prevent the development of obesity and metabolic syndrome in the population.

The optimal period for the prevention of obesity and overweight is childhood and adolescence (preclinical period and the period of absence of complications). We propose to start preventive measures to identify risk factors, focusing on the following **indicators of risk factors** developed by us for overweight and obesity in children and adolescents:

1. Nutrition: Excessive consumption of high-calorie foods; consumption of large portions of food; availability and cheapness of fast food; non-obser-

vance of the food intake and rest by modern children and adolescents; lack of breakfast; lack of family meals; eating out with peers; eating at night hours; watching television while eating; insufficient intake of vegetables and fruits; abundance of affordable low-quality sugary carbonated beverages and juices; advertising for non-healthy foods and improper eating behaviors; and the inaccessibility of quality food.

2. Physical inactivity: A low level of physical activity where energy consumption is higher than its expenditure, the inability to do sports, and dependence on gadgets and television.

3. Family factors: Genetic predisposition, cultural and intrafamilial traditions, socio-economic status of the family, low level of education, low level of mutual support and trust in the family, and weak parental control.

4. Psychological factors: Chronic stress; negative emotional background in the family; kindergarten; school; moreover, insufficient sleep duration; lack of hobbies; inability to structure activities and leisure, low self-esteem and difficulty in communication with the peers.

The system of questionnaires and tests used on a regular basis within the periodic examination of children aged 1–2, 3–5, 6–7, 8–9, 10–11, 12–13, and 14–16 years (filled in by parents for children, and adolescents fill in independently), including information on the indicators of the risk factors (mentioned above), enables to identify in the population, the patients with risk factors for overweight, obesity, and a metabolic syndrome at the preclinical stage and the stage of minimal clinical manifestations. The whole range of preventive and therapeutic measures applies to them, including a psychological counseling; psychological correction; individual and family psychotherapy; lifestyle optimization activities; consultative diagnostic; and the therapeutic assistance of a nutritionist, gastroenterologist, and endocrinologist, as well as rehabilitation.

In cases where it was not possible to avoid the development of obesity at the preclinical stage, it is required to focus on the official criteria presented in Table 1 and Table 2, for early detection of the metabolic syndrome.

CONCLUSION

Therefore, while examining a sample of residents of St. Petersburg, an increased body weight was revealed in children in 6.8% of cases (overweight in 5.4% of cases, degree I obesity in 1.4% of cases), among adolescents in 14.6% of cases (overweight in 11.7% of cases, degree I obesity in 2.9% of cases), and in adults in 62% of cases (overweight in 36% of the cases, degree I obesity in 13% of the cases, degree II obesity in 7% of the cases, and degree III obesity in 6% of the cases). In a comparative assessment of the indicators of children and adolescents examined by us, it was revealed that the number of adolescents with an increased body weight is more than two times higher than in the group of children. Comparing the data of the children and adults examined, it was established that the incidence of increased body weight in adults is nine times higher than in children. The activation of risk factors for the development of obesity may occur precisely in adolescence during puberty, which leads to a significant increase in the incidence of overweight and obese people in adulthood. The increase in body weight in the subjects with age may also be associated with dietary habits (western diet with an increased content of high-calorie refined food), and the presence of many risk factors in the megalopolis, as well as with age-related slowdown in basal metabolism.

It should be emphasized that extensive epidemiological studies should be conducted with a certain frequency to identify children and adolescents with overweight and obesity, including a comparative assessment of these changes over time.

ADDITIONAL INFORMATION

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