

Comparative Characteristics of Eating Behavior, Habits, and Patterns of Normal and Overweight Children, Including Obese Children

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Abstract

Introduction: One of the reasons for the high prevalence of overweight and obesity among adults, and especially children and adolescents, is eating habits and eating behavior, which are formed by the rules of nutrition established in the family. **Purpose of the Study:** Conduct a comparative assessment of the nature of nutrition and eating habits of overweight schoolchildren, including obesity, and those with normal body weight to justify the development of measures aimed at preventing the formation of overweight and alimentary-related diseases. **Materials and Methods:** The materials for the study were the data of a survey of 2029 schoolchildren aged 7-17. The survey program included questions reflecting knowledge of the principles of healthy eating and adherence to its principles in family and school meals, the structure and mode of eating were studied. Statistical analysis was carried out using STATISTICA 10 and Microsoft Excel application packages. Parametric methods of analysis were used. Differences were considered statistically significant at $p < 0.05$. **Results:** A high frequency of adherence to the consumption of high-calorie foods was established, which is typical both for respondents with overweight and obesity, and with normal body weight. In the group of children with overweight and obesity, a higher frequency of food intake was revealed both on weekends and on school days 75.4% versus 65.6% and in the group with normal body weight, respectively, 73.4% versus 60.8% ($p \leq 0.05$), which is largely due to the greater proportion of children in this group who eat according to the main diet at school (73.2% versus 59.3%, $p \leq 0.05$), as well as attending the canteen in addition to the main nutrition (78.6% vs. 14.3%, ($p \leq 0.05$), more often buying main meat and fish dishes (6.7% vs. 4.8%), cereals (1.8% vs. 7%), sausages or wieners (4.0% vs. 1.1%), less often - fruits (2.7% vs. 3.4%), which increases the energy value of the diet compared to children with normal body weight. **Conclusion:** The study made it possible to identify violations of eating behavior and eating habits in schoolchildren with different BMI indicators, which pose additional risks of overweight and obesity in schoolchildren. Habits in the group of children with overweight, which are the source of the formation of risk factors for diseases associated with overweight and obesity, as well as the peculiarities of eating habits in the group of children with normal body weight. The data obtained require the need to develop preventive measures aimed at creating positive motivation in children to reduce the consumption of critically important nutrients, develop healthy eating habits, and consume food that is balanced with regard to actual energy consumption and physiological need for food and biologically valuable substances.

Keywords: body mass index, obesity, eating behavior, eating habits, healthy eating, risks associated with unhealthy eating, diet-related diseases

1. Introduction

The high prevalence of overweight and obesity among adults, and especially among children and adolescents, is registered worldwide, and obesity has the status of a chronic non-communicable epidemic according to WHO estimates (WHO, 2015; Lobstein T, Jackson-Leach R & Moodie ML., 2015; Word Health Organization, 2017). This requires improved monitoring of the population's nutrition both in organized groups and at home.

The risks of overweight and obesity in children in modern conditions include the increasing consumption of high-calorie foods, which are a source of simple carbohydrates and saturated fats (Word Health Organization, 2017; Namazova-Baranova LS, Kovtun OP, Anufrieva EV & Naboychenko ES., 2019; Dzhumagaziev AA, Bezrukova DA, Bogdanyants MV & Orlov FV., 2016; Suleimanov MA & Savelyeva OV., 2019; Polupanov AG, Tolebaeva AA, Altymysheva AT et al., 2019; He B., Long W, Li X. et al., 2018). This is due to such habits as excessive calorie dinner, many high-calorie snacks during the day, combined with low motor activity (Livingstone KM, Celis-Morales C, Papandonatos GD, et al., 2016; Callahan D., 2016; Belykh NA & Blohova EE., 2021), which leads to a deficiency of essential amino acids, vitamins, a number of macro- and microelements (Kozyreva PM, Safronova AM & Starovoitov ML., 2014; Tutelyan VA, Gorokhov AV, Mikhailova EI, Vladimirov LN, Lebedev NP, Ignatieva ME, Lebedeva UM & Stepanov KM., 2015; Varani A & Varani J., 2016).

In the Russian Federation, the federal project "Formation of a system to motivate citizens to a healthy lifestyle, including healthy eating and avoidance of bad habits" is aimed at realizing the formation of healthy eating habits¹. This project is being implemented as part of the national project "Demography"².

Eating habits and eating behaviors formed in childhood have a major role in the formation of overweight in adults (Ostojic SM, Stojanovic MD, Stojanovic V, et al., 2011; Hirsch YaV & Yuditskaya TA., 2013; Chirkina TM, Aslanov BI, Dushenkova TA & Rishchuk SV., 2016; Kiess W, Penke M, Sergeyev E & Neef M., 2015; Pyrieva EA, Gmoshinskaya MV, Shilina NM & Gurchenkova MA., 2017).

Children's eating behavior is formed by the rules established in the family, so the formation of healthy eating behavior in the family is the basis for the prevention of alimentary-dependent diseases, including obesity (Wang J & Fielding-Singh P., 2018). It is established that the formation of pathological habits begins, as a rule, from 5 years of age, taking definite forms by 7 years of age (Hirsh YaV & Yuditskaya TA., 2018). Eating behavior includes attitudes, behaviors, habits, and emotions about food that are individual to each person. Eating disorders are more commonly manifested by overeating, occurring in 1.5%-2.0% of the population and in 10-30% of patients seeking medical care for overweight and obesity, as well as night eating syndrome (Nikishina EI, Nikishina VB & Petrash EA., 2021; Hee Soon KI.M, Jiyoung PA. RK, Yumi MA & Mihae IM., 2019). The problem of uncontrolled (compulsive) overeating, which occurs in more than 30.0% of obese adolescents, is of particular importance nowadays. The need for constant overeating can become pathological, as gustatory psychostimulation dulls the emotional discomfort experienced by adolescents (Locke AE, Kahali B, Berndt SI, Justice AE, Pers TH, Day FR, et al., 2015).

An important direction in recent years is the study of the actual nutrition of different sex and age groups of the population as the main condition for the prevention of the formation of excess body weight and treatment of obesity is the correction of nutrition. In this aspect, the study of nutritional characteristics of children and adolescents with overweight and obesity compared to those with normal body weight is of particular importance (Sharmanov TS, Salkhanova AB & Dathabaeva GK., 2018).

2. Purpose of the Study

To conduct a comparative assessment of the nature of nutrition and dietary habits of schoolchildren with excess body weight, including obesity and normal body weight to justify the development of measures aimed at correcting nutritional behavior and bad dietary habits that cause the formation of excess body weight and alimentary-related diseases.

3. Materials and Methods

The analysis was based on the results of a questionnaire survey of 2159 schoolchildren aged 7-17 studying in 6 educational organizations of the Novosibirsk Region. The questionnaire survey was carried out in accordance with the program of sociological survey recommended by Rosпотребнадзор for studying the issues of

¹ Passport of the Federal project Formation of a system to motivate citizens to a healthy lifestyle, including healthy nutrition and avoidance of bad habits. Approved by the Presidential Council for Strategic Development and National Projects (Minutes of December 14, 2018 N 3). <https://docs.cntd.ru/document/564412400?section=text>

² The passport of the National Demography Project was approved by the Presidential Council for Strategic Development and National Projects. (Protocol No. 16 dated December 24, 2018). <https://storage.strategy24.ru/files/project/201912/75b8f0ac116c6c1d21575a7d7a6ee5c1.pdf>

schoolchildren's nutrition within the framework of the National Project "Demography"¹.

For schoolchildren under 14 years of age, the questionnaires were filled out by their parents/legal representatives, after 14 years of age — by schoolchildren in the presence of their parents/legal representatives. The survey was conducted with the informed consent of parents/legal representatives. The questionnaire contained 49 questions, including questions reflecting knowledge of the principles of healthy eating and adherence to the principles of healthy eating in the family, peculiarities of children's independent choice of dishes and products, frequency of consumption of healthy foods (vegetables, fruits, fermented milk products, bakery products made of whole flour), as well as foods with excessive saturated fat, salt, sugar and others. The issues of structure and dietary regimen were studied. The program included anthropometric data (body length and weight) entered by the respondents (parents/legal representatives), on the basis of which the body mass index (BMI) was calculated and assessed according to the method developed by WHO² with calculation of the Z-score (the number of standard deviations from the median values of children's physical development indicators). Normal body weight was considered to be BMI ± 1 SD; underweight - < -2.0 SD; overweight - BMI from $+1.0$ SD to $+2.0$ SD; obesity - BMI $> +2.0$ SD. Comparative analysis was performed in the normal weight group (n=1133) and the overweight group including obesity (n=679). Critical frequency by products and dishes, dietary regimen were determined by the method of expert evaluations for compliance with the requirements of sanitary and epidemiologic rules and regulations 2.3/2.4.3590-20.³

Statistical analysis was performed using the application packages of STATISTICA 10 and Microsoft Excel. The normality of distribution was checked using the Shapiro–Wilk method. Parametric methods of research were used, since the studied indicators had a normal distribution. Sample mean values of quantitative characteristics are given as $M \pm m$, where M is the sample mean, m is the standard error of the mean. Differences at $p < 0.05$ were considered statistically significant.

The results of the study were reviewed and approved by the local ethical committee of Novosibirsk Research Institute of Hygiene of Rospotrebnadzor (Minutes № 19 from 13.05.2022).

4. Results

The analysis of indicators characterizing the respondents' lack of adherence to the principles of healthy eating in the family showed that this problem is a characteristic of both groups under study. Comparative analysis revealed that respondents from the group with overweight and obesity, compared to the group with normal body weight, more often pointed out the lack of knowledge of healthy eating principles (6.5% vs. 3.1%), the lack of consideration of healthy eating principles in the home diet (31.4% vs. 27.6%), the lack of fruit in the child's daily menu (23.7% vs. 17.7%), the priority in the diet of bread and bakery products made of high-grade flour (57.2% vs. 48.6%). These differences were statistically significant ($p \leq 0.05$).

According to such indicators as the prevalence of the problem of lack of vegetables in the child's daily diet, fish in the weekly diet, and deficit in the consumption of dairy products, no statistically significant differences were found ($p \geq 0.05$) (Table 1).

Table 1. Comparative characteristics of indicators of adherence to healthy nutrition in the family by groups of children with normal and overweight, including obesity (according to the results of a sociological survey) per 100 respondents

Indicators	Children who are overweight (including obese)				Children with normal body weight				p
	M	m	M - m	M + m	M	m	M - m	M + m	
Do not know the principles of healthy	6,5	0,5	6,1	7,0	3,1	0,2	3,0	3,3	$\leq 0,05$

¹ MP 2.3.0167-20 "Preparation and monitoring of the nutritional status of students in general education organizations", approved on 03/20/2020 by the head of the Federal Service of Rospotrebnadzor, Chief State sanitary doctor of the Russian Federation A.Y. Popova. The passport of the National Demography Project was approved by the Presidential Council for Strategic Development and National Projects. (Protocol No. 16 dated December 24, 2018). <https://storage.strategy24.ru/files/project/201912/75b8f0ac116c6c1d21575a7d7a6ee5c1.pdf>

² Obesity and overweight. The newsletter. June 2021 [accessed September 30, 2022] Address: <https://www.who.int/ru/news-room/fact-sheets/detail/obesity-and-overweight>

³ SanPiN 2.3/2.4.3590-20 "Sanitary and epidemiological requirements for the organization of public catering", approved by Resolution No. 32 of the Chief State Sanitary Doctor of the Russian Federation dated October 27, 2020.

eating									
Do not adhere to the principles of a healthy diet	31,4	2,2	29,2	33,6	27,6	1,4	26,2	29,0	$\leq 0,05$
Consume vegetable dishes in home meals not daily	28,8	2,0	26,8	30,9	26,2	1,3	24,9	27,5	$\geq 0,05$
There is no fruit in the diet every day	23,7	1,7	22,1	25,4	17,7	0,9	16,8	18,5	$\leq 0,05$
Mostly consume high-grade flour bread	57,2	4,0	53,2	61,3	48,6	2,4	46,2	51,0	$\leq 0,05$
Fish dishes less than once a week	44,8	3,1	41,6	47,9	43,6	2,2	41,4	45,7	$\geq 0,05$
Do not use two or more dairy products (dishes) in daily nutrition	28,3	2,0	26,3	30,3	26,7	1,3	25,4	28,0	$\geq 0,05$

The sources of knowledge about healthy eating principles for both groups of respondents were in equal amounts in the overweight and obese group and in the normal weight group: medical workers, television and the Internet (31.6%, 31.7% and 31.0%, respectively). 1.6% of respondents indicated that they received information from scientific publications and 1.8% from popular publications; for 2.2% of respondents, relatives and friends were the source of knowledge about healthy eating principles.

Comparative characterization of the frequency of consumption of foods and dishes that do not meet the principles of healthy eating allowed us to establish that adherence to the consumption of high-calorie foods is characteristic of both overweight and obese respondents and respondents with normal body weight.

It was found that the prevalence of high frequency of consumption of foods and dishes characterized by the content of ingredients that are additional factors contributing to the formation of overweight and obesity was higher among children with normal body weight, the differences were statistically significant ($p \leq 0.05$) (Table 2).

Table 2. Comparative characteristics of the frequency of consumption of products and dishes that do not meet the principles of healthy nutrition

Consumption frequency indicators	Children who are overweight (including obese)				Children with normal body weight				p
	M	m	M - m	M + m	M	m	M - m	M + m	
Sausages (every day)	15,9	1,1	14,8	17,0	21,4	1,1	20,3	22,4	$\leq 0,05$
Fast food (once a week or more)	14,1	1,0	13,1	15,0	20,8	1,0	19,7	21,8	$\leq 0,05$
Chips, crackers (once a week or more)	29,0	2,0	27,0	31,1	35,1	1,8	33,3	36,9	$\leq 0,05$
Ketchup (3 times a week or more)	33,6	2,4	31,3	36,0	38,0	1,9	36,1	39,9	$\leq 0,05$
Mayonnaise (3 times a week or more)	40,3	2,8	37,5	43,1	41,6	2,1	39,5	43,6	$\geq 0,05$
Sweet pastries and pies (3 times a week or more)	38,2	2,7	35,6	40,9	53,9	2,7	51,2	56,6	$\leq 0,05$
Cakes (once a week or more)	33,2	2,3	30,9	35,5	44,9	2,2	42,7	47,1	$\leq 0,05$
Chocolate 3-4 times a week or more	46,5	3,3	43,3	49,8	63,7	3,2	60,5	66,9	$\leq 0,05$

Caramel, marshmallow, marshmallow (3 times a week or more)	27,4	1,9	25,5	29,3	34,3	1,7	32,6	36,0	$\leq 0,05$
Sugary carbonated drinks (3 times a week or more)	27,2	1,9	25,3	29,1	32,1	1,6	30,5	33,7	$\leq 0,05$
Add three teaspoons of sugar or more to tea	21,2	1,5	19,7	22,7	24,3	1,2	23,1	25,5	$\leq 0,05$
Have a habit of adding salt to dishes	16,7	1,2	15,5	17,9	17,3	0,9	16,4	18,1	$\geq 0,05$

It should be noted that the highest prevalence in both surveyed groups was found for frequent consumption of chocolate (46.5% and 63.7%, respectively, in the overweight and obese group and in the normal weight group) and muffins and pies (38.2% and 53.9%, respectively). Almost every fifth (21.2%) of the respondents in the overweight and obese group and every fourth (24.3%) in the normal weight group have the habit of adding three or more teaspoons of sugar to their tea ($p \leq 0.05$). No significant differences were found in both groups in the prevalence of high frequency of mayonnaise consumption (40.3% and 41.6%) and the habit of adding salt to dishes (16.7% and 17.3%) - $p \geq 0.05$.

A comparative assessment of eating patterns by the number of meals on weekends and school days revealed that the frequency of meals less than 4 times a day on weekends is lower than on school days in both groups. At the same time, both on school days and weekends, the prevalence of insufficient meal frequency in the group of overweight and obese children was statistically significantly lower than in the group with normal body weight ($p \leq 0.05$) (Table 3).

Table 3. Comparative characteristics of the prevailing nutritional stereotypes by the number of meals on school days and days off (in terms of 100 respondents)

Number of meals	Children who are overweight (including obese)				Children with normal body weight				p
	M	m	M - m	M + m	M	m	M - m	M + m	
1) EDUCATIONAL DAY									
Less than four meals	34,3	2,4	31,9	36,7	39,2	2,7	36,5	41,9	≥0,05
Four meals	43,6	3,1	40,6	46,7	41,6	2,1	39,5	43,7	≥0,05
Five or more meals	22,0	1,5	20,5	23,6	19,2	1,0	18,3	20,2	≤0,05
2) DAY OFF									
Less than four meals	24,1	0,6	23,5	24,7	26,6	1,9	24,8	28,5	≤0,05
Four meals	37,7	2,6	35,1	40,4	38,4	1,9	36,5	40,3	≥0,05
Five or more meals	37,3	2,6	34,7	39,9	35,0	1,7	33,2	36,7	≥0,05

The proportion of respondents who had 4 or more meals on weekends was statistically significantly higher compared to the school day and was 75.4% vs. 65.6% in the overweight and obese group and 73.4% vs. 60.8% in the normal weight group, respectively ($p \leq 0.05$). The average number of meals on school days for the "overweight children" group was 3.78 vs. 3.72 for normal weight children; on weekends, 4.11 and 4.06, respectively.

The higher number of meals per day in the group of respondents with overweight and obesity is largely due to the peculiarities of school meals. Thus, this group showed higher indicators of the number of children who consistently eat the basic diet (73.2% vs. 59.3%, $p \leq 0.05$), as well as those who attend the canteen in addition to the basic diet, buying food in the canteen (buffet, vending machines). Such schoolchildren are 78.6% overweight and obese against 14.3% of children with normal body weight, the differences in indicators are statistically significant ($p \leq 0.05$).

When considering the structure of supplementary food, a comparative assessment of the demand for certain

types of dishes and products among respondents (in terms of 100 respondents) was carried out.

The first place in the priority choice of supplementary food is occupied by baked goods in both studied groups, and in the group of children with normal body weight this indicator was significantly higher than in the group of children with overweight and obesity and amounted to 20.1% vs. 12.2%. Overweight children more frequently purchased first meals (4.9% vs. 3.2%), main meat and fish dishes (6.7% vs. 4.8%), porridge (1.8% vs. 0.7%), sausages or wieners (4.0% vs. 1.1%), and fruit less frequently (2.7% vs. 3.4%).

Statistically significant differences were revealed in the number of respondents taking vitamin and mineral complexes and biologically active supplements (BASs). Thus, 33.4% of children with overweight and obesity and 42.4% of children with normal body weight indicated this during the survey ($p \leq 0.05$). It should be noted that the share of children taking VMC (vitamins and mineral complex) and dietary supplements on a regular basis is 8.9% among overweight and obese children and 13.4% among children with normal body weight. 72.8% of the group of overweight and obese respondents and 68.8% of those with normal body weight indicated that they take these drugs on a regular basis, while the rest of the respondents (among children taking TMK and dietary supplements) do not take the drugs regularly.

5. Discussion

The study showed that the problems characterizing the lack of commitment to the principles of healthy eating include increased consumption of refined carbohydrate-containing foods, lack of whole-flour bread rich in B vitamins in the diet, insufficient frequency of consumption of fish, vegetables and fruits in the current structure of the respondents' diet, and, consequently, underconsumption of vitamins D and A, C, micronutrients, fiber, so necessary for the harmonious growth and development of children. At the same time, these problems are characteristic of both the group of respondents with overweight and obesity, and with normal body weight, as indicated by the studies of Sharmanov et al. (2018), who studied the actual nutrition of children aged 9-10 years and found a more pronounced imbalance in macro-, micronutrients and vitamins in children with obesity and normotrophy at a similar in nature and unbalanced diet, both in children with obesity and normotrophy (Sharmanov TS, Salkhanova AB & Dathabaeva GK., 2018). The survey showed that the prevalence of high frequency of consumption of products that are risk factors for the formation of excessive body weight practically for all studied items was higher among children with normal body weight. Differences in the indicators were statistically significant ($p \leq 0.05$), which predetermines in them high exogenous risks of excess body weight formation and associated risks of health disorders. The revealed peculiarity requires additional study with clarification of the content of the survey aimed at finding out the reasons, among which there may be a meaningful restriction of consumption of products with high energy value by children with overweight and obesity.

At the same time, among respondents with overweight and obesity there was a higher frequency of meals at weekends and a higher number of children eating at school, as well as a higher demand compared to children with normal body weight in the choice of supplementary food products, in which preference was given to both baked goods and main meat and fish dishes, which indirectly indicates a higher caloric content of their diet. It should be noted that this occurs against the background of a pronounced excessive intake of chocolate, mayonnaise, ketchup, cakes, baked goods, chips and caramel into the body.

In the group with excess body weight there were lower rates of intake of vitamin and mineral complexes and dietary supplements, although according to T. Sharmanov et al. (2018) obese children received a greater amount of almost all vitamins and minerals, probably due to the greater amount of food consumed, nevertheless, the diet was not sufficiently balanced in a number of trace elements (Sharmanov TS, Salkhanova AB & Dathabaeva GK., 2018).

An important role is played by the population's awareness of the principles of healthy nutrition, the analysis of which based on the questionnaire data showed that respondents from the group with overweight and obesity have less knowledge about this problem. This concerns both knowledge of the principles of healthy nutrition and their consideration in the daily family menu and the priority of independent choice of products by schoolchildren. Reduced knowledge about nutrition is associated with a significant predictor of eating behavior aimed at regulating and controlling emotional behavior associated with eating disorders in obesity (Paszta-Opilka A, de Jonge R, Zachurzok A & Górnik-Durose ME., 2020). It was found that for one third of respondents the sources of information about nutrition principles were television and the Internet, which, according to a number of studies, more often advertised sugary and carbonated drinks, chocolate and confectionery products, after watching advertisements for which children more often consumed these products during snacks, which, of course, increased the energy value of the diet (Polupanov AG, Tolebaeva AA, Altymysheva AT et al., 2019; Chubarov TV, Bessonova AV, Zhdanova OA, Artyushchenko AI & Sharshova OG., 2021; Kontsevaya AV, Imaeva AE, et al., 2020; Norman J, Kelly B, McMahon AT, et al., 2018). There is evidence that overweight children are particularly susceptible to the influence of TV commercials (Boyland EJ &

Halford JC. G., 2013).

Recently, great importance has been given to the development of programs aimed at promoting healthy eating habits among both children and parents, who have an important role to play in influencing children to develop eating habits by creating a home environment that creates conditions for accessible healthy food. In addition to the home environment, the school environment should play an effective role in promoting healthy eating behavior and physical activity among children (Nyberg, G, Sundblom, E, Norman Å, Bohman B, Hagberg J & Elinder LS., 2015; Hee Soon KIM, Jiyoung PA. RK, Yumi MA & Mihae IM., 2019). This is particularly important because physical activity along with unhealthy dietary habits are recognized as leading factors in the development of overweight and obesity in children (Dzhumagaziev AA, Bezrukova DA, Bogdanyants MV & Orlov FV., 2016; Adieva MK, Aukenov NE & Kazymov MS, 2021; Lobstein T, Jackson-Leach R, Moodie ML., et al., 2015).

6. Conclusion

The conducted study allowed to reveal the violation of eating behavior, food habits in schoolchildren with different BMI indicators, which represent additional risks of formation of overweight and obesity in schoolchildren. These include: consumption of foods that are a source of excessive intake of salt and saturated fats, simple carbohydrates; lack of practice of consumption of vitamin and mineral complexes and dietary supplements; insufficient (less than 4 times a day) frequency of meals on school days; prevalence of high-calorie foods and dishes with a low content of vitamins and minerals, fiber (mainly baked goods, side dishes, confectionery, juices and juice-containing products) in the structure of supplementary food in general educational organizations.

In the group of children with excess body weight, food habits that are the source of formation of risk factors for diseases associated with excess body weight and obesity were identified: a higher frequency of meals, more frequent use of supplementary food in school with a preference for high-calorie foods.

At the same time, the peculiarity of nutrition revealed in the group of children with normal body weight, manifested by a higher frequency of consumption of foods and dishes that do not meet the principles of a healthy diet, determines in them high exogenous risks of health disorders associated with overweight and obesity. This requires further study and the need to develop preventive measures aimed at forming in children a positive motivation to reduce the consumption of critically important nutrients, the development of healthy eating habits, and the consumption of food balanced with regard to actual energy expenditure and physiological needs for nutrients and biologically valuable substances.

Information About the Authors' Contribution

Concept and design of the study: Novikova I.I.; Data collection: Novikova I.I., Romanenko S.P.; Analysis and interpretation of results: Shevkun I.G., Aizman R.I.; Literature review: Shevkun I.G., Romanenko S.P.; Preparation of the manuscript: Novikova I.I., Shevkun I.G., Romanenko S.P., Aizman R.I. All authors reviewed the results of the work and approved the final version of the manuscript.

Compliance with Ethical Standards

The article material was approved by the ethical committee of FBSI "Novosibirsk Research Institute of Hygiene" of Rospotrebnadzor (Protocol № 19 dated 13.05.2022).

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Conflict of Interest

The authors declare no obvious and potential conflicts of interest in connection with the publication of this article.

References

- Adieva MK, Aukenov NE, Kazymov MS, (2021). Prevalence and risk factors for obesity among adolescents. Literature review. *Nauka i zdravookhraneniye*, 23(1), 21-29. <https://doi.org/10.34689/SH.2021.23.1.003> (In Russian).
- Belykh NA, Blohova EE., (2021). Vitamin D sufficiency and indicators of calcium-phosphorus metabolism in overweight and obese children. *Voprosy pitaniya.*, 90(2), 83-90. Accessed June 07, 2022. Available at: <file:///C:/Users/admin/Downloads/obespechennost-vitaminom-d-i-pokazateli-kaltsiy-fosfornogo-obmena-u-detey-s-izbytochnoy-massoy-tela-i-ozhireniem.pdf> (In Russian).
- Boyland EJ, Halford JC. G., (2013). Television advertising and branding. Effects on eating behaviour and food

- preferences in children. *Appetite*, 62, 236-241. <https://doi.org/10.1016/j.appet.2012.01.032>
- Callahan D., (2016). *The five horsemen of the modern world: climate, food, water, disease and obesity*. New York: Columbia Univ. Press, 416.
- Chirkina TM, Aslanov BI, Dushenkova TA, Rishchuk SV., (2016). The prevalence of obesity among children and adolescents in St. Petersburg. *Profilakticheskaya i klinicheskaya meditsina*, 4(61), 11-17. (In Russian). Available at: https://profclinmed.szgm.ru/PIK4_2016.pdf#page=11
- Chubarov TV, Bessonova AV, Zhdanova OA, Artyushchenko AI, Sharshova OG., (2021). Risk factors for the development of obesity in different periods of childhood. *Ozhireniye i metabolism*, 18(2), 163-168. (In Russian). <https://doi.org/10.14341/omet12756>
- Dzhumagaziev AA, Bezrukova DA, Bogdanyants MV, Orlov FV., (2016). The problem of obesity in children in the modern world: realities and possible solutions. *Voprosy sovremennoy pediatrii*, 15(3), 250-256. (In Russian). doi: <https://doi.org/10.15690/vsp.v15i3.1561>
- He B., Long W, Li X. et al., (2018). Sugar-sweetened beverages consumption positively associated with the risks of obesity and hypertriglyceridemia among children aged 7-18 years in south China. *Journal of Atherosclerosis and Thrombosis*, 25(1), 81-89. 10.5551/jat.38570.
- Hee Soon KI.M, Jiyoung PA. RK, Yumi MA, Mihae IM., (2019). What are the barriers at home and school to healthy eating?: Overweight/obese child and parent perspectives. *The Journal of Nursing Research*, 27(5), e48. <https://doi.org/10.1097/jnr.0000000000000321>
- Hirsch YaV, Yuditskaya TA., (2013). The role and place of eating disorders in the development of childhood obesity. *Vestnik SurGU. Meditsina*, 3(17), 14-21. (In Russian). Available at: <https://cyberleninka.ru/article/n/rol-i-mesto-narusheniy-pischevogo-povedeniya-v-razviti-detskogo-ozhireniya>
- Hirsh YaV, Yuditskaya TA., (2018). Comparative analysis of the eating behavior of children of different age groups. *Byulleten' Sibirskoy meditsiny*, 2, 21-30. (In Russian). Доступно по: <https://cyberleninka.ru/article/n/sravnitelnyy-analiz-pischevogo-povedeniya-detey-razlichnyh-vozrastnyh-grupp>
- Kiess W, Penke M, Sergeyev E, Neef M., (2015). Childhood obesity at the crossroads. *J Pediatr Endocr Met*, 28(5-6), 481-484. doi: <https://doi.org/10.1515/jpem-2015-0168>
- Kontsevaya AV, Imaeva AE, et al., (2020). The extent and nature of television food advertising to children and adolescents in the Russian Federation. *Public Health Nutr*, 23(11), 1868-1876. doi: <https://doi.org/10.1017/S1368980020000191>
- Kozyreva PM, Safronova AM, Starovoitov ML., (2014). Analysis of the actual nutrition and nutritional status of various population groups. *Vestnik Rossiyskogo monitoringa ekonomicheskogo polozheniya i zdorov'ya naseleniya*, (4). Moscow: Higher School of Economics. (In Russian).
- Livingstone KM, Celis-Morales C, Papandonatos GD, et al., (2016). FTO genotype and weight loss: systematic review and meta-analysis of 9563 individual participant data from eight randomised controlled trials. *British Medical Journal*, 354(Art. i4707), 1-11. doi: <https://doi.org/10.1136/bmj.i4707>
- Lobstein T, Jackson-Leach R, Moodie ML., (2015). Child and adolescent obesity: part of a bigger picture. *Lancet*, 385(9986), 2510-2520. DOI: 10.1016/S0140-6736(14)61746-3
- Lobstein T, Jackson-Leach R, Moodie ML., et al., (2015). Child and adolescent obesity: part of a bigger picture. *Lancet*, 385(9986), 2510-2520. [https://doi.org/10.1016/S0140-6736\(14\)61746-3](https://doi.org/10.1016/S0140-6736(14)61746-3)
- Locke AE, Kahali B, Berndt SI, Justice AE, Pers TH, Day FR, et al., (2015, February 12). Genetic studies of body mass index yield new insights for obesity biology. *Nature*, 518(7538), 197-206. <https://doi.org/10.1038/nature14177>
- Namazova-Baranova LS, Kovtun OP, Anufrieva EV, Naboychenko ES., (2019). The value of behavioral determinants in the formation of overweight and obesity in adolescents. *Profilakticheskaya meditsina*, 22(4), 43-48. (In Russian). doi: <https://doi.org/10.17116/profmed20192204243>
- Nikishina EI, Nikishina VB, Petrash EA., (2021). A method for correcting eating disorders in adolescents with obesity. *Rossiyskiy vestnik perinatologii i pediatrii*, 66(4), 81-88. (In Russian). doi: <https://doi.org/10.21508/1027-4065-2021-66-4-81-88>
- Norman J, Kelly B, McMahon AT, et al., (2018). Sustained impact of energy-dense TV and online food advertising on children's dietary intake: a within-subject, randomised, crossover, counter-balanced trial. *Int J Behav Nutr Phys Act*, 15(1), 37. <https://doi.org/10.1186/s12966-018-0672-6>

- Nyberg, G, Sundblom, E, Norman Å, Bohman B, Hagberg J, Elinder LS., (2015). Effectiveness of a universal parental support programme to promote healthy dietary habits and physical activity and to prevent overweight and obesity in 6-year-old children: the healthy school start study, a cluster-randomised controlled trial. *PloS one*, 10(2), e0116876. <https://doi.org/10.1371/journal.pone.0116876>
- Ostojic SM, Stojanovic MD, Stojanovic V, et al., (2011). Correlation between fitness and fatness in 6-14-year old Serbian schoolchildren. *Journal of Health, Population and Nutrition*, 29(1), 53-60. doi: <https://dx.doi.org/10.3329%2Fjhpn.v29i1.7566>
- Pasztak-Opilka A, de Jonge R, Zachurzok A, Górnik-Durose ME., (2020). Adult attachment styles and mothers' life satisfaction in relation to eating behaviors in the families with overweight and obese children. *Plos one*, 15(12), e0243448. <https://doi.org/10.1371/journal.pone.0243448>
- Polupanov AG, Tolebaeva AA, Altymsheva AT et al., (2019). Marketing of food products and drinks on television channels with children and adolescents in the Kyrgyz Republic. *Profilakticheskaya meditsina*, 22(6), 78-84. (In Russian). <https://doi.org/10.17116/profmed20192206278>
- Pyrieva EA, Gmoshinskaya MV, Shilina NM, Gurchenkova MA., (2017). Early stages of the formation of eating behavior. *Ros. vestnik perinatologii i pediatrii*, 62(3), 125-129. (In Russian). doi: <https://doi.org/10.21508/1027-4065-2017-62-3-125-129>
- Seburg EM, Olson-Bullis BA, Bredeson DM, et al., (2015). A review of primary care-based childhood obesity prevention and treatment interventions. *Current Obesity Reports*, 4(2), pp. 157-173. <https://doi.org/10.1007/s13679-015-0160-0>
- Sharmanov TS, Salkhanova AB, Dathabaeva GK., (2018). Comparative characteristics of the actual nutrition of children aged 9–10 years. *Voprosy pitaniya*, 87(6), 28-41. (In Russian). doi: <https://doi.org/10.24411/0042-8833-2018-10064>
- Suleimanov MA, Savelyeva OV., (2019). Improving factor of physical activity and its economic aspect. *Sovremennyye nauchnyye issledovaniya*, 103-106. (In Russian).
- Tutelyan VA, Gorokhov AV, Mikhailova EI, Vladimirov LN, Lebedev NP, Ignatieva ME, Lebedeva UM, Stepanov KM., (2015). Policy in the field of healthy nutrition of the population of the Republic of Sakha (Yakutia). *Yakutskiy meditsinskiy zhurnal*, 3(51), 6-9. Accessed June 07, 2022. Available at: <https://e.nlr.ru/online/view/29960/files/assets/basic-html/page-1.htm> (In Russian).
- Varani A, Varani J., (2016). The western-style diet, calcium deficiency and chronic disease. *Nutr. Food Sci.*, 6, 3-8. doi: 10.4172/2155-9600.1000496 <https://www.researchgate.net/publication/305507134>
- Wang J, Fielding-Singh P., (2018). How food rules at home influence independent adolescent food choices. *J. Adolesc. Health*, 5, S1054-139X(18)30133-2. doi: <https://doi.org/10.1016/j.jadohealth.2018.02.010> Available at: <https://www.ncbi.nlm.nih.gov/pubmed/29779673>
- WHO, (2015). Obesity and overweight. Available at: <http://www.who.int/mediacentre/factsheets/fs311/ru/> (In Russian).
- World Health Organization, (2017). WHO Ambition and Action in Nutrition 2016–2025, p. 64. Available at: <https://docviewer.yandex.ru/view/1130000027820932/>

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