HYGIENIC EDUCATION OF YOUNGER SCHOOLCHILDREN USING A RATIONAL NUTRITION SKILLS DEVELOPMENT PROGRAM

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Protection of health of children is the most important task before the country; preservation and strengthening of health of schoolchildren necessitates introduction of scientifically sound technologies and new methods of hygienic education. This study aimed to evaluate the effectiveness of the developed original educational program for primary schoolchildren designed to give them knowledge about rational nutrition and healthy lifestyle. From 2019 to 2020, we tested the rational nutrition and healthy lifestyle skills development program that relies on the Children and Adolescents Individual Diet Calculation and Hygienic Assessment Module. The study involved 336 schoolchildren (176 schoolchildren in the treatment group, 160 in the control group) from 4 classes of three educational institutions in Smolensk. The analysis of effectiveness of preventive measures showed that the proportion of children whose daily diet included vegetables and fruits has grown 1.5 times, and the consumption of fast food products and sugary carbonated drinks has dropped 4 and 2.5 times, respectively. Control group, where no preventive measures were implemented, exhibited no positive trends. The effectiveness of the program was confirmed by a significant decrease in the share of overweight primary schoolchildren: from 17.6% to 9.3% ($\chi^2 = 5.239$, $p = 0.023$). The results of this study allow recommending the developed nutrition and healthy lifestyle skills development program as an effective hygienic education technology for primary schoolchildren.

Keywords: primary schoolchildren, rational nutrition, educational program, information technology

Author contribution: the authors have made equal contributions to this publication.

Compliance with ethical standards: the study was approved by the Ethics Committee of the Smolensk State Medical University (protocol No. 1 of October 24, 2017). Each participant signed a voluntary informed consent form. The study conformed to the principles of biomedical ethics and did not endanger the participants.

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ГИГИЕНИЧЕСКОЕ ВОСПИТАНИЕ МЛАДШИХ ШКОЛЬНИКОВ С ИСПОЛЬЗОВАНИЕМ ПРОГРАММЫ ПО ФОРМИРОВАНИЮ НАВЫКОВ РАЦИОНАЛЬНОГО ПИТАНИЯ

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Охрана здоровья детского населения остается важнейшей государственной задачей. Сохранение и укрепление здоровья учащихся диктуют необходимость внедрения научно-обоснованных технологий и новых методов гигиенического воспитания. Целью работы было оценить эффективность разработанной оригинальной образовательной программы по гигиеническому воспитанию младших школьников в вопросах рационального питания и здорового образа жизни. С 2019 по 2020 г. в динамике апробировали программу по формированию навыков рационального питания и здорового образа жизни с применением информационной технологии «Модуль расчета и гигиенической оценки индивидуального рациона питания детей и подростков». В исследовании приняли участие 336 школьников (176 школьников — основная группа, 160 школьников — группа сравнения) 4-х классов трех общеобразовательных учреждений г. Смоленска. Анализ эффективности проводимых профилактических мероприятий показал, что в 1,5 раза увеличилась доля детей, в ежедневный рацион которых входили овощи и фрукты. В 4 и 2,5 раза соответственно снизилось потребление продукции «фаст-фуда» и сладких газированных напитков. В группе школьников, где не проводили профилактические мероприятия, положительная динамика не наблюдалась. Подтверждением эффективности программы стало значимое снижение доли младших школьников с избыточной массой тела с 17,6% до 9,3% ($\chi^2 = 5,239$, $p = 0,023$). Полученные результаты позволяют рекомендовать разработанную нами программу по формированию навыков рационального питания и здорового образа жизни как эффективную технологию гигиенического воспитания младших школьников.

Ключевые слова: младшие школьники, рациональное питание, образовательная программа, информационная технология

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The most important guideline for modern healthcare and education is to strengthen the health of the nation and protect that of children. Decree of the President of the Russian Federation No. 204 of May 7, 2018 sets a specific task: develop a system motivating citizens to lead a healthy lifestyle, including in the aspects of nutrition and physical culture [1]. Implementation of the state projects aimed at strengthening public health is inextricably linked with hygienic education and introduction of innovative health-saving programs [2, 3].

Nutrition, with its age-dependent specifics, is a key factor influencing growth and development of a child's body [4]. Nutrition's quantitative and qualitative attributes shape the processes of the organism's physical development and functioning, and determine its adaptive resistance to adverse environmental factors [5, 6].

Increasing the awareness of all social strata, including children, about fundamental, scientifically proven nutrition-related knowledge is an effective way to strengthen public health

[7–9]. Children and adolescents are the most promising target audience, since childhood is the period when fundamental information is learned, and stereotypes that most often persist throughout life are formed [10].

Health-saving programs are effective in prevention of many social problems and remedying drawbacks of the public health protection system [11, 12]. The World Health Organization (WHO) and other international institutes are actively working on the development and implementation of health protection and promotion programs in educational establishments [13, 14].

Deployment of educational programs aimed at development of rational nutrition and healthy lifestyle skills in schools can expand children's knowledge in this area, which makes schools a viable platform for such programs [15, 16].

The purpose of this study was to evaluate the effectiveness of the original educational program for primary schoolchildren designed to give them hygienic knowledge and promote their motivation to adopt rational nutritional patterns and lead a healthy lifestyle.

METHODS

The study was conducted in 2019–2020. Schoolchildren from three secondary schools in Smolensk (Secondary School No. 8, Secondary School No. 26, Secondary School No. 35) were involved in the evaluation of the effectiveness of the original educational program aimed at development of rational nutrition and healthy lifestyle skills. The participants (n = 336, studying in the fourth grade) were divided into two groups, 176 schoolchildren in the treatment group, where preventive measures were implemented, and 160 schoolchildren in the control group, where no such measures were deployed. Inclusion criteria: 4th grade (ages 9.5–10.5 years); voluntary consent to participate in the study; informed consent form signed by parents (legal representatives) allowing to collect and process the survey data the children participate in. Exclusion criteria: different age category; status other than schoolchild; lack of the signed informed consent form; severe hereditary and congenital diseases affecting nutritional status (4th and 5th health status groups).

To establish the degree of maturity of the rational nutrition skills and the level of awareness of the schoolchildren about the key components of healthy lifestyle, we surveyed the participants using the specially developed questionnaire. It included 10 questions seeking to uncover the features of the diet, eating behavior, and lifestyle (habitual level of physical activity, daily routine). The participants were surveyed twice: once before the implementation of the preventive program and again six months afterward. The effectiveness of the preventive measures was assessed by examining the change in the proportion of overweight schoolchildren, an indicator that was monitored before and 12 months after the start of the program.

We used MyOffice package (New Cloud Technologies; Russia) for statistical analysis of the data collected. In the context of sample comparison, the chi-squared (χ^2) test and the Fisher's exact test were used. The differences were considered significant at $p < 0.05$.

RESULTS

In 2017–2019, pilot of the School Medicine federal project by the Russian Ministry of Health was conducted in the Smolensk Region. In the context of this project, specialists from the General Hygiene Department of Smolensk State Medical University studied the prevalence of overweight and obesity among primary schoolchildren of Smolensk, and established these conditions in a significant proportion (25.3%) of the said children [17]. The excessive nutrition risk factors were identified in in-school and daily life routines; they were used as the basis for the original educational program aimed at development of the rational nutrition and healthy lifestyle skills.

The aim of the program is to make primary schoolchildren highly motivated to practice healthy eating and healthy lifestyle. Its key objectives were to teach schoolchildren the basics of nutrition; to give them proper nutrition patterns; to motivate them to be more physically active, and to do sports; and to involve parents of schoolchildren, their teachers, educators, and school psychologists in the process of development of healthy lifestyle skills in this population.

The preventive program had three directions: organizational and methodological, educational, and scientific. The organizational and methodological direction involved development of methodological recommendations, manuals, and reference materials for schoolchildren and their parents, teachers, school psychologists, and medical and preventive specialists, with the respective materials factoring in the specifics of the target audience.

Educational activities utilized modern tools in hygiene education and information technology. The latter took form of the Children and Adolescents Individual Diet Calculation and Hygienic Assessment Module, a specially developed computer program (Computer Program State Registration Certificate No. 2020616752 of 22.06.2020; hereinafter referred to as the Module).

The scientific direction implied a complex of actions designed to provide scientific support to the preventive measures and to enable assessment of their effectiveness.

Methodologically, the rational nutrition and healthy lifestyle skills development program consisted of five lessons of 40 minutes each. Each lesson included informational and practical parts. During the former, schoolchildren were given the rules of healthy eating and explained the importance of the main components of food in plain terms. One lesson was dedicated to educating the children about the importance of regular physical activity, the need to keep it at the optimal level, and the process of drawing up a rational daily routine. There was also a lesson for the parents, where they learned new information about organization of rational nutrition for their children, and ways to encourage adoption of a healthy lifestyle. During the practical part of the lessons, schoolchildren absorbed the given theoretical knowledge in the context of games. The Module, used by children and their families, was also a component of the practical part.

The module allows calculating the energy value (caloric content) of food in the diet; determine the individual daily need for basic nutrients and energy depending on age and gender; build an optimal diet for the child that factors in modern hygienic requirements and standards. The module includes a reference block of theoretical material for children and parents, providing comprehensive information on compiling healthy diets based on current Russian hygiene requirements and WHO recommendations (Fig. 1).

In the context of the integrated approach, the lessons were co-hosted by child and adolescent hygiene specialists, pediatricians, teachers, and school psychologists. Fig. 2 provides th details of the educational program.

To analyze the effectiveness of our comprehensive approach to hygienic education based on the original educational program designed to develop rational nutrition and healthy lifestyle skills in primary schoolchildren, we evaluated the results of the survey these children took.

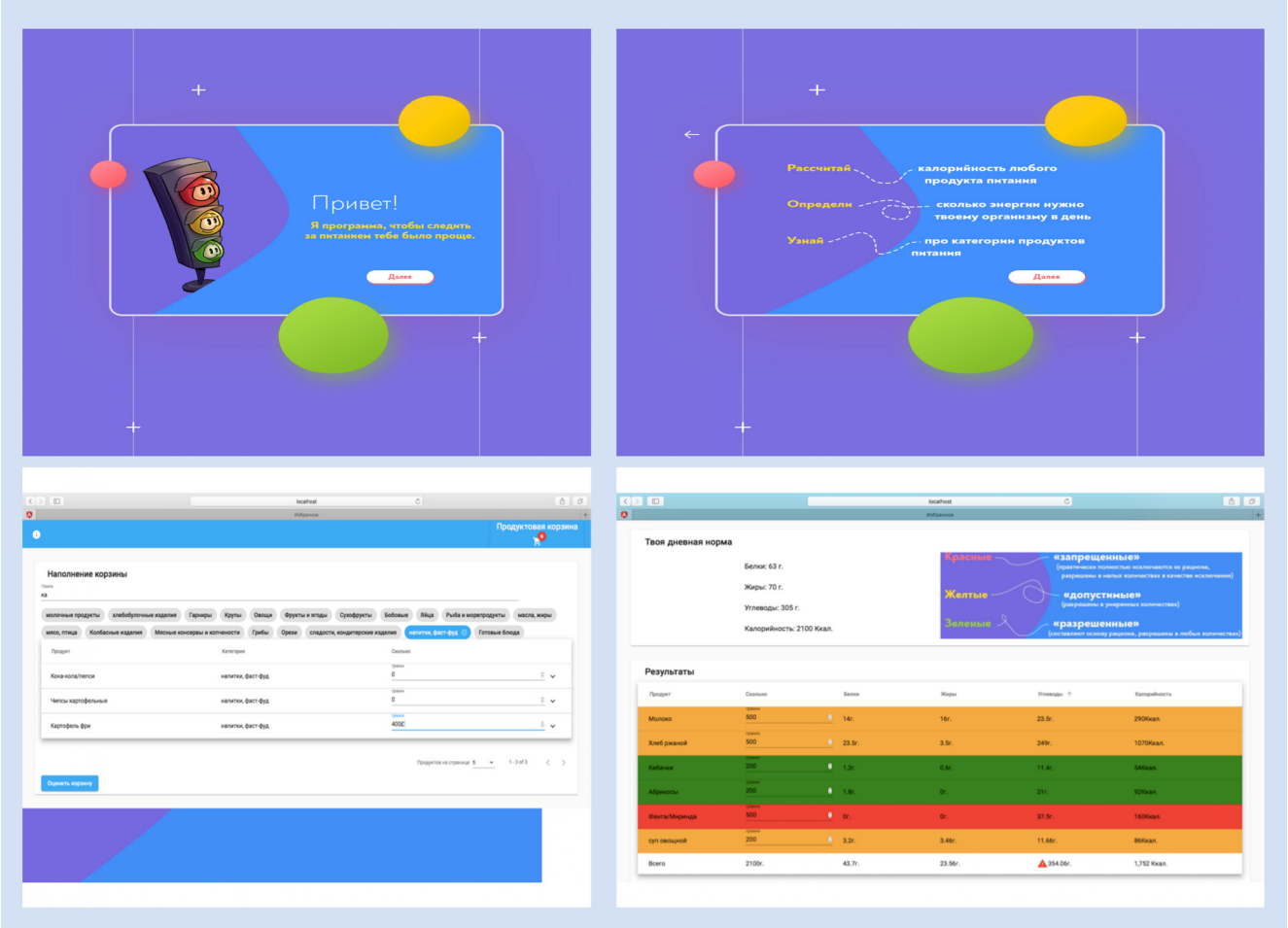

Fig. 1. Interface of the Children and Adolescents Individual Diet Calculation and Hygienic Assessment Module

The following notions were introduced for the comparative analysis:

– treatment group (n = 176): TG — schoolchildren of the treatment group during the initial diagnosing; TG$^+$ — schoolchildren of the treatment group during diagnosing 6 months after the start of the preventive program;

– control group (n = 160): CG — schoolchildren of the control group during the initial diagnosing; CG$^+$ — schoolchildren of the control group during diagnosing after 6 months.

A comparative analysis of the survey results showed a significant positive trend in indicators reflecting the development of rational nutrition skills and certain elements of a healthy lifestyle (Fig. 3–4).

For example, the program increased the share of children who have breakfast every day from 71.6% to 90.3% (φ^*_{emp} = 4.62; $p < 0.01$). There were significantly more schoolchildren with positive nutritional changes in the treatment group (TG$^+$) than in the control group (CG$^+$): 90.3% and 70.6%, respectively ($p < 0.01$).

The share of schoolchildren in the treatment group who often snack right before bedtime decreased 1.8 times, from 19.3% to 10.8% (φ^*_{emp} = 2.26; $p < 0.05$). Participants from the treatment group (TG$^+$) consumed food significantly less often before bedtime than their peers from the control group (CG$^+$): 10.8% and 26.9%, respectively ($p < 0.01$).

As for the nutritional preferences and foods eaten, the results were as follows: in the treatment group, the number of schoolchildren consuming (daily) food that includes vegetables and fruits increased from 46.6% to 70.5% (φ^*_{emp} = 4.59; $p < 0.01$); in the control group, there was no significant effect registered. Second diagnosing confirmed that the share of treatment group schoolchildren (TG$^+$) who regularly consume vegetables and fruits (70.5%) was significantly higher than that seen in the control group (CG$^+$), where the figure was 45% ($p < 0.01$).

In treatment group, the habitual consumption of fast food products decreased from 4.5 to 1.1% (φ^*_{emp} = 1.68, $p < 0.05$), and sugary carbonated drinks — from 14.7 to 5.7% (φ^*_{emp} = 2.89; $p < 0.01$). Comparing these indicators, we established that in the treatment group, there were significantly fewer schoolchildren prone to eating fast food and consuming sugary drinks than in the control group.

As for the daily routine and lifestyle, the following significant changes were registered in the treatment group: the share of schoolchildren actively spending leisure time outdoors increased 63.1 to 77.8% (φ^*_{emp} = 3.06; $p < 0.01$); the share of children doing sports increased from 35.8 to 52.3% (φ^*_{emp} = 3.13; $p < 0.01$). A comparative analysis of the data collected in two groups at the stage TG$^+$ and GC$^+$ stage showed that the proportion of schoolchildren who regularly engage energetic leisure activities outdoors and do sports is significantly higher in the treatment group.

Before deployment of the preventive program, 37.5% of schoolchildren in the treatment group noted that it was most difficult for them to give up playing games on a computer (tablet, smartphone); after the deployment, this figure went down to 27.3% (φ^*_{emp} 2.06; $p < 0.05$). A comparison of the data at the TG$^+$ and CG$^+$ stage has shown that there are significantly fewer treatment group participants affected by this than in the control group: 27.3% vs. 41.3%, respectively (φ^*_{emp} = 2.71; $p < 0.01$).

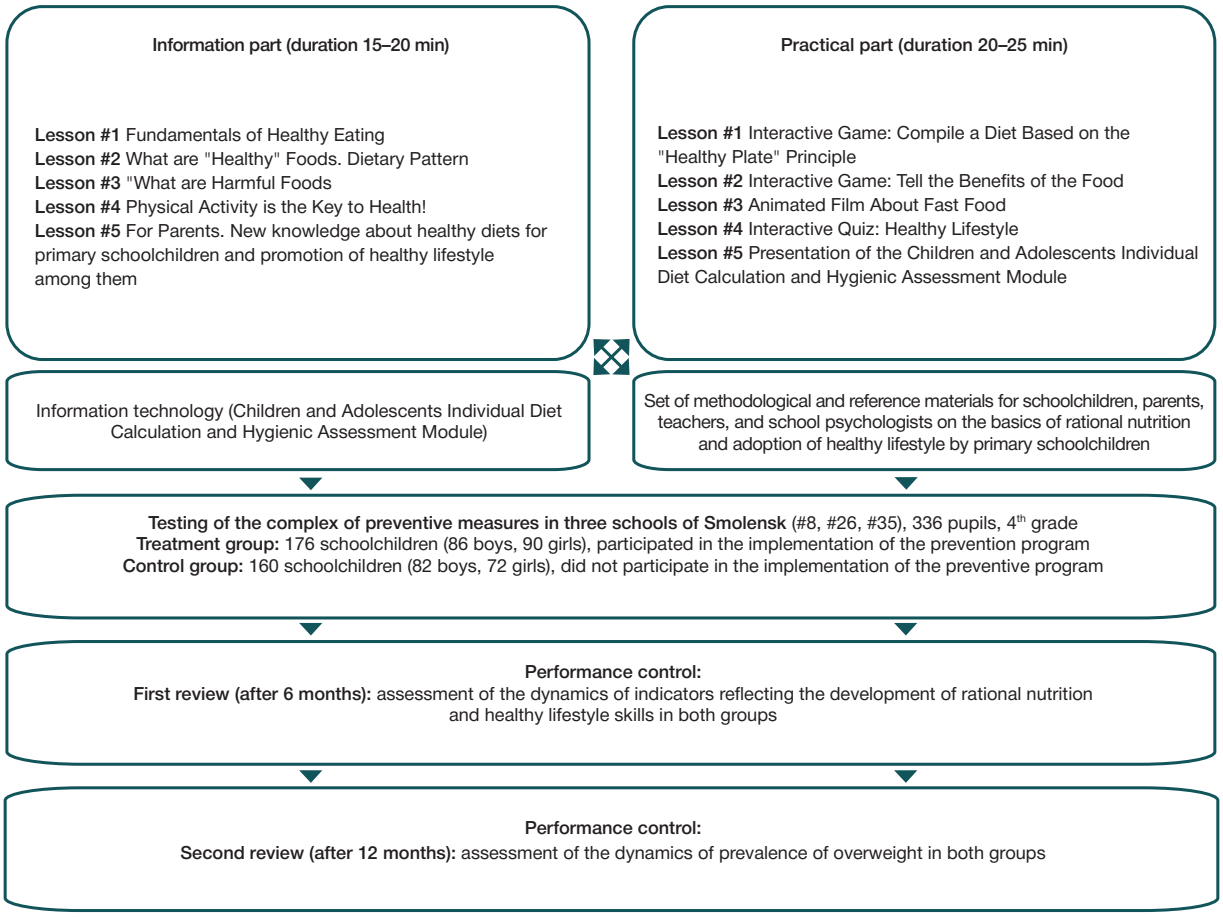

Fig. 2. The algorithm of the rational nutrition and healthy lifestyle skills development program

The effectiveness of the program and the included preventive measures designed to develop rational nutrition and healthy lifestyle skills in schoolchildren was confirmed by significant changes registered through the study. Specifically, in the treatment group, the participants from which stayed in the program for 12 months, the proportion of overweight children decreased from 17.6 to 9.6%, which is a statistically significant result ($\chi^2 = 5.239$, $p = 0.023$). In the control group, which was not in the program, the respective proportion changed in the opposite direction during the same period of time: from 16.9 to 19% ($p > 0.05$).

These data confirm that the implemented program of preventive measures has had a positive impact on the health of primary schoolchildren. The program employed various methods of hygienic education that helped form a conscious attitude to diet and lifestyle in the children. Participating in the respective events, they not only learned new information about healthy nutrition, but also changed their eating habits. Such changes were positive for preservation and strengthening of the children's health, and mitigated the risks of overweight and obesity.

The experience of deploying the original rational nutrition and healthy lifestyle skills development program for primary schoolchildren has found application in practical healthcare. The materials resulting from the study are used in the work of the Children's Health Center of the Smolensk Children's Clinical Hospital and the Smolensk Regional Children's Clinical Hospital.

DISCUSSION

Despite the measures taken in our country to strengthen the health of the child population, the trend reflecting the status of somatic and mental health of schoolchildren is downward [18].

The environment of school is natural for children and adolescents. It is a place where they spend a significant portion of their time, so the matter of adoption of a healthy lifestyle should be part of the educational process. The specific traits of schoolchildren, however, add complexity to the respective efforts, since they may not see elementary hygiene skills that are appropriate for their age as a natural part of life, including maintenance of the proper daily routine with balanced work and rest, alternating of mental and physical activity, practicing regular and rational nutrition, receiving adequate sleep, getting age-appropriate physical activity, doing adequate outdoor activities, and using gadgets rationally [19–21].

In recent years, there has been published an increasing number of works describing various methodological approaches and technologies of hygienic education for schoolchildren. These reports note that successful development of healthy lifestyle skills in children and adolescents is a long process that involves consistent exposure to health-preserving programs and technologies [15, 22]. One example of a non-standard approach to hygienic education of this population relies on habit trackers and checklists [23].

The testing of the the original educational program and information technology developed by us, the Children and Adolescents Individual Diet Calculation and Hygienic Assessment Module, has shown its high efficiency in the formation of rational nutrition skills and adoption of basic elements of a healthy lifestyle among primary schoolchildren. An integrated approach to hygiene education based on the analysis of the key excessive eating risk factors in this population helped reduce the likelihood of development of overweight and obesity.

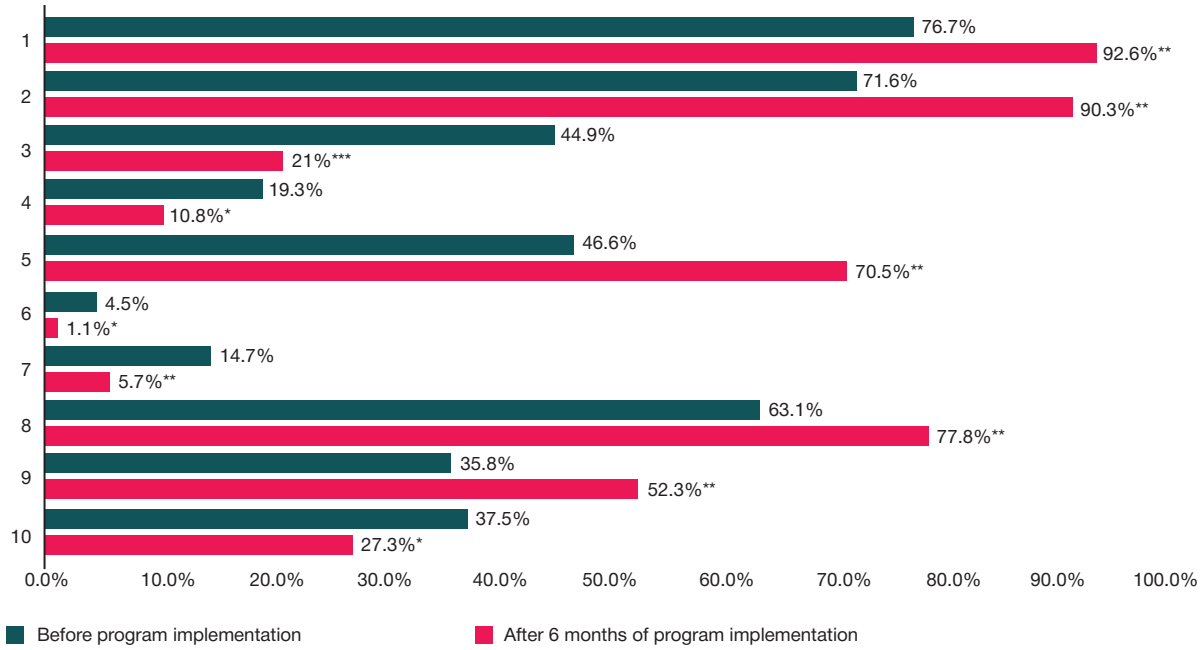

Fig. 3. Indicators of the treatment group schoolchildren
Note: 1 — the share of schoolchildren eating regular meals; **2** — the share of schoolchildren regularly having breakfast at home; **3** — the share of schoolchildren regularly snacking between meals; **4** — the share of schoolchildren regularly snacking before bedtime; **5** — the share of schoolchildren regularly adding fresh vegetables and fruits to their diet; **6** — the share of schoolchildren regularly consuming fast food products; **7** — the share of schoolchildren regularly consuming sugary carbonated drinks; **8** — the share of schoolchildren practicing energetic leisurely activities outdoors every day; **9** — the share of schoolchildren doing extracurricular sports; **10** — the share of schoolchildren preferring to spend their free time using a computer/tablet. The significance of the differences between the groups (Fisher z-transformation): * — $p < 0.05$; ** — $p < 0.01$; *** — $p < 0.001$.

CONCLUSIONS

The positive results of the study that involved deployment of the original nutrition and healthy lifestyle skills development program allow recommending it for inclusion in the hygienic education curricula for primary schoolchildren. The developed program was proven to be highly effective, and can be considered as an element of primary prevention in relation to the correction of the nutritional status of primary schoolchildren.

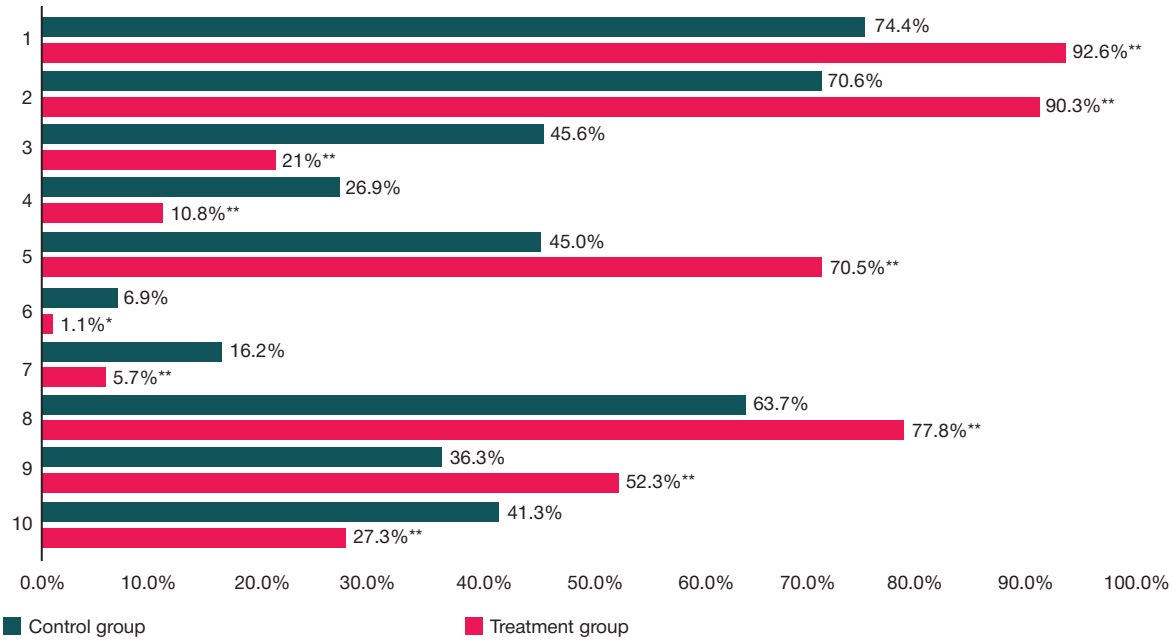

Fig. 4. Indicators of schoolchildren from the treatment group and the control group
Note: 1 — the share of schoolchildren eating regular meals; **2** — the share of schoolchildren regularly having breakfast at home; **3** — the share of schoolchildren regularly snacking between meals; **4** — the share of schoolchildren regularly snacking before bedtime; **5** — the share of schoolchildren regularly adding fresh vegetables and fruits to their diet; **6** — the share of schoolchildren regularly consuming fast food products; **7** — the share of schoolchildren regularly consuming sugary carbonated drinks; **8** — the share of schoolchildren practicing energetic leisurely activities outdoors every day; **9** — the share of schoolchildren doing extracurricular sports; **10** — the share of schoolchildren preferring to spend their free time using a computer/tablet. The significance of the differences between the groups (Fisher z-transformation): * — $p < 0.05$; ** — $p < 0.01$; *** — $p < 0.001$.

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