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# РОССИЙСКИЙ ВЕСТНИК ГИГИЕНЫ

НАУЧНЫЙ МЕДИЦИНСКИЙ ЖУРНАЛ ВОРОНЕЖСКОГО ГОСУДАРСТВЕННОГО МЕДИЦИНСКОГО УНИВЕРСИТЕТА ИМ. Н. Н. БУРДЕНКО И РОССИЙСКОГО НАЦИОНАЛЬНОГО ИССЛЕДОВАТЕЛЬСКОГО МЕДИЦИНСКОГО УНИВЕРСИТЕТА ИМ. Н. И. ПИРОГОВА



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# METHODOLOGICAL ASPECTS OF STUDYING THE ACTUAL NUTRITION OF ATHLETES

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Analysis of actual nutrition of athletes and its correspondence to energy expenditure seems relevant as a balanced diet produces a direct effect on physical endurance and professional performance of athletes. It is meaningful to estimate not just nutritional and energy value of the diet, but also a degree of diversity of basic groups of food products as sources of essential nutritional substances in the diet of athletes along with dietary fibers to optimize the gut microbiome diversity. Regular studies of actual nutrition conducted with certain time intervals and simultaneous assessment of biomarkers characterizing the alimentary status enable to trace their effect on professional performance, effectiveness of the training process, adequate restoration and health for every athlete and the whole team.

**Keywords:** athletes, actual nutrition, 24-hour reproduction method, frequency method, microbiome

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# МЕТОДОЛОГИЧЕСКИЕ АСПЕКТЫ ИЗУЧЕНИЯ ФАКТИЧЕСКОГО ПИТАНИЯ СПОРТСМЕНОВ

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Анализ фактического питания спортсменов и его соответствия энерготратам представляется актуальным, поскольку сбалансированный рацион непосредственно влияет на физическую выносливость и профессиональную результативность спортсменов. При этом целесообразно оценивать не только пищевую и энергетическую ценность рациона, но и степень разнообразия основных групп пищевых продуктов как источников эссенциальных пищевых веществ в питании спортсмена, а также пищевых волокон для оптимизации видового разнообразия кишечного микробиома. Проведение периодических исследований фактического питания через определенные временные интервалы с одновременной оценкой биомаркеров, характеризующих пищевой статус, позволит отслеживать их влияние на профессиональную производительность, эффективность тренировочного процесса, адекватность восстановления и состояние здоровья как каждого конкретного спортсмена, так и команды в целом.

**Ключевые слова:** спортсмены, фактическое питание, метод 24-часового воспроизведения, частотный метод, микробиом

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According to the results of studies conducted by the Federal Research Center for Nutrition, Biotechnology and Food Safety, prevalence of impaired optimal product structure, food and energy value of the diet is noted in the majority of examined athletes. The first place is occupied by non-correspondence of daily dietary calories to actual energy expenditure; percentage of fat and saturated fatty acids in the structure of dietary calories exceeds the recommended levels by 20–40%; aggregate consumption of carbohydrates is below the recommended level by 10–35%; high consumption of added sugar (18–24%) and salt is noted [1].

In some studies, a significant difference of up to 44% was recorded between the data about actual consumption obtained using questioning (survey) and registration with portion weighing. Exactness of obtained data depends on unconscious or conscious under-reporting of data regarding use or exclusion of some products and dishes out of the diet (alcoholic beverages, fast food, confectionery products); altered eating rate or customary food behavior due to a complex complete description of ingredient composition when the questionary is filled in [2, 3]. Due to positive or negative assessment of survey results, these data can be confirmed using the measurement errors. A lack of the 'golden standard' of transformation of primary data to interpret results and reliable tools, including experienced trained interviewers who can conduct large studies, restricts the possibility of comparing data of various studies, especially the ones devoted to assessment of training process effectiveness.

Recommendations related to organization of optimal nutrition for athletes commonly concern a higher need in energy to satisfy actual energy expenditures, increased quota of proteins and carbohydrates in the structure of total caloric intake to maintain and gain muscle mass and restore glycogen reserves respectively and an increased need in certain microelements (for instance, iron, calcium, sodium) and vitamins. However, specific kind of sports, scope and intensity of training, and level of intake of food products are interrelated. It means that the food intake should not be static during different phases of a training process with various levels of load. Actual nutrition is accessed and biochemical indicators and vitamin supply in athletes are examined to understand how they correspond to the level and kind of physical activity considering age- and gender-related features, type of sporting specialization and phase of sports activity. Risks of metabolic disbalances including energy exchange are detected. To reduce the risks, recommendations related to nutrition correction are developed.

Meanwhile, actual nutrition is of primary importance. However, as collection of data is important and due to possible errors arising during interpretation of results, the assessment is not always conducted or the results yield little information. A complex study of frequency values and consumed number of basic groups of food products and alimentary status along with their dynamics control help detecting individual requirements and trace their changes depending on the scope and intensity of training sessions during the training and contest period [4].

Research purpose: determine basic methodological aspects of examining actual nutrition in athletes and people with a high level of physical activity.

## MATERIALS AND METHODS

84 athletes were examined, including 25 basketball players, male students of the Academy of Physical Culture (20.9 ± 1.8 years) in spring, 24 male athletes playing for Amor hockey club (average age of 26.4 ± 7.4 years) in summer (August) and 25 females (22.4 ± 3.7 years) from the ice hockey team with pucks in spring (March) at the Novogorsk training center, athletes from national archery teams of the Republic of Buryatia ($n$ = 10) in summer (August) at Enkhaluk sports camp (Republic of Buryatia, Kabansky district, Novy Enkhaluk village).

Actual nutrition of athletes was studied using two methods: 24-hour reproduction method and frequency method.

During the frequency method, a special questionnaire was used, which allows to estimate anthropometric characteristics, level of physical activity (considering working days and weekends), rate of consuming some groups of products for a certain period of time. Analysis of Human Nutritional Status computer program (version 1.2.4 of Research Institute of Nutrition of the Russian Academy of Medical Sciences of 2004) assesses caloric intake, composition of average daily diet, rate and number of separate products, and graphically displays the level of consumption of certain groups of products as compared with the recommended values during the preceding month. The primary questioning lasts at least 45 minutes.

The 24-hour reproduction method establishes the amount of actually consumed food products and dishes by surveying of the interviewed person who enumerates what was eaten prior to the survey by memory. In the end of the survey, they obtain data about the time of food intake, place of food making and taking, composition and amount of the dish and product, and ways of its preparation. The obtained data are included into a special questionnaire or directly to the program. The most reliable data are obtained in the presence of three questions related to nutrition: two working days and one day-off before that.

When analyzing the results of examination of actual nutrition, it should be estimated as follows:

- Correspondence of the diet energy value to energy expenditure of athletes;
- Contribution of proteins, fats and carbohydrates to the total caloric intake expressed as percentage;
- Specific consumption of proteins, fats and carbohydrates in g/kg of body mass of an athlete per day;
- Correspondence of dietary micro- and macronutrients to the recommended levels and needs of athletes;
- Dietary regimen (amount and time of food intake) and distribution of food and energy value by food intake during a day or training sessions.

Arrival of every critically important nutrient as part of foods for particular nutritional uses and nutritional supplements is evaluated separately considering liquid to dissolve instant mixtures (water, milk with various mass fraction of fat, other fluid), number of consumed meals per intake and number of intakes per day.

Adequate consumption of basic nutrients is estimated in accordance with methodical recommendations MP 2.3.1.0253–21 'Standards of Physiological Needs in Energy and Nutrients for Various Groups of the Russian Federation'.

## RESEARCH RESULTS

It is known that the type of actual nutrition (regimen, scope, chemical composition) can be influenced by the level of physical activity depending on sporting tasks, seasonality, individual food preferences, religious beliefs, etc.

When the examination results of basketball players were compared, it has been established that daily caloric intake calculated on the basis of the frequency method insignificantly exceeds the one obtained using the 24-hour

reproduction method. Meanwhile, consumption of proteins and carbohydrates was also higher with no differences in the fat content (fig. 1 and 2).

Moreover, a tendency to a more moderate consumption of nutrients and energy on a weekday was detected using the 24-hour reproduction method. Thus, caloric intake was 2,880 ± 1,015 kcal/day due to a lower consumption of carbohydrates and fats with an increased amount of protein.

Analysis of the results obtained while examining actual nutrition among athletes during training at Enhalo camp displayed a similar tendency: energy value and content of basic nutrients obtained using the frequency method were higher. In this case, a more significant difference was observed because actual nutrition was assessed using the method of food consumption frequency analysis during a month that preceded visits to the training camp. It means that athletes were relatively free to choose among dishes and products available at home, in the dining area and at food trade companies. During the training session, when the diet was assessed using the 24-hour reproduction method, all athletes were eating at the camp dining area, and only some of them had non-perishable products (confectionery, including chocolate, chips, etc.) at their disposal. In other words, during the training session, the possibility to diversify the diet is objectively limited.

Contribution of proteins, fats and carbohydrates to the total caloric intake studied using the both methods, was 14%, 42% and 44% and 11%, 42% and 47% respectively. In this case, percentage of fat in the caloric intake coincides and significantly exceeds the recommended upper level, which, obviously reflects the really existing fat content of athletes' diet (table 1).

During assessment of food consumption frequency by a woman's ice hockey team of the Russian Federation it has been established that not enough dairy products were consumed. Contribution of the group of food products to energy value, proteins, fats and carbohydrates was 9.6 ± 6.7 kcal/day, 15.3 ± 10.2 kcal/day, 12.2 ± 9.1 kcal/day and 4.2 ± 3.4 kcal/day respectively. Frequency of meat and fish consumption was sufficient and extremely low respectively. It has been established that fruits and vegetables were consumed below recommended levels. Meanwhile, consumption of confectionary products (candies, cakes, chocolate) was high and constituted 2.2 ± 1.3 meals/day, respectively. Bakery goods provided to 11.3 ± 4.9% of total energy value and 30.1 ± 19.5% of total amount of carbohydrates, whereas confectionary products constituted 14.8 ± 8.9% and 18.5 ± 8.8% hereof respectively. It should be noted that high caloric intake of confectionary products is ensured due to increased content of fat, including margarine transfat, which is a risk factor of atherosclerosis and cardiovascular diseases.

The nutrition profile of male hockey players and frequency of consumption of basic groups of products mainly corresponded to generally accepted recommendations. They had more bread and cereals (0.4 to 7.1), vegetables (1.7 to 8) and fruits (0.7 to 9.6 meals per day) as compared with female hockey players. They consumed confectionary products (to 5.1 meals per day) and added sugar more frequently than women; and this could result in sharp fluctuations of blood glucose and associated fatigue. Consumption frequency of dairy products (0 ÷ 4.3 meals per day) was almost the same as the one in women and was lower than the recommended one.

The basic sources of fat were meat, sausages and eggs. Consumption of fish was very low as well: 0 to 0.8 meals per day. Male hockey players had relatively high consumption of vegetables and fruits (3–5 meals per day) with no achievement of recommended values, though; as a result, dietary fibers constituted to 30% of normal values as compared with a rather low medium level (7.2% of the recommended one) in female team players. The difference in the frequency of consumption of certain groups of food products could be correlated with their seasonal availability (table 2).

According to the presented data (table 2), marked differences in the level of consumption of several basic groups of products are found among hockey players of both genders. The women had deficiency of sources of complex and simple carbohydrates, playing an important role in provision of easily accessible energy for highly intense sports activity and maintenance of optimal endurance. Their inadequate intake can result in a decreased effectiveness of a

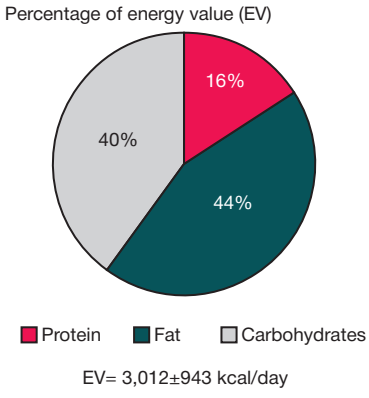


**Fig. 1.** The structure of diet energy value obtained using the food consumption frequency method

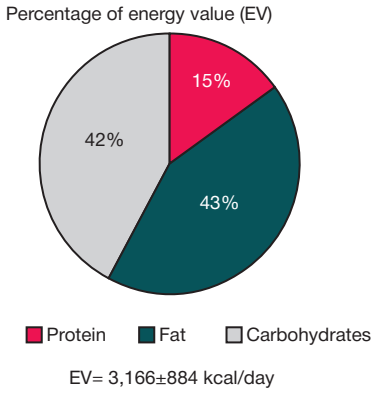


**Fig. 2.** The structure of diet energy value obtained using the 24-hour reproduction method

**Table 1.** Comparison of results of studying the actual nutrition of athletes obtained using two methods

| Values | Moscow State Academy of Physical Culture | | Enkhaluk camp | |
|---|---|---|---|---|
| | Frequency method | 24-hour reproduction method | Frequency method | 24-hour reproduction method |
| Energy value, kcal/day | 3,166 ± 884 | 3,012 ± 943 | 2,902 ± 1,198 | 2,516 ± 593 |
| Protein, g/day | 136 ± 41 | 111 ± 38 | 104 ± 46 | 70 ± 17 |
| Fat, g/day | 146 ± 69 | 144 ± 64 | 134 ± 61 | 118 ± 42 |
| Carbohydrates, g/day | 375 ± 108 | 317 ± 110 | 314 ± 147 | 29 8± 56 |

**Table 2.** Frequency of consumption of basic groups of food products by ice hockey players (men, women)

| Group of products | Actual nutrition, meals per day | | Recommended frequency, meals per day |
|---|---|---|---|
| | Men (*n* = 24) | Women (n = 25) | |
| Cereals and bakery | 2.9 ± 1.5* | 1.1 ± 0.4 | 5–8 |
| Milk and dairy products | 1.7 ± 1.81 | 1.6 ± 1,7 | 2–3 |
| Meat and meat products | 2.1 ± 0.9* | 1.5 ± 0,9 | 1–2 |
| Fish and fish products | 0.1 ± 0.4 | 0.2 ± 0,3 | 1–2 |
| Confectionery | 2.8 ± 1.2* | 2.2 ± 1,3 | 0–1 |
| Vegetables | 5.4 ± 2.0* | 1.6 ± 0.7 | 5–8 |
| Fruits | 2.8 ± 2 | 2.3 ± 1.2 | |

*$p < 0.05$

training process, premature fatigue and functional overstress. Moreover, deficiency of intake of dietary fibers that ensure normal functioning of the gastrointestinal tract and support gut microbiome diversity is found against the background of structurally unbalanced diet energy value. It is known that change in its composition caused by deficiency of fiber and complex carbohydrates is accompanied by decreased physical performance, endurance, immunological reactivity of an athlete's body and increased susceptibility to infectious agents [5, 6]. Unlike women, male hockey players eat many fruits and vegetables. The detected differences can be associated with gender-related dietary behaviour and seasonality of nutrition, including affordability of more plant products.

The results significantly ($p < 0.05$) differ among athletes depending on their gender and the season when the actual nutrition is examined. It points to feasibility of monitoring of frequency and amount of consumed basic groups of products during at least two periods: fall-winter and spring-summer.

It would be interesting to examine how the peculiarities of eating behavior, including conscious self-restriction, and interrelation between consumption of meat and milk with the alimentary status in particular, can influence health of athletes.

Results of examination of two athletes engaged in different kinds of sports are provided as an example.

1. Male, Master of Sports, aged 21, involved in rowing for 5 years, had no medical contraindications to cow's milk and replaced it with vegetable beverages based on cereals and nuts; he also refused from meat. Though Hb count was satisfactory, blood chemistry analysis displayed deficiency of serum iron (7.9 mcM/l with 10.6–28.3 mcM/l being normal values), which meant iron deficiency. Considering the detected disturbances in the nutritional pattern and abovementioned data about the alimentary status, the athlete was recommended to optimize the diet to replenish iron supplies and improve endurance [7].
2. Male, Candidate Master of Sports, basketball player aged 22.3, abruptly refused from animal derived products except for fish (to 300 g per day) during the observance of Christian fasting. His diet was rich in potato pies, peanuts (to 300 g per day), plant-based milk substitute (200–400 ml) resulting in disturbed structure of diet energy value (abrupt increase of fat proportion to 45%), protein content corresponded to 16% (recommended levels), whereas carbohydrate content was rather low (39% of caloric intake respectively).

## DISCUSSION OF RESULTS

24-hour reproduction method allows to estimate the dietary regimen, food and energy value of products and dishes included into separate meals, their contribution to daily energy value, correspondence to purposes and objectives of the training process. In athletes engaged in various kinds of sport, prevalence of Relative Energy Deficiency in Sport (RED-s) amounts to 22–58%. This results in hormonal and metabolic dysfunctions and reduces professional performance. Thus, the method estimating energy balance within a day remains pressing, as it assesses the energy value of products during every meal and energy expenditure of the body, including physical load, resulting in a deeper understanding of changes in real time and identification of energy deficiency markers [8].

According to data obtained during our and other published studies, combination of two or more methods assessing actual nutrition can increase exactness of the results. Thus, the combined method of collecting data about actual nutrition can ensure a more effective technology of qualitative assessment of consumption of nutrients and energy by athletes. Using software on devices with the image function increases the accuracy of recorded data [9–11]. Results of systematic review show that preservation of the image of consumed products improves self-reporting and reveals unaccounted products and errors while determining the portion size, which can be forgotten when only traditional methods of assessment are used. Clarifying the issues about the portion size, additional use of sauces, bread, added sugar, frequency and daily dose of foods for particular nutritional uses and nutritional supplements, via general chats in messengers due to rapid feedback from a nutritional specialist, improved motivation, enhancing confidence within the 'sportsman and interviewer' couple can be an effective tool to monitor nutrition and influence the feeding behavior [12, 13].

The next stage includes diet personalization in accordance with the individual metabolic and genetic profile of an athlete. Based on the examination results, individual recommendations about diet correction are developed for every athlete, all team members or a group of those examined along with the coaching staff and physician; education is provided in the form of a cycle of lectures and seminars discussing the obtained results and ways to optimize the diets including the use of specialized food products and dietary supplements. It improves the metabolic status of athletes and ensures optimal conditions to improve sports skills.

Studies of drinking regimen and water-salt balance of athletes as a key factor limiting professional success in sport constitutes another section that examined actual nutrition. It is established that over half of athletes have a training session or go to a contest being hypohydrated or with an improperly organized drinking regimen during a training session. It results in reduced functional capabilities and health disturbance in the form of a thermal collapse or hypovolemic shock.

Prior to inclusion of foods for particular nutritional uses and nutritional supplements into the diet, it is important to estimate the content of not just basic, but also of biologically

active nutrients in an athlete's diet. Only having studied actual nutrition and values of nutritional status and having compared them with recommendations (i. e., following determination of available deficits or excessive arrival of nutrients), it's possible to develop a plan of inclusion of specialized food products and nutritional supplements for athletes.

It is recommended to study actual nutrition both in the beginning, and during key moments of the training sessions, and during an injury, after operations accompanied by a long-term decrease in vital capacity during restoration, development of acute diseases or exacerbation of existing ones.

Exact assessment of athletes' health and performance requires an integrative and dynamic approach to analysis of alimentary status biomarkers. Individual requirements in nutrients and energy significantly depend on specific features of various kinds of sports, phases of the training cycle and alimentary preferences of athletes. Regular monitoring of actual nutrition, administration of foods for particular nutritional uses and nutritional supplements, medicines and values of the alimentary status will enable detection of individual disturbances and trace changes along with the increase of a training volume. Assessment of alimentary status using an objective study of biomarker concentration eliminates systemic errors related to subjective assessment of nutrition.

## CONCLUSIONS

In our opinion, to examine actual nutrition in a large group of athletes it's better to use the frequency method, whereas an individual examination can be done in a more effective way using the 24-hour reproduction method two working days and one day off before that. While interpreting the result, it is important to take into account seasonality of nutrition, religious restrictions and certain gender-related features of product selection. To ensure better comprehension of the results of actual nutrition monitoring, including drinking regimen, level of energy expenditure during training sessions and contests, and their effect on athletes, assessment of biomarkers should include various and well confirmed markers of production, health and restoration. As many standards used to estimate biomarkers are suitable for populations in general, but not for athletes, repeated measurements allow every doctor in sports medicine, coach and athlete to set personalized reference values. An athlete can trace dynamics of these individual 'normal' values which can vary every day and every week and correlation with reduced performance, occurrence of the overtraining syndrome or risk of an injury.

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# METABOLIC SYNDROME AND OBESITY IN CHILDREN AS A SOCIAL AND HYGIENIC ISSUE

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The problem of pediatric obesity focused on risk factors at early stages because their modification can reduce the risk of later metabolic diseases and disability. It is the metabolic syndrome that describes a set of cardiometabolic risk factors, including abdominal obesity, insulin resistance, elevated blood pressure, high level of triglycerides and low level of high-density lipoproteins that increase the risk of cardiovascular diseases and type 2 diabetes mellitus. Obesity mainly determines statistical values that characterize the case with endocrine gland diseases among children and adolescents in the Republic of Tatarstan. Obesity is not growing at the same rate any more. The current level of excessive weight in children is too high and requires intervention at the level of the community and school. Inactivity and non-rational nutrition can contribute to formation of excessive body mass among children. Regular physical activity and better nutrition of adolescents is a worthy investment in the health of future generations.

**Keywords**: metabolic syndrome, obesity, prevention, hygiene, physical activity

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# МЕТАБОЛИЧЕСКИЙ СИНДРОМ И ОЖИРЕНИЕ У ДЕТЕЙ КАК СОЦИАЛЬНО-ГИГИЕНИЧЕСКАЯ ПРОБЛЕМА

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Проблема детского ожирения поставила в центр внимания факторы риска на ранних стадиях, так как их модификация может снизить риск более поздних метаболических заболеваний и инвалидности. Ожирение больше не растет теми же темпами, текущий уровень избыточного веса и ожирения у детей слишком высок и требует вмешательства на уровне сообщества и школы. Малоподвижный образ жизни, нерациональное питание могут вносить вклад в формирование избыточной массы тела среди детского населения. Регулярная физическая активность подростков, наряду с улучшением их питания, является достойной инвестицией в здоровье будущих поколений.

**Ключевые слова:** метаболический синдром, ожирение, профилактика, гигиена, физическая активность

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In 2019, 18% of children aged 5 to 19 and 6% of children under five years had an excessive weight or obesity. Moreover, 340 million of children and adolescents aged 5–19 had an excessive weight or obesity. The recent international and national studies display a growing obesity epidemic among schoolchildren, especially among children aged 6–19 during the last three decades [1]. Obesity is no longer growing at the same rate, the current level of excessive weight and obesity in children is too high and requires intervention at the level of the society and school [2]. It is the metabolic syndrome that describes a set of cardiometabolic risk factors, including abdominal obesity, insulin resistance, increased blood pressure, high level of triglycerides and low level of high-density lipoproteins that increase the risk of cardiovascular diseases and type 2 diabetes mellitus [3]. Obesity largely determines statistical values that characterize the case with endocrine gland diseases among children and adolescents in the Republic of Tatarstan. It is impossible not to pay attention to more than a two-fold increase in prevalence of obesity among patients aged 15–17 during the period. The fact needs analysis and immediate actions [4].

The probability of obesity developed among the adults who had an excessive body mass in childhood is increased 5 times as compared with children having a normal body mass. Inactivity and improper nutrition can contribute to an excessive body mass among children [5]. Thus, understanding determinants of children's obesity and their interactions is fundamental to development of strategies aimed to struggle the epidemic [6–11].

The problem of pediatric obesity has put risk factors at early stages in the center of attention, as their modification can reduce the risk of later metabolic diseases and disability. In the Republic of Tatarstan, a number of children with obesity has

increased many times within the last 20 years. In 2020, there were 14.2 thousand people in the Republic of Tatarstan [4].

Modern data about epidemiology and reasons for obesity in children and adolescents along with modern treatment strategies are described in reviews by Hiba Jebeile, Aaron S Kelly, Grace O'Malley, Louise A Baur. Prior to COVID-19, the prevalence of obesity among children and adolescents in many countries with a high level of income has reached the plateau though the level of obesity increased. In the pandemic, children and adolescents from several countries managed to gain weight. Obesity is associated with cardiometabolic and psychosocial comorbidity and premature morbidity among adults. Developed and preserved obesity is mainly explained by a biosocioecological scheme where the biological predisposition, socioeconomical and ecological factors interact and promote deposition and growth of fatty tissue.

First-line therapy involves family behavioral activities to fight obesity, including diet, physical activity, inactivity and quality of sleep along with the strategies of changed behavior. The benefit of intense dietary approaches, pharmacotherapy, metabolic and bariatric surgeries as additional treatment methods is proven. However, the majority of countries have a limited access to these treatment modalities. The studies confirm that formation of the program for personalization and individualization of obesity treatment in children and adolescents and their implementation in clinical practice are still necessary [12].

According to Kyle R Leister, Burak T Cilhoroz, Jared Rosenberg, Elise C Brown, Joon Young Kim, variation in the parameters of metabolic syndrome (MS) in children prevents consensus in relation to diagnostic criteria in this population. In spite of these irregularities, it has been found out that physical exercises can mitigate the negative consequences of MS. The studies confirm that adolescents with MS have a higher probability to obtain metabolic complications as soon as they become older. The studies of the prognostic nature of MS in adolescents concentrate on the association with the future development of MS as an adult, type 2 diabetes mellitus, cardiovascular diseases and atherosclerosis. General criteria of the studies include measurements of BMI, HDL, triglycerides, glucose and BP. The studies have shown that the presence and severity of MS in childhood can be associated with an increased rate of MS and other cardiovascular diseases subsequently. The conclusions show that it is important to eliminate MS-associated symptoms in adolescents to prevent MS and/or cardiovascular diseases as adults [13].

According to Jie Cai, Yaping Zhao, Jing Wang, Lei Wang, physical activity among children can be developed with support of the society. Government, community, educational institutions, kindergartens and children's sports clubs should cooperate to create a system of social support of physical activity of children within a family. In accordance with analysis of the authors, it has been found out that Government plays a guiding role in the development of physical activity of children in a family by way of creation and implementation of the program aimed at prevention and periodic health examination of children with metabolic syndrome and obesity. It is the society that provides additional support to physical activity of children in a family. Thus, it is necessary to develop an adequate set of population and personalized medical and preventive along organizational and administrative activities aimed to prevent obesity. An educational institution is not just a center of development of physical activity of children in a family. It also plays an important role in promotion of physical upbringing of children among parents [14].

## CONCLUSIONS

Based on the study results, certain recommendations concerning nutrition and physical activity of students can be developed and effective educational programs can be determined. Excessive body mass and obesity in children and adolescents can be prevented due to interventions aimed at the change in the way of life, formation of a habit to physical activity and rational nutrition. Prevented obesity in children can produce a favorable effect on health not only in childhood, but also in an adult life [5]. Several risk factors, which are interrelated and enhance the effect of one another, thereby greatly increasing the risk, are commonly found in one child. The basis of health and healthy habits are established in childhood, with proper nutrition and physical activity being an essential part hereof.

Early diagnostics of metabolic disturbances will enable to detect a group of risk requiring close monitoring and immediate actions. An excessive body mass, especially obesity, increases a risk of cardiovascular diseases, non-insulin dependent diabetes mellitus, different forms of cancer and disability.

Teaching physical culture and formation of a healthy lifestyle, which requires well prepared and motivated teachers, should play a key role in the area of health during the entire life. Promotion of a healthy lifestyle through a regular physical activity and proper nutrition in childhood and adolescence along with simultaneous adoption of professional preventive measures to reduce excessive body mass and obesity is crucial to public health. Regular physical activity and proper nutrition should be part of a daily life. Secondary school children probably belong to the most suitable contingent to promote proper nutrition and regular physical activity; they can also promote involvement of parents and a broader public. Regular physical activity and improved nutrition of adolescents are a worthy investment in health of future generation. The results obtained during the study should be taken into account while developing the strategies of preventing obesity in children, including a wider involvement of families and preventive work at schools [15–20].

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# COMPARATIVE ASSESSMENT OF PHYSICAL DEVELOPMENT OF SCHOOLCHILDREN AND CHILDREN INVOLVED IN SWIMMING

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Health of children and adolescents is an essential criterion of well-being of the society. Monitoring of health among children is impossible without assessment of physical development of children and adolescents. Individual-based analysis of anthropometric characteristics is required to develop personalized preventive activities. Considering different levels of physical load of schoolchildren in case of a disturbed nutritional status, an approach to body mass constituent study that deviates from the normal values requires examination. The study purpose was to assess physical development and component composition in schoolchildren during a medical examination and in children involved in classic swimming at a sports club in the city of Samara. The study object involved children studying at a general educational institution and not engaged in any sports sections (first group), and children involved in classic swimming at a sports club in Samara (second group. Significant differences in basic values of body composition were found during the conducted study of physical development and component composition of schoolchildren who do not go in for sports and junior athletes.

**Key words:** hygiene of children and adolescents, physical development, anthropometric indicators, bioimpedance analysis

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**Compliance with ethical standards:** the research was approved by the Ethics Commission of the Samara State Medical University of the Ministry of Health of the Russian Federation (protocol No. 9 as of Sept. 24, 2022). Voluntary informed consent was obtained for every participant (legal representative).

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# СРАВНИТЕЛЬНЫЙ АНАЛИЗ ФИЗИЧЕСКОГО РАЗВИТИЯ ШКОЛЬНИКОВ И ДЕТЕЙ, ПРОФЕССИОНАЛЬНО ЗАНИМАЮЩИХСЯ ПЛАВАНИЕМ

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Состояние здоровья детей и подростков — это неотъемлемый критерий уровня благополучия общества. В свою очередь мониторинг состояния здоровья детской популяции не воможен без оценки физического развития детей и подростков. Анализ антропометрических признаков на индивидуальном уровне необходим для построения персонализированных профилактических мероприятий. С учетом различного уровня физических нагрузок школьников, при нарушениях нутритивного статуса подход к исследованию компонента массы тела, отклоняющегося от нормы, требует изучения. Целью исследования была оценка физического развития и компонентного состава тела у школьников в период медицинского осмотра и у детей, профессионально занимающихся классическим плаванием в спортивном клубе г. Самара. Объектом исследования были дети, обучающиеся в общеобразовательном учреждении и не занимающиеся в каких-либо спортивных секциях (первая группа), и дети-спортсмены, профессионально занимающиеся классическим плаванием в спортивном клубе г. Самара (вторая группа). Проведенное исследование физического развития и компонентного состава тела школьников, которые не занимаются спортом, и детей-спортсменов выявило достоверные различия основных показателей состава тела.

**Ключевые слова:** гигиена детей и подростков, физическое развитие, антропометрические показатели, биоимпедансный анализ

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Physical development is the most important objective indicator of health in our country, children and adolescents in particular, and displays the effect of psychoemotional, economic, climate, geographical and social factors on their health [1, 2]. Under modern conditions of life, over 25% of schoolchildren have disharmonious physical development, which is strongly associated with an excessive body mass and obesity [3, 4]. In the majority of cases, it results from a change in the way of life and disturbed nutrition among schoolchildren, which, in its turn, promotes prevention of a number of diseases and creates favorable conditions for a child's adaptation to the environment. According to the WHO, 340 million of people aged 5 to 19

suffer from obesity. In the Samara region, newly diagnosed obesity incidence of children is still high and amounted to 54.9 cases per 10 thousand of children in 2020 [5]. The most important constituent of health monitoring is represented by individual and collective assessment of how an adolescent's body is developed. A sharp decrease in physical development of children and adolescents has been found in the Volga Federal District in the last few years [6–8]. Incidence of non-infectious diseases, and obesity, in particular, is increased, a number of healthy children is reduced and a number of children with a chronic pathology is increasing more and more [9]. Properly organized physical education can form the basis of harmonious physical development of a child, enhance the nervous system and immunity, and improve the state of the body. Besides, sport teaches the child discipline, develops a strength of character and will power and an ability to set and achieve goals [10, 11]. During the intensive growth of children and especially athletes, excessive weight can be associated not just with predominant deposition of fat stores, but also with high values of skeletal muscle mass in accordance with anthropometric analysis. Biophysical methods display more exact results of measured body mass characteristics. The method of body composition bioimpedance analysis (BIA) was the most widespread application [12–14]. The study results are used in clinical setting to analyze the alimentary status, nutritional condition, risk of metabolic syndrome, obesity, cardiovascular and other pathologies, and as a diagnostic criterion of therapy effectiveness in various diseases [15, 16]. The need in studying the body mass component, which deviates from the normal values in case of disharmonious physical development requires examination taking into account different levels of physical load among schoolchildren.

The study purpose consisted in comparison of physical development and component composition among schoolchildren and children involved in classical swimming at a sports club in Samara.

## PATIENTS AND METHODS

The study object involved children studying at a general educational institution and not engaged in any sports sections (first group) and children engaged in classic swimming at a sports club in Samara (second group). The study was conducted at educational institutions and at a sports institution for supplementary education, respectively. Organizations, supervisors of which approved participation of children in the study, were selected. Anthropometric values and component composition analysis were measured in 110 children (54 people were schoolchildren, 56 were junior athletes) aged 9 to 12. Inclusion criteria for the first group: schoolchildren who are not engaged in sports or who go in for sports for less than 2 years, without clinical manifestations of the disease, and having the first or second group of health at the time of examination. Inclusion criteria for the second group: schoolchildren involved in classical swimming at a sports organization for supplementary education 3 and more times a week for at least two years and permanently residing in the Samara region; children without clinical manifestations of diseases and having the first or second group of health at the time of examination. Exclusion criteria for the both groups: chronic diseases; intake of medicinal preparations, marked edemas of the extremities; permanent residence outside the Samara region; refusal of parents (legal representatives) to participate in the study. Additional exclusion criteria for the second group: going in for classic swimming at a sports club 2 times a week or less; for less than two years.

Body length and mass were measured using standard instruments such as a height chart with accuracy up to 0.5 cm for body length, and VEM-150-Massa-K electronic medical scale with accuracy up to 60 g for body mass. Anthropometric values were assessed using the regional regression scale for the Samara region and Anthro-prof software product such as Programme assessing physical development of schoolchildren [17]. Component composition and phase angle were determined using Medass ABC-02 appliance as per the standard scheme and disposable bioadhesive electrodes. Percentage of adipose mass (PAM,%), active cell mass (ACM, kg), phase angle (PA, degrees), skeletal muscle mass (SMM) and percentage of SMM (%) were analyzed. During the process, special attention was paid to the angle between the right shoulder and vertical body axis, which, in accordance with the method, should constitute 45°; the right forearm should be located parallel to the body vertical axis, whereas legs should be placed on the width of the shoulder. BIA was carried out in the morning on an empty stomach or 2.5–3 hours after food intake [18]. Primary data were collected and stored in Microsoft Excel 2010 (USA). Statistical processing of the obtained materials was done with Statistica programme package (StatSoft Inc.; USA, version 13.1).

## STUDY RESULTS

Analysis of physical development in two groups has revealed a significant difference in a number of children with harmonious physical development ($p$ = 0.43). Children with disharmonious physical development due to excessive body mass are found in both groups. However, these differences were not significant ($p$ = 0.321). The first group includes children with a deficient body mass in accordance with regional regression scales; no such children were detected in the second group though three children had an excessive body length. Results of physical development in two groups are presented in table 1.

Analysis of AM (kg), AM (%), SMM (kg) and percentage of SMM (%), AAM (kg), and PA (degrees) was performed for every

**Table 1.** Results of physical development in two groups

| Values of physical development | | | Group 1 | Group 2 | $p$ |
|---|---|---|---|---|---|
| Normal (harmonious) physical development | | Abs. | 34 | 49 | – |
| | | % | 63 | 87.5 | 0.043 |
| Disharmonious physical development | BMI | Abs. | 10 | 4 | – |
| | | % | 18.5 | 7.2 | 0.321 |
| | Body mass deficiency | Abs. | 10 | – | – |
| | | % | 18.5 | – | – |
| | High body length | Abs. | – | 3 | – |
| | | % | – | 5.3 | – |

**Table 2.** Quantitative assay of BIA values

| BIA values | Schoolchildren | Junior athletes | *p* |
|---|---|---|---|
| AM (kg) | 10.8 ± 1.4 | 6.1±1.7 | 0.032 |
| AM (%) | 21.5±2.1 | 16.6±1.1 | 0.041 |
| SMM (kg) | 11.5±3.1 | 18.3±1.2 | 0.043 |
| SMM (%) | 42.3±1.1 | 52.4±4.6 | 0.031 |
| AAM (kg) | 16.3±2.1 | 19.7±4.4 | 0.487 |
| PA (degrees) | 4.3±0.44 | 6.88±1.22 | 0.049 |

**Table 3.** Gradation of BIA values

| BIA value | Gradation | Schoolchildren | Junior athletes | *p* |
|---|---|---|---|---|
| AM (%) | Normal value | 34±1.1 | 49±0.44 | 0.001 |
| | Deficiency | 10±0.23 | 3±2.3 | 0.004 |
| | Excess | 10±0.71 | – | – |
| SMM (%) | Normal value | 30±1.16 | 48±1.0 | <0.001 |
| | Deficiency | 22±0.56 | – | 0.001 |
| | Excess | 2±0.22 | 8±1.6 | 0.003 |
| ACM (%) | Normal value | 48±1.11 | 50±1.12 | 0.203 |
| | Deficiency | 5±2.23 | 2±1.34 | 0.251 |
| | Excess | 1±0.22 | 4±1.21 | 0.083 |
| PA (degrees) | Normal value | 46±0.91 | 48±2.11 | 0.033 |
| | Low | 7±0.56 | – | – |
| | High | 1±1.11 | 8±1.1 | <0.001 |

child from the examined groups (table 3). During comparison of bioimpedansometry results it has been found out that AM (kg) and AM (%) in schoolchildren is significantly higher than in children involved in swimming ($p = 0.032$). Schoolchildren had significantly lower values of SMM (kg) ($p = 0,043$ and $p = 0,031$, respectively). The values of phase angles in schoolchildren were significantly lower ($p = 0.487$) as compared with junior athletes.

However, there were no statistical significance in the values of active cell mass among schoolchildren and children who went in for sports ($p = 0.487$). Quantitative assay of BIA values is shown in table 2.

If a gradation of values is produced, it should be noted that a number of children with percentage of adipose tissue is significantly higher than a number of children in the second group (<0.001). In the first group, a number of examined children was also significantly higher ($p = 0.004$). No children with excessive adipose tissue were found in the second group.

The values of skeletal muscle mass showed opposite results, whereas the normal values were significantly higher in the first group as compared with the second one ($p = 0.003$). According to bioimpedansometry, no children with deficiency of muscular mass were detected in the second group.

Percentage of active cell mass was similar in both groups.

The value of normal phase angle was significantly lower in the first group ($p = 0.033$), with a higher high value in the second group ($p < 0.001$). A gradation of BIA values is presented in table 3.

## DISCUSSION OF RESULTS

Based on the study of anthropometric indicators, children with disharmonious physical development due to both an excessive body mass, and body mass deficiency were revealed in the group of schoolchildren. In the group of junior athletes, disharmonic physical development occurred due to excessive body mass but in a smaller number of people as compared with schoolchildren, and also a small percentage of the examined children had a high body length.

Bioimpedansometry displays the results of anthropometric studies in every group. The adipose body mass is a marker of 'hidden obesity' and allows to assay the excess or shortage of a fat constituent in the body. According to the analysis of adipose body mass in a group of schoolchildren, a great number of children with higher values displaying an excessive alimentary status and predisposition to obesity was discovered. None of the examined junior athletes had an excessive adipose body mass. In our opinion, which coincides with studies of other authors [10, 15], the adipose mass is a source of energy for an athlete and is directly associated with physical performance of athletes closely correlating with biochemical and functional parameters of the body widely used in sports.

The skeletal muscle mass values were decreased in the first group, with muscle deficiency being found in a certain percentage of those examined. The latter can be associated with a decreased physical activity of children and can result in reduced efficiency and endurance, decreased immunity, obesity and muscular spasms. Higher values of skeletal muscle mass and percentage of skeletal muscle mass were recorded in the second group among all those examined. Increased SMM values can indicate intensive physical load and constitute an essential criterion assessing physical development in junior athletes and their constitution.

There were no differences in the active cell mass analysis among two groups. According to the present study, the results of which are consistent with the results of other authors [19–21], the active cell mass indicators can be associated with individual features of the younger generation during the active growth of the body.

A phase angle is a parameter specific for bioimpedance way of obtaining data about the general condition of the body, its fitness and endurance, and rate of metabolism. The phase angle values are increased along with regular physical loads and optimal rational nutrition. Reduced values are solitarily recorded in the first group of those examined during analysis of the phase angle, and they were within a normal range for the majority. In the second group, most athletes had increased values of the phase angle typical of those who actively go in for sports.

CONCLUSIONS

Significant differences in the primary parameters of body composition were found during the performed study of physical development and component composition of schoolchildren who do not go in for sports and junior athletes. The obtained results prove that it is necessary to use anthropometric studies along with data of bioimpedance analysis, which serves as an informative technique to assess appropriateness of nutrition, physical and motor activity of children.

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## HYGIENIC DESCRIPTION OF LIFESTYLE FACTORS AMONG STUDENTS OF COLLEGES

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Assessment of lifestyle factors is a pressing issue with a high social and state value. Purpose of the study is to compare lifestyle factors of young men and young women who study at colleges. A cross-sectional sampling descriptive study was conducted in 2021–2022. 371 students from 2 colleges of various profiles aged 16 to 20 (25.4% of young men and 74.6% of young women) participated in the study. Socioeconomic indicators, regimen of nutrition, periodic consumption of basic products and dishes, taste preferences of students, compliance with sleep pattern, duration of self-preparation for lessons, physical exercises and sporting activities, creative hobbies and use of gadgets were examined. It has been established that the majority of young people live in favorable social conditions, over one-third of them stay away from their parents and other adult relatives. The majority of those interviewed estimate income of their families as an average, all families have at least one PC. The majority of students have eating disorders, peculiarities of dietary behavior, and violations of the regimen of the day such as insufficient sleep duration, high academic load, insufficient involvement in creative or social activity, low level of motor activity and walking, long-term use of PCs and other gadgets.

**Keywords**: lifestyle, nutrition, physical activity, young people, students, colleges

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**Author contribution:** Bronskih NA — survey of students, statistical processing of results, review of literature on this issue; Sharenko EM — survey, statistical processing of results, searching the necessary literature; Popova OS — academic advisor, design development, organization of work, estimating quality of the obtained results, author's criticism; Nasybulina GM — academic advisor, developing the study design, editing and editorial processing of the article.

**Compliance with ethical standards:** voluntary informed consent has been obtained from all those interviewed before the study.

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## ГИГИЕНИЧЕСКАЯ ХАРАКТЕРИСТИКА ФАКТОРОВ ОБРАЗА ЖИЗНИ УЧАЩИХСЯ КОЛЛЕДЖЕЙ

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Оценка факторов образа жизни является актуальной проблемой, имеющей высокую общественную и государственную значимость. Цель исследования — проведение сравнительного анализа факторов образа жизни юношей и девушек, обучающихся в колледжах. В течение 2021–2022 гг. было проведено выборочное описательное одномоментное исследование методом анкетного опроса. В исследовании приняли участие 371 учащихся 2 колледжей разного профиля в возрасте от 16 до 20 лет, 25,4% юношей и 74,6% девушек. Изучены показатели социально-экономического статуса, режим питания, периодичность потребления основных продуктов и блюд, вкусовые предпочтения обучающихся, соблюдение режима сна, продолжительность самоподготовки к учебным занятиям, занятий физической культурой и спортом, творческими увлечениями, использования гаджетов. Установлено, что социальные условия проживания большей части молодых людей благополучные, более трети проживают отдельно от родителей и других взрослых родственников. Большинство респондентов оценивают доход семьи как средний, во всех семьях есть минимум один компьютер. У значительной части обучающихся выявлены нарушения режима питания, найдены особенности пищевого поведения, обнаружены нарушения режима дня: недостаточная продолжительность сна, высокая учебная нагрузка, недостаточная вовлеченность в творческую или общественную деятельность, низкий уровень двигательной активности и пеших прогулок, продолжительное использование компьютеров и других гаджетов.

**Ключевые слова:** образ жизни, питание, физическая активность, молодежь, учащиеся, колледжи

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**Соблюдение этических стандартов:** перед началом исследования получено добровольное информированное согласие от всех респондентов.

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Health is a natural condition of the body caused by normal functioning of all organs and systems. In accordance with literature and Rosstat, percentage of young people with the first group of health is steadily declining [1]. Scientists associate the issue with changes in the lifestyle [2–3]. Hypodynamia, excessive energy value and imbalanced diet are pressing modern issues and primary sources of non-infectious diseases [4–6]. Thus, examining the lifestyle of students under modern

social and economic conditions is a pressing issue, the solution of which allows not just to assess the risk factors of losing health but also develop evidence-based measures to preserve and strengthen health of students and enhance the possibilities to obtain more qualitative professional education [7–9]. The purpose of the study is to perform a comparative analysis of lifestyle factors among young men and young women who study at colleges.

## MATERIALS AND METHODS

Theoretical (literature analysis), empirical (surveying) and statistical methods are used to achieve the goal. From April 2021 to May 2022, a sampling observational descriptive crossover (one stage) study was performed on Google-forms platform using the survey method. The study object was represented by students from two colleges of Yekaterinburg. 371 students with 25.4% of young men and 74.6% young women aged 16 to 20 who provided an informed voluntary consent participated in the study. The subject of the study was represented by social and economic indicators (living conditions, education of parents, perception of income, availability of a car and PCs in a family) and lifestyle factors such as nutrition regimen, frequency of consumption of basic products, peculiarities of dietary behavior, sleeping pattern, duration of self-preparation for classes, periodicity and duration of walks and involvement in creative activity, physical activity, use of stationary and mobile electronic gadgets.

Questionnaire based on Health Behavior in School-Aged Children (HBSC, 2017), Health and Nutrition Intercultural Quality Life Research (Federal Research Center for Nutrition, Biotechnology and Safety of Food, 2018) and Nutrition Behavior Survey by Savchikova Yu. L. (2005) WHO international surveys were used to study a lifestyle. The data were analyzed using extensive values and their errors for qualitative attributes, mean values and errors for quantitative attributes. Extensive indicators were calculated according to the following formula: part of phenomenon (environment)/ whole phenomenon (environment) x 100%. The error was calculated by the following formula: $m = \sqrt{P^*}(100 — P)/n — 1$, where $P$ is a value of the extensive indicator, $n$ is a sampling size.

The statistical difference between the groups of comparison (young men and young women) was estimated using the Student's t-test for relative values: $t = (P_1 - P_2) / \sqrt{(m_1^2 + m_2^2)}$.

The average value was estimated using the following formula: $Mcp. = \Sigma M_i / n$, where $M_i$ means the value indicator for every sampling participant. The error of mean was calculated using the following formula: $m = \sigma/\sqrt{N}$, where $N$ is a sampling size. The statistical value between the comparison groups was estimated by the Student's t-test for average values: $t = (Mcp_1 - Mcp_2) / \sqrt{(m_1^2 + m_2^2)}$. The statistical significance of differences was assessed at the level of significance equal to $p \leq 0.05$.

Statistical analysis was done using Microsoft Excel 2007 (USA).

## RESULTS

According to the results, it has been found out that young men more commonly live with their mothers (59.6 ± 5.1%), and less frequently with other relatives: father (34.0 ± 4.9%), sister (23.4 ± 4.4%), and brother (20.2 ± 4.1%) ($p < 0.05$). They live separately from adult family members (19.1 ± 4.1%), with a friend or girlfriend (18.1 ± 4.0%) ($p < 0.05$). According to the survey, girls more commonly live with their mothers (52.3 ± 3.0%) and other family members: father (30.3 ± 2.8%), sister (23.1 ± 2.5%), and brother (19.9 ± 2.4%) ($p < 0.05$). As compared with young men, they live alone or with a boyfriend/ friend with the same frequency: (13.7 ± 2.1%) и (26.0 ± 2.6%) respectively ($p > 0.05$). According to the survey, (56.38 ± 5.1%) mothers and (28.7 ± 4.7%) fathers ($p < 0.05$) of young men, and (48.7 ± 3%) mothers and (28.2 ± 2.7%) fathers ($p < 0.05$) of young women have higher education. (33.2 ± 4.9%) of mothers and (39.5 ± 5.1%) of fathers ($p > 0.05$) of young men, and (33.6 ± 2.5%) of mothers and (41.2 ± 3.0%) of fathers ($p > 0.05$) of young women have secondary professional education.

The majority of surveyed (70.2 ± 4.7%) young men and (83.8 ± 2.2%) young women believe that their families have the same income as others. (80.9 ± 4.1%) of young men and (86.2 ± 2.1%) young women have a room of their own ($p > 0.05$). Families of young men (41.5 ± 5.1%) and young women (41.1 6 ± 3.0%) ($p > 0.05$) have one computer. Two computers can be found in the families of (27.7 ± 4.6%) young men and (41.2 ± 3.0%) young women ($p < 0.05$); more than two computers are available in the families of (25.5 ± 4.5%) young men and (17.3 ± 2.3%) young women ($p > 0.05$). More than half of families have one car: the response was provided by (56.4 ± 5.1%) young men and (52.4 ± 3.0%) of young women ($p > .05$). (24.5 ± 4.4%) of young men and (27.1 ± 2.7%) of young girls have no car in their families. Within the last 12 months, families of young men went for holiday only once (23.4 ± 4.4%), twice (13.8 ± 3.6%), more than twice (20.2 ± 4.1%), had no holiday at all (42.6 ± 5.1%). Families of (33.9 ± 2.8%) young women went for holiday once ($p < 0.05$), twice (12.6 ± 2.0%) ($p > 0.05$), more than twice (11.6 ± 1.9%) ($p > 0.05$), had no holiday at all (41.9 ± 3.0%) ($p > 0.05$).

According to the survey, it has been established that not all students follow the principles of rational nutrition. Many students skip a meal, which can later produce an unfavorable effect on the gastrointestinal tract. Most frequently both young men, and young women skip breakfast or dinner (fig. 1).

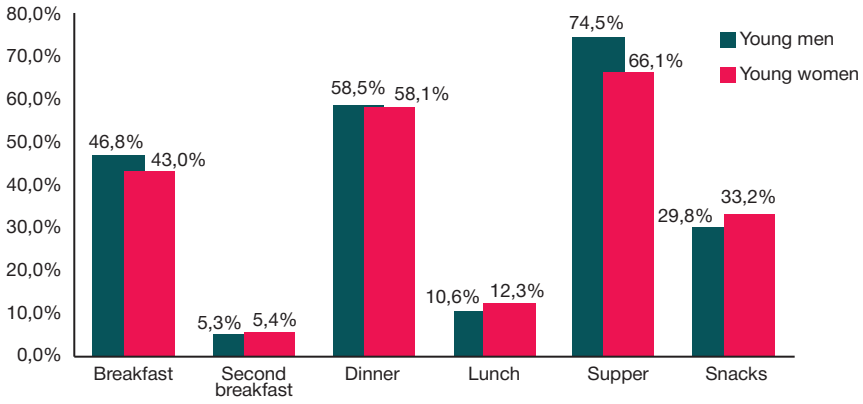


**Fig. 1.** Percentage of students who daily take main and additional meals

**Table 1.** Frequency of consuming food products and related dishes within the last month, $P \pm m$

| Products and dishes | Gender | Over 5 times a day | 3–4 times a day | 1–2 times a day | 4–6 times a day | 2–3 times a day | 1 time a day | 1–2 times a day | never |
|---|---|---|---|---|---|---|---|---|---|
| Fruits | M | 2.1 ± 1.5 | 1.1 ± 1.1 | 9.6 ± 3.0 | 19.1 ± 4.1 | 31.9 ± 4.8 | 20.2 ± 4.1 | 12.8 ± 3.4 | 3.2 ± 1.8 |
| | F | 0.4 ± 0.4 | 3.6 ± 1.1 | 13.4 ± 2.0 | 16.9 ± 2.3 | 23.1 ± 2.5 | 21.7 ± 2.5 | 18.8 ± 2.3 | 2.2 ± 0.9 |
| Vegetables | M | 1.1 ± 1.1 | 4.3 ± 2.1 | 16.0 ± 3.8 | 15.9 ± 3.8 | 35.1 ± 4.9 | 18.1 ± 4.0 | 8.5 ± 2.9 | 1.1 ± 1.1 |
| | F | 0.7 ± 0.5 | 5.8 ± 1.4 | 14.8 ± 2.1 | 20.9 ± 2.4 | 31.8 ± 2.8 | 14.8 ± 2.1 | 10.5 ± 1.8 | 0.7 ± 0.5 |
| Milk and other dairy products | M | 3.2 ± 1.8 | 8.5 ± 2.9 | 19.1 ± 4.1 | 17.1 ± 3.9 | 14.9 ± 3.7 | 14.9 ± 3.7 | 13.8 ± 3.6 | 8.5 ± 2.9 |
| | F | 1.8 ± 0.8 | 4.7 ± 1.3 | 15.2 ± 2.2 | 21.2 ± 2.5 | 19.9 ± 2.4 | 18.1 ± 2.3 | 9.7 ± 1.8 | 9.4 ± 1.8 |
| Cottage cheese or cheese | M | 1.1 ± 1.1 | 1.1 ± 1.1 | 11.7 ± 3.3 | 15.9 ± 3.8 | 24.5 ± 4.4 | 23.4 ± 4.4 | 16.0 ± 3.8 | 6.4 ± 2.5 |
| | F | 1.1 ± 0.6 | 1.4 ± 0.7 | 8.3 ± 1.7 | 15.8 ± 2.2 | 25.3 ± 2.6 | 23.1 ± 2.5 | 18.1 ± 2.3 | 6.9 ± 1.5 |
| Cream cheese and sweet dairy-based desserts | M | 1.1 ± 1.1 | 3.2 ± 1.8 | 4.3 ± 2.1 | 14.8 ± 3.7 | 19.1 ± 4.1 | 20.2 ± 4.1 | **28.7 ± 4.7*** | 8.5 ± 2.9 |
| | F | 2.2 ± 0.9 | 1.8 ± 0.8 | 5.8 ± 1.4 | 16.2 ± 2.2 | 24.2 ± 2.6 | 23.8 ± 2.6 | **17.3 ± 2.3*** | 8.7 ± 1.7 |
| Meat, bakery | M | 3.2 ± 1.8 | 7.4 ± 2.7 | 21.3 ± 4.2 | 25.5 ± 4.5 | 20.2 ± 4.1 | 13.8 ± 3.6 | 5.3 ± 2.3 | 3.2 ± 1.8 |
| | F | 0.7 ± 0.5 | 5.1 ± 1.3 | 20.6 ± 2.4 | 20.9 ± 2.4 | 24.9 ± 2, | 16.6 ± 2.2 | 9.0 ± 1.7 | 2.2 ± 0.9 |
| Sausages | M | 1.1 ± 1.1 | 7.4 ± 2.7 | 13.8 ± 3.6 | **25.5 ± 4.5*** | 14.9 ± 3.7 | 19.1 ± 4.1 | 11.7 ± 3.3 | 6.4 ± 2.5 |
| | F | 1.1 ± 0.6 | 3.6 ± 1.1 | 10.5 ± 1.8 | **11.9 ± 1.9*** | 28.2 ± 2.7 | 20.6 ± 2.4 | 14.4 ± 2.1 | 9.7 ± 1.8 |
| Fish and seafood | M | 1.1 ± 1.1 | 3.2 ± 1.8 | 5.3 ± 2.3 | 10 ± 3.0 | 16.0 ± 3.8 | **19.1 ± 4.1 *** | 28.7 ± 4.7 | 17.0 ± 3.9 |
| | F | 0.7 ± 0.5 | 1.1 ± 0.6 | 3.6 ± 1.1 | 5.1 ± 1.3 | 17.0 ± 2.3 | **30.0 ± 2.8*** | 27.8 ± 2.7 | 14.8 ± 2.1 |
| Pasta | M | 2.1 ± 1.5 | 5.3 ± 2.3 | 12.8 ± 3.4 | **23.4 ± 4.4*** | 26.6 ± 4.6 | **14.9 ± 3.7*** | 12.8 ± 3.4 | 2.1 ± 1.5 |
| | F | 1.4 ± 0.7 | 2.5 ± 0.9 | 11.2 ± 1.9 | **13.3 ± 2.0*** | 29.6 ± 2.7 | **31.8 ± 2.8*** | 7.2 ± 1.6 | 2.9 ± 1.0 |
| Cereals, porridge | M | 3.2 ± 1.8 | 5.3 ± 2.3 | 8.5 ± 2.9 | 21.2 ± 4.2 | 24.5 ± 4.4 | 19.1 ± 4.1 | 10.6 ± 3.2 | 7.4 ± 2.7 |
| | F | 0.7 ± 0.5 | 2.5 ± 0.9 | 6.9 ± 1.5 | 5.5 ± 2.2 | 30.3 ± 2.8 | 21.7 ± 2.5 | 10.8 ± 1.9 | 11.6 ± 1.9 |
| Potatoes | M | 1.1 ± 1.1 | 4.3 ± 2.1 | 10.6 ± 3.2 | 20.2 ± 4.1 | 36.2 ± 5.1 | 18.1 ± 4.0 | 9.6 ± 3.0 | 0 |
| | F | 0.7 ± 0.5 | 3.2 ± 1.1 | 9.4 ± 1.8 | 13.3 ± 2.0 | 32.9 ± 2.8 | 24.5 ± 2.6 | 11.2 ± 1.9 | 4.7 ± 1.3 |
| Soups | M | 3.2 ± 1.8 | 1.1 ± 1.1 | 13.8 ± 3.6 | 14.8 ± 3.7 | 28.7 ± 4.7 | 26.6 ± 4.6 | 10.6 ± 3.2 | 1.1 ± 1.1 |
| | F | 0.4 ± 0.4 | 3.2 ± 1.1 | 7.6 ± 1.6 | 16.2 ± 2.2 | 26.4 ± 2.6 | 22.7 ± 2.5 | 15.9 ± 2.2 | 7.6 ± 1.6 |
| Eggs and related dishes | M | 2.1 ± 1.5 | 3.2 ± 1.8 | 5.3 ± 2.3 | **19.1 ± 4.1 *** | 25.5 ± 4.5 | 24.5 ± 4.4 | 16.0 ± 3.8 | 4.3 ± 2.1 |
| | F | 0.7 ± 0.5 | 1.8 ± 0.8 | 8.7 ± 1.7 | **9.3 ± 1.8*** | 26.0 ± 2.6 | 24.2 ± 2.6 | 19.9 ± 2.4 | 9.4 ± 1.8 |
| Bread | M | 6.4 ± 2.5 | 13.8 ± 3.6 | 22.3 ± 4.3 | 14.9 ± 3.7 | 14.9 ± 3.7 | 14.9 ± 3.7 | 8.5 ± 2.9 | 4.3 ± 2.1 |
| | F | 2.9 ± 1.0 | 6.9 ± 1.5 | 14.1 ± 2.1 | 18.7 ± 2.3 | 18.4 ± 2.3 | 20.9 ± 2.4 | 9.7 ± 1.8 | 8.3 ± 1.7 |
| Pies, pizza and other pastry | M | 0 | 5.3 ± 2.3 | 12.8 ± 3.4 | 13.8 ± 3.6 | 21.3 ± 4.2 | 20.2 ± 4.1 | 23.4 ± 4.4 | 3.2 ± 1.8 |
| | F | 1.4 ± 0.7 | 2.9 ± 10 | 7.6 ± 1.6 | 13.3 ± 2.0 | 23.5 ± 2.5 | 23.1 ± 2.5 | 20.2 ± 2.4 | 7.9 ± 1.6 |
| Chips, croutons and other snacks | M | 1.1 ± 1.1 | 2.1 ± 1.5 | 2.1 ± 1.5 | 8.5 ± 2.9 | 13.8 ± 3.6 | **35.1 ± 4.9*** | **19.1 ± 4.1 *** | 18.1 ± 4.0 |
| | F | 1.1 ± 0.6 | 2.2 ± 0.9 | 2.2 ± 0.9 | 8.3 ± 1.7 | 19.1 ± 2.4 | **22.7 ± 2.5*** | **30.0 ± 2.8*** | 14.4 ± 2.1 |
| Candies, gingerbread and other confectionary products | M | 3.2 ± 1.8 | 3.2 ± 1.8 | 7.4 ± 2.7 | 18.1 ± 4.0 | 21.3 ± 4.2 | 22.3 ± 4.3 | 14.9 ± 3.7 | 9.6 ± 3.0 |
| | F | 1.1 ± 0.6 | 3.6 ± 1.1 | 7.6 ± 1.6 | 12.2 ± 2.0 | 23.8 ± 2.6 | 22.0 ± 2.5 | 17.7 ± 2.3 | 11.9 ± 1.9 |
| Candies, chocolate | M | 2.1 ± 1.5 | 3.2 ± 1.8 | 6.4 ± 2.5 | 10.6 ± 3.2 | 21.3 ± 4.2 | 31.9 ± 4.8 | 17.0 ± 3.9 | 7.4 ± 2.7 |
| | F | 3.6 ± 1.1 | 3.6 ± 1.1 | 8.3 ± 1.7 | 15.8 ± 2.2 | 22.4 ± 2.5 | 23.5 ± 2.5 | 17.0 ± 2.3 | 5.8 ± 1.4 |
| Hamburgers, French fries, nuggets | M | 2.1 ± 1.5 | 0 | 1.1 ± 1.1 | 7.4 ± 2.7 | 11.7 ± 3.3 | 20.2 ± 4.1 | 34.0 ± 4.9 | 24.5 ± 4.4 |
| | F | 1.8 ± 0.8 | 1.4 ± 0.7 | 2.5 ± 0.9 | 4.3 ± 2.3 | 10.5 ± 1.8 | 22.4 ± 4.3 | 40.1 ± 2.9 | 17.0 ± 2.3 |
| Carbonated soft drinks | M | 1.1 ± 1.1 | 1.1 ± 1.1 | 5.3 ± 2.3 | 12.8 ± 3.7 | 18.1 ± 4.0 | 27.7 ± 4.6 | 22.3 ± 4.3 | 10.6 ± 3.2 |
| | F | 2.2 ± 0.9 | 2.5 ± 0.9 | 3.2 ± 1.1 | 7.9 ± 2.2 | 15.9 ± 2.2 | 23.5 ± 2.5 | 28.2 ± 2.7 | 16.6 ± 2.2 |
| Fruit juices, dried fruit drinks, berry drink, etc. | M | 2.1 ± 1.5 | 2.1 ± 1.5 | **11.7 ± 3.3*** | 14.8 ± 3.7 | 20.2 ± 4.1 | 21.3 ± 4.2 | 19.1 ± 4.1 | 6.4 ± 2.5 |
| | F | 2.9±1.0 | 3.0 ± 1.0 | **3.6 ± 1.1 *** | 11.1 ± 1.9 | 22.0 ± 2.5 | 30.3 ± 2.8 | 17.7 ± 2.3 | 9.4 ± 1.8 |

Note: indicators with statistically significant differences are shown in bold ($p < 0.05$).

**Table 2.** Peculiarities of dietary behavior in students, $P \pm m$

| Peculiarities of dietary behavior | Young men (n=94) | Young women (n=277) |
|---|---|---|
| It frequently happens that they eat an excessive amount of food and feel that they can't stop and control what they eat and in what amount | **38.2 ± 5.0*** | **23.1 ± 2.5** |
| They often overeat until they experience discomfort due to fullness of the stomach | **18.1 ± 4.0*** | **32.1 ± 2.8** |
| They eat even what they don't like eating without being hungry | 22.3 ± 4.3 | 33.2 ± 2.8 |
| They feel guilty when they eat more than usual | **19.1 ± 4.1 *** | **36.1 ± 2.9** |
| Haunted by obsessive thoughts about food or how not to overeat | **7.4 ± 2.7*** | **27.1 ± 2.7** |
| Get distracted from troubles and conflicts while eating | **12.7 ± 3.4*** | **31.1 ± 2.8** |
| They eat everything what's on their plate because they were taught to do so as children | 18.1 ± 4.0 | 23.1 ± 2.5 |
| They were pampered with food in childhood when they were ill or experienced unpleasant events | **45.7 ± 5.1 *** | **58.8 ± 3.0** |
| They were deprived of food in childhood as a punishment | 8.5 ± 2.9 | 4.6 ± 1.3 |

Note: indicators with statistically significant differences are shown in bold ($p < 0.05$).

Meanwhile, (86.1 ± 3.6%) of young men and (87.7 ± 2.0%) of young women can have supper less than 2 hours before sleep. Only (20.2 ± 4.1%) of young men and (21.2 ± 2.5%) of young women have breakfast together with their parents. (42.5 ± .1%) of men and (38.2 ± 2.9%) of women have lunch with their friends. Representatives of both genders frequently have supper alone. Only a half of families follow the necessary frequency of nutrition and take food at a certain time.

During analysis it has been found out that a significant part of students rarely includes fruits, vegetables, milk products, cereals, fish into the diet; they prefer sausage products and pasta (table 1). Young men prefer sandwiches (54.2 ± 5.1%), fruits, berries or nuts (53.1 ± 5.1%) as snacks. Young women prefer fruits, berries, nuts (53.1 ± 3.0%), dairy beverages/ yogurt (18.7 ± 2.3%). The majority of families have necessary food products for cooking. Young men stated that they always have bread and bakery products (85.1 ± 3.7%), pasta (77.6 ± 4.3%), milk and dairy products (72.3 ± 4.6%), fresh fruits and vegetables (68.1 ± 4.8%), meat and poultry (68.1 ± 4.8%) at home. The most girls always have cereals (84.5 ± 2.2%), bread and bakery products (84.1 ± 2.2%), milk and dairy products (80.9 ± 2.4%), pasta (81.9 ± 2.3%), meat and poultry (74.0 ± 2.6%), fresh fruits and vegetables (72.2 ± 2.7%) at their disposal.

Only (23.1 ± 4.5%) of young women and (38.2 ± 5.0%) of young men ($p<0.05$) believe that they have proper nutrition. Less than a half of those requested believe that their weight is normal: (45.5 ± 3.0%) of young women and (45.8 ± 5.7%) of young men ($p>0.05$). Meanwhile, (32.5 ± 2.8%) of young women and (23.4 ± 4.4%) of young men think that their weight is above normal values ($p>0.05$); whereas (14.4 ± 2.1%) of young women and (23.4 ± 4.4%) young men think that their weight is above the normal values ($p<0.05$). Girls would like to reduce their weight more frequently than boys: (40.1 ± 2.9%) against (25.5 ± 4.5%) ($p<0.05$). According to the study results, young women get more emotional about excessive weight, amount of consumed food, eat their feelings, suffer from a guilty conscience if they eat more that they should, but they overeat less frequently than men (table 2). According to a half of those interviewed, their relatives have excessive weight.

When analyzing the sleep pattern, it has been established that the majority of those surveyed sleep less than 7 hours a day: (54.3 ± 5.1%) of young men and (49.5 ± 3.0%) of young women. About one fourth of interviewed young men (20.2 ± 4.1%) and one-third part of women (32.1 ± 2.8%) are deprived of sleep on a daily basis ($p < 0.05$).

Over 70% of those requested estimate their academic achievements as satisfactory. However, (34.1 ± 4.9%) of young men and (44.7 ± 3.0%) of young women report that it's hard for them to study ($p < 0.05$). Average duration of self-preparation for classes in a college constitutes 2.4 ± 0.04 hours per day among young women and 3.3 ± 0.02 hours a day among young men. Percentage of young men, self-preparation in whom exceeds the hygienic standard (3 hours) amounted to (27.7 ± 46%) in young men and (48.4 ± 3.0%) in young women ($p < 0.05$).

(29.7 ± 4.7%) of young men and (48.7 ± 3.0%) of young women ($p < 0.05$) are engaged in creative and social activity and have hobby. Young men do it 3.25 ± 0.07 times a week in average, whereas young women are engaged in this activity 2.49 ± 0.04 times a week ($p < 0.05$). Average duration of classes has no statistically significant differences and amounted to 1.6 ± 0.03 hours in women and 1.5 ± 0.06 hours in men ($p > 0.05$). While assessing the results of motor activity it has been found out that (50.0 ± 5.2%) of young men and (33.9 ± 2.8%) of young women ($p < 0.05$) are engaged in regular physical exercises (apart from lessons in a college). An average number of lessons was 3.3 ± 0.07 times a week with an average duration of 1.8 ± 0.03 hours in men, and 2.2 ± 0.03 times a week with an average duration of 1.5 ± 0.01 hours in women.

According to WHO, physical activity should be no less than 1 hour a day or 7 hours a week [10]. While practicing different types of physical activity, support of parents and friends is important. In young men, their best friend/relative (43.6 ± 5.3%), or less frequently, parents — father (10.6 ± 3.2%) and mother (16.0 ± 3.8%) — go in for sports ($p < 0.05$). As far as young women go, their sister or brother (38.3 ± 2.9%), best friend (37.5 ± 2.9%), and less frequently, parents — father (15.5 ± 2.2%), mother (18.8 ± 2.3%) ($p < 0.05$) — go in for sports.

(54.3 ± 5.1%) of young men and (48.7 ± 3.0%) of young women walk every day, (17.0 ± 3.9%) of young men and (19.1 ± 2.4%) of young women walk 4–6 times a week, (13.8 ± 3.6%) of young men and (22.7 ± 2.5%) of young women walk 1–3 times a week, whereas (14.9 ± 3.7%) of young men and (9.4 ± 1.8%) of young women walk less frequently than once a week or do not go for a walk at all. The average duration of walking during a day accounts for 1.8 ± 0.05 hours a day in young men, and 1.6 ± 0.04 hours a day in young women ($p > 0.05$).

According to analysis of frequency and duration of use of gadgets, the screen time was significantly increased on weekends as compared with academic days. Girls use gadgets more frequently than boys both during academic days and on weekends with the average time of their using being longer on weekends than on academic days (5.3 ± 0.1 hours a day against 4.8 ± 0.07 hours a day). Young men use gadgets for 4.4 ± 0.1 hours on academic days and for 5.0 ± 0.1 hours on

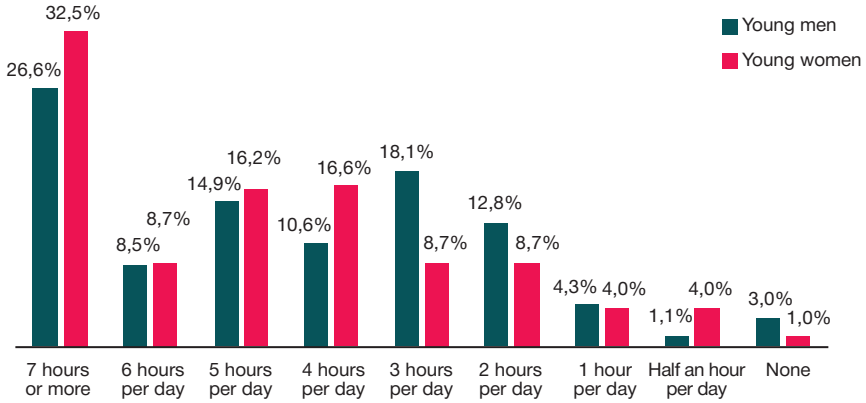


**Fig. 2.** Distribution of students by duration of using gadgets during non-study time on academic days

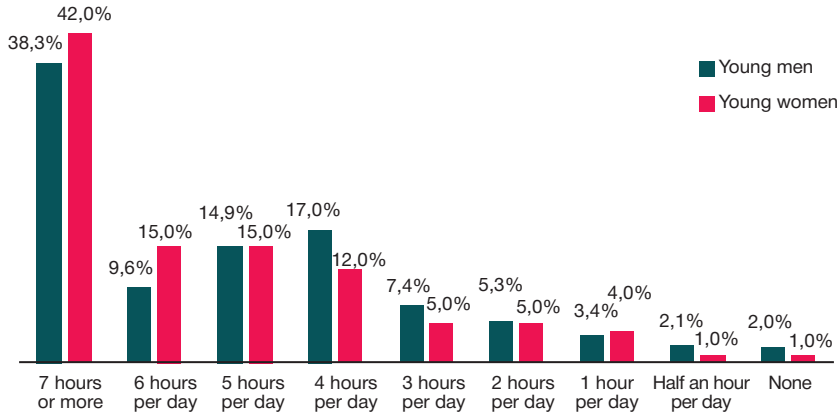


**Fig. 3.** Distribution of students by duration of using gadgets during non-study time on weekends

weekends. (87 ± 3.7%) of young men and (89 ± 2.1%) young women have the average screen time of over 170 minutes a day [9] (fig. 2, 3).

## DISCUSSION OF RESULTS

Thus, the obtained results show there is a high prevalence of risk factors in a lifestyle of students from colleges: unbalanced and improper feeding, poor sleep, low physical activity, lack of walking in the open air, increased mental burden and high level of gadgetization.

A review of Russian and foreign scientific literature sources regarding examination and assessment of health-related behavior of adolescents and young people was performed [11–15]. Thus, obtained results are in accordance with the results of 'Hygienic description of medical and social factors and lifestyle of modern Moscow schoolchildren' research by Bokaryova NA et al. [15]. Issues of irregular and unbalanced nutrition are found in various age groups of students from colleges of Yekaterinburg and Moscow. Meat and dairy products, fresh vegetables and fruits are insufficiently presented in the diet intended for a growing body. Sleep deficit (less than 7 hours a day), long-term and regular use of gadgets by schoolchildren are noted in the study. Sports and dance sections are more frequently visited by schoolchildren than by college students ($p < 0.05$). Modern adolescents spend 5–6 hours a week on sections with a sports component; in our study, a similar level is established for young men, and it is less for young women. Our results comply with results of studies by Shubochkina EI et al. conducted among the students of organizations of secondary vocational education in Moscow [16, 17].

In these studies, results regarding risk factors were similar with those obtained during our study: violation of diet, lack of various food, imbalanced diet, low motor activity, which occurs more frequently in young women than in young men, sleep deficit associated with academic and other lessons.

In connection with the above, it is necessary to solve the tasks related to informing of and attraction of attention of adolescents and young people to the significance of proper organization of main components of a lifestyle, teaching them skills of rational organization of the daily routine, nutrition, daily activity, curricular and extracurricular activities. It is important to pay attention to compliance with hygienic requirements to schedule planning and conduction of lessons, organization of physical education and nutrition.

## CONCLUSIONS

The majority of college students have favorable living conditions, and their parents have higher or specialized secondary education, whereas young people have a separate room and PC of their own. Many of those interviewed stay separately from their parents, on their own or with a boyfriend/girlfriend.

Many students have irrational and imbalanced nutrition skipping meals, most frequently breakfasts or dinners. Young people seldom consume fruits, vegetables, dairy products, cereals, fish, but rather frequently have sausage products and pasta. It has been found out that the majority of girls are worried about how they look and excessive weight as compared with young men.

While assessing the daily regimen the following results have been achieved. The majority of those interviewed sleep less than 7 hours a day, many of them get little sleep on a daily basis. One-third part of young men and half of women have difficulties with academic load. Girls are more frequently

engaged in a creative activity and hobby. Young men do heavy physical activity more frequently than young women and have more and longer training sessions.

They are engaged in a greater amount of training sessions with a longer duration. Their peers (friends, brothers or sisters) or, much less frequently, their parents, set an example in exercises or sports. Only half of those interviewed walk every day. The average duration of walking is higher among young men. Over 90% of study participants use PCs and other gadgets for 2 and more hours per day with their duration being significantly increased on weekends as compared with school days.

The study results confirm relevance and significance of monitoring of lifestyle among young men to preserve and improve their health. It is necessary to develop methods of prevention, introduce evidence-based medical and pedagogical programs related to formation of a healthy lifestyle and training of adolescents and young people.

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# AWARENESS OF MEDICAL COLLEGE STUDENTS ABOUT THE FORMATION OF REPRODUCTIVE HEALTH

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The study objective is to assess awareness of medical college students about formation of reproductive health. 80 female students from a medical college were surveyed concerning formation of their menstrual function; this survey was followed by an interview of 126 female students and 81 male students from medical colleges about their awareness of reproductive health protection and attitude to hygienic education regarding this topic. Data were processed using Statistica 13.0 (StatSoft, USA). 83.8% girls had their periods between 11 and 14, whereas in 7.5% of girls they started at the age of 15 and older. During the interview, 22.5% of girls had an irregular menstrual cycle. The conducted study revealed an insufficient awareness of students from a medical college of reproductive health formation. It produces a negative effect on their own health and will prevent subsequent effective hygienic education of different categories of population as far as this issue goes.

**Key words:** menstrual function, students, reproductive health care

**Compliance with ethical standards:** the study was approved by the Local Ethics Committee of Pirogov Russian National Research University (protocol No. 159 as of November 21, 2016) and done within a research project (Research and Technology State Registration Number НИОКТР АААА-А19-119021890068-7 as of February 18, 2019). It did not expose participants to danger and corresponded to requirements of biomedical ethics.

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# ОСВЕДОМЛЕННОСТЬ СТУДЕНТОВ МЕДИЦИНСКОГО КОЛЛЕДЖА О ФОРМИРОВАНИИ РЕПРОДУКТИВНОГО ЗДОРОВЬЯ

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Цель исследования — оценка осведомленности студентов медицинского колледжа о формировании репродуктивного здоровья. С помощью анкетирования онлайн были опрошены 80 девушек-студенток медицинского колледжа о формировании у них менструальной функции; далее были опрошены 126 студенток медицинского колледжа и 81 студент медицинского колледжа об их осведомленности по вопросам охраны репродуктивного здоровья и отношении к проведению гигиенического воспитания по этой теме. Обработка данных осуществлялась с использованием Statistica 13.0 (StatSoft, США). В период с 11 до 14 лет менструации начались у 83,8% девушек и у 7,5% — в 15 лет и более поздние сроки. На момент опроса не установившийся менструальный цикл имели 22,5% девушек. Проведенное исследование показало недостаточную осведомленность студентов медицинского колледжа по вопросам формирования репродуктивного здоровья, что негативно влияет на их собственное здоровье и не позволит в дальнейшем эффективно осуществлять гигиеническое воспитание различных категорий населения по данному вопросу.

**Ключевые слова:** менструальная функция, студенты, охрана репродуктивного здоровья

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Reproductive health is comprehended as an ability to conceive and give birth to children, protection from sexually transmitted diseases, access to family planning methods, protection and safety during pregnancy and labor, support of maternal and child's health [1]. Importance of reproductive potential of the country is recorded in the 'Demography' National Project which has been implemented since 2019.

A set of factors producing a negative effect on reproductive health of young people has been described [2–5].

However, the role of knowledge of young people in the area of reproductive health protection requires further examination. The study objective is to assess awareness of students from a medical college about reproductive health formation.

## MATERIALS AND METHODS

80 female students of a medical college were interviewed online about formation of their menstrual function. The average age of the interviewed girls was 18.4 ± 0.2 years. Subsequently, 126 female students of a medical college and 80 male students of a medical college were asked questions about their awareness of protection of reproductive health and attitude to hygienic education on this topic using online survey. The average age of the interviewed girls and boys was 18.4 ± 0.2 years and 18.5 ± 0.3 years, respectively.

The surveys were developed by the author having the 'Organization of healthcare and public health' certificate, with participation of teachers from the department of hygiene of faculty of pediatrics having professional certificates such as 'Hygienic education' and 'Hygiene of children and adolescents.

Criterion of inclusion of survey results into the study involved properly filled in questionnaires. This was manifested as voluntary informed consent, age and gender of students from a medical college.

The results were processed using Statistica 13.0 (StatSoft, USA). When processing the results, compliance of the obtained values to the normal distribution law of variation series was assessed. Descriptive statistics using the arithmetic mean

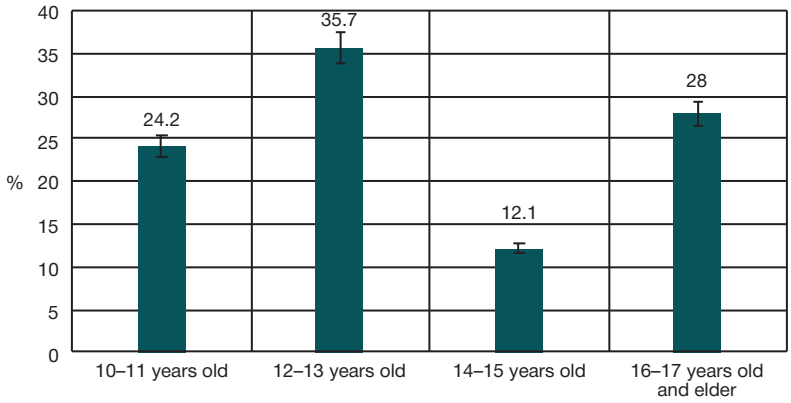


**Fig.** Distribution of answers among students of a medical college while answering the question about the age of beginning of hygienic education on the issues of reproductive health protection,%

(*M*) and mean square deviation (σ) was carried out. Student t-test (the differences were significant at $p \leq 0.05$) was used to estimate reliability of differences between mean values. Pierson contingency coefficients were calculated (95.0%, $p \leq 0.05$).

## RESULTS

Among the interviewed girls, the mean age at menarche was ($M \pm m$) 12.3 ± 0.2 years. 83.8% and 7.5% of girls had first menses between 11 and 14 years and at the age of 15 and later, respectively. 22.5% of girls had an irregular menstrual cycle at the interview.

The girls had an abnormal menstrual cycle: duration of the menstrual cycle was less than 21 days (epimenorrhea) in 1.3% of girls and more than 35 days (opspmenorrhea) in 15.0% of girls. Delay in menstrual cycle for 9 days and more was found among 36.3% of those interviewed. 15.0% of the girls mentioned that duration of their menstrual cycle was 7 days and more.

23.8% of students from a medical college noted that they had blood secretion between periods. 37.5% of girls reported appearance of pain in the lower abdomen between periods. 45.0% of girls had pronounced pain in the lower abdomen. When menstrual pain is classified on a ten-point scale with 0 for a lack of pain, 1 to 3 for a mild pain, 4 to 6 for a moderate pain, 7 to 9 for severe pain, and 10 points for very severe pain, the mean value ($M \pm m$) amounted to 6.1 ± 0.3 points. Severe and very severe pains were found in 41.3% and 1.4% of girls, respectively.

Irritation, aggressiveness, tearfulness, raid fatigue and weakness are reported by 80.0% of girls prior to and during periods; edemas, increased body mass, constipation, diarrhea, breast augmentation and tenderness of the mammary glands were found in 86.3% of girls before and during periods; headaches, dizziness, nausea, vomiting, insomnia, increased sensitivity to sounds and smells prior to and during periods were noted in 40.0%; rise in BP, pain in the heart, palpitation and panic attacks were noted among 15.0% of girls, respectively.

However, only 36.6% of students from the medical college gave a positive answer to the question 'Do you have problems with a menstrual cycle?'. It means that the students are poorly aware of reproductive health formation. This is confirmed during calculation of the Pearson's contingency coefficient using four-fold contingency tables ($k$ = 0,28).

The study conducted among male and female students from a medical college confirms the fact. Thus, 33.4% of girls and 24.7% of boys noted that the topic of hygienic education on protection of reproductive health and sexual behavior had never been covered during their training. 90.3% of students from a medical college believe that the classes should be included into curriculum.

Due to the lack of proper information and awareness of reproductive health formation among medical students who are future medical professionals, only 24.2% of those interviewed managed to provide a correct answer to the following question 'At what age is it necessary to begin sexual education of a child?' (fig.)

28.0% of students of a medical college believe that the topic should be discussed at the age of 16–17 and later. It means that they want to gain the information for themselves.

Students constitute a reproductive potential of the country. Thus, their attitude to the problem as future parents is important. 91.3% of those interviewed provided a positive answer to the question whether parents should discuss the issue associated with reproductive health with their children. 76.8% of students from a medical college mentioned that they were ready to attend free courses and webinars for parents devoted to sex education. 83.6% of students are ready to obtain necessary information through profile groups in social networks; 57.5% of them have already searched for the data and found its deficiency.

## DISCUSSION OF RESULTS

Medical professionals must have a wide range of knowledge in matters of prevention, in particular. Then they will be able to conduct qualitative preventive work with their future patients and hygienic education of different categories of patients. However, the conducted study has shown that both female and male medical students have a lack of updated knowledge in protection of own reproductive health and that of someone of a different age (schoolchildren, for instance).

This situation is intolerable as far as implementation of Demographics National Project goes. It pays a great attention to protection of reproductive potential among young people considering the current demographic situation [6].

It has been previously shown that college students know little about reproductive health (35.0% and less) [7].

It has also been reported that optimal knowledge on the issue among students of medical universities is lacking as well [8–9].

The issue of attention deficiency is acute among other population categories, including migrants [10–11].

At school, the problem requires special attention as well, as this is the time of menstrual cycle formation in girls [12–13].

Data about effectiveness of various preventive and educational programs in the area of reproductive health protection can be found in literature [14–16].

CONCLUSION

The conducted study has shown an insufficient awareness of students from a medical college in matters of formation of reproductive health. It produces a negative effect on their own health and will hamper subsequent effective hygienic education of different categories of population as far as this issue goes. Students from a medical college should be provided updated information, which has to be integrated into the educational process. At the same time, they have to be given valid references to Internet sources of the leading preventive medical companies as additional information on the issue.

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# MEDICAL AND SOCIAL PROBLEMS OF OPTIMIZING THE NUTRITION OF CHILDREN AND ADOLESCENTS UNDER THE CONDITIONS OF TODAY

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The article reviews publications devoted to the issue of optimization of nutrition of children and adolescents including school nutrition, various ways of formation of eating habits, succession of home and school nutrition, nutrition of children with alimentary-dependent diseases and children who go in for sports, quality of raw materials and products for school nutrition, and nutrition using new products. The information was searched for with eLIBRARY.RU, PUBMED, Web of Science and Scopus information portals and platforms from 2007 to 2021. Publications related to the issue were assessed while studying at school and during distance learning. Modern issues of nutrition of schoolchildren such as disturbances of alimentary behavior and underdeveloped skills of nutritional culture, dietary habits of schoolchildren with alimentary-dependent diseases and approaches to nutrition optimization at educational institutions are highlighted. The ways of prevention of alimentary-dependent diseases are estimated by way of inclusion of functional products into the diet of schoolchildren. Principal methodical and regulatory documents that can help reduce risks of alimentary-dependent diseases are mentioned. Pressing trends of researches regarding the reviewed topic were suggested to preserve health of schoolchildren as far as healthy nutrition goes.

**Keywords:** literature review, nutrition of schoolchildren, alimentary-dependent diseases, distance learning, nutrition optimization, new products

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# МЕДИКО-СОЦИАЛЬНЫЕ ПРОБЛЕМЫ ОПТИМИЗАЦИИ ПИТАНИЯ ДЕТЕЙ И ПОДРОСТКОВ В СОВРЕМЕННЫХ УСЛОВИЯХ

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В статье представлен обзор публикаций по проблеме оптимизации питания детей и подростков, включая школьное питание различными способами, формирование пищевых привычек, преемственности домашнего и школьного питания, питания детей с алиментарно-зависимыми заболеваниями и детей, занимающихся спортом, качества сырья и продукции для школьного питания, питания с использованием новых продуктов. Поиск информации осуществлялся с использованием информационных порталов и платформ eLIBRARY.RU, PUBMED, Web of Science и Scopus за период 2007–2021 гг. Оценивались публикации по данной проблеме в обычных условиях обучения детей и во время дистанционного обучения. Показаны современные проблемы в питании школьников: нарушение пищевого поведения и несформированность навыков культуры питания, выделены и освещены особенности питания школьников с алиментарно-зависимыми заболеваниями, подходы к оптимизации питания в образовательных организациях. Оценены способы профилактики алиментарно-зависимых заболеваний путем включения в рацион школьников функциональных продуктов питания. Указаны основные методические и нормативные документы, использование которых позволит снизить риски возникновения алиментарно-зависимых заболеваний. Предложены актуальные направления исследований по теме обзора для сохранения здоровья обучающихся с позиции здорового питания.

**Ключевые слова:** обзор литературы, питание школьников, алиментарно-зависимые заболевания, дистанционное обучение, оптимизация питания, новые продукты

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Schoolchildren of today have accelerated rates of growth and development. Earlier puberty (occurring two years earlier as compared to students of the XX century) is typical of modern schoolchildren. The rate of growth and development of the skeleton and endocrine system usually outpace the ones of their peers in the beginning of the XX century. For instance, in 15-year-old teenagers the body length and the body mass are averagely increased by 6–10 cm and 3–10 kg respectively. Thus, children and adolescents have more frequently accelerated rates of growth and development of various systems of the body such as cardiovascular, respiratory and locomotor ones. This explains why certain diseases (hypertension, osteoporosis, diabetes) become younger. The majority of such issues in children and adolescents is commonly associated with a lifestyle such as disturbed type of nutrition, low physical activity, economic condition of the family, shortcomings in organization of preventive work of medical workers [1]. The last 50–70 years are characterized by changes in nutrition of schoolchildren associated with unbalanced content of basic micronutrients (proteins, fats, carbohydrates and micronutrients — vitamins, mineral substances and microelements). It should be noted that certain disbalance is found among students of different ages; this does not correspond to the normal ratio of proteins, fats and carbohydrates (1: 1, 1: 4,8). The diet of modern children often consists of excessive amounts of meat products, fats, sugar, but lacks phosphorus, calcium, iron and magnesium, which fails to restore the daily physiological need of a body in a number of cases [2, 3]. According to the National projects approved by Order of the President of the Russian Federation No. 204 as of May 07, 2018, it is necessary to improve

life quality of population and create conditions to increase life expectancy using the healthy way of life and harmonic development[1, 2].

Adequate balanced nutrition is a condition of normal functioning of all organs and systems. This is especially important during the period of intensive growth and hormonal transformation of a growing body, which depend on developed standards and habits in the field of healthy nutrition. The children who are 7 to 18 years old and who attend general educational organizations spend most time at school. Thus, organized school nutrition is an essential part of nutrition of a modern student and should be economically affordable, take into account the present diseases and preferences of children, and rely on local traditions [4].

The purpose of the present review is to determine problematic aspects in organization of nutrition among children and adolescents, its possible optimization at school and home, nature of nutrition considering the existing diseases and going in for sports.

Performed analysis of contextual information posted on official sites of the regions of the Russian Federation has shown that the most problematic issues involve implementation of activities on modernization of regional and municipal nutrition systems among students of educational institutions, determination of cost of school nutrition, condition of infrastructure used to organize school nutrition, ensuring quality control and safety of nutrition at educational institutions[1,2].

While studying provision of warm food to children of Yuzhno-Sakhalinsk, it has been found out that breakfasts were provided to 82%, dinners to 11.6%, breakfasts and dinners (two meals a day) to 14%, other forms of nutrition (lunch, buffet food) to 19.2% of children [5]. Another problem consists in non-correspondence of the nature of food taken by modern students to the rules of healthy nutrition: meat is daily consumed by 63% of students only, milk and dairy products by 71% of students, fruits and vegetables are consumed by 55%, whereas 82% of those interviewed eat confectionary on a daily basis. Other factors include hypodynamia and long stay in front of a computer, tablet, mobile phone and TV monitor. For instance, 45% of schoolchildren watch TV for 2 and more hours per day, whereas 18% of students spend 3–4 hours on the same [6]. Similar data are quoted by other authors describing hypodynamia, excessive use of carbohydrates, violation of sleep and wakefulness, reduced night sleep, most commonly resulting not just in neurotization, but also in metabolic disorders and increases the risk of obesity among schoolchildren several times [7, 8].

Examining the features of formation of eating behavior in preschool children with an excessive body mass and obesity by survey of parents revealed disturbed nutrition regimen, frequency of food intake and volume of food. Only 37% of children with excessive body mass and obesity had three warm meals a day, 14% of children with excessive body mass and obesity ate at the same time of the day, 17% of children with excessive body mass and obesity had a meal with other members of the family. Authors revealed the factors that promoted disturbed formation of eating behavior, including violation of the diet, etc. [9]. Examination of regional information posted on official sites in relation to organization of school nutrition has shown that in a number of cases normative and methodological documentation at educational institutions, information about possible organization of the so-called inclusive nutrition of students with various diseases such as diabetes and celiac disease are lacking [10, 11][3].

While assessing inclusive nutrition of children and disabled adolescents by questioning it has been found out that 38% are exempt from parental payment in a kindergarten, 29% obtained free two meals a day at an educational institution, whereas one third part of parents reported that they came across nothing of the abovementioned [12]. While organizing inclusive nutrition it should be noted that it is important to develop skills (not throwing bread crumps, proper use cutlery and wiper cloth, chewing thoroughly with your mouth closed) associated with food intake in disabled children. It should be noted that wishing bon appetite is an obligatory condition [13, 14]. The study authors provided offers concerning nutrition of disabled children such as limitation and regulation of marketing of food products with high content of saturated fats, free sugars, salt and drinks high in sugar and limitation of the amount of advertising, types of advertised products and urging to purchase calls used to improve product attractiveness [15].

Basic trends of state policy in childhood protection including production of qualitative products for children and food products are incorporated as part of measures of the Decade of childhood (2018–2027) as basic constituents of harmonic growth and development and health preservation among the younger generation of the Russians [2, 13].

When interviewing the schoolchildren, assessment of actual nutrition has shown that their nutrition is characterized by low consumption of biologically valuable products. Schoolchildren get meat and fish products, dairy products and fruits with vegetables twice a week in 40.3%, 15.6% and 28.6% of cases respectively. It should be noted that schoolchildren often go to school without having breakfast (25%). Only 70.1% have warm food at school; every day they consume fast food (18.2%), chips (16.8%), sweet carbonated beverages (21.6%), with no starters (13.9%), with supplementary intake of vitamin preparations (38.2%). A tendency to increased consumption of bread and pastries and disturbed food regimen (less than 4 times a day) was observed in 40.2% of students [16].

Due to a growing number of children with obesity mainly associated with improper feeding, growth of cardiovascular and gastrointestinal diseases, decreased immunity, predominance in the diet of food with insufficient content of vitamins and mineral substances due to certain reasons (low family income, large families, vegan children, and those with disturbed food behavior (only high-carbohydrate fast food), limited health-related nutrition (intolerance of certain food products and their exclusion from the diet), modern products are not just food, but rather substances that produce an effect on human health and well-being. Food products should contain all necessary constituents for healthy nutrition of children and adolescents: proteins, fats, carbohydrates, macro- and micronutrients, microorganisms (lacto- and bifidobacterial), mineral substances, vitamins and food fibers.

Eating habits vary depending on the region. While studying the nutritional status in children from the Komi Republic (KR) and Khanty-Mansi Autonomous Okrug — Yugra aged 7 to 17 in 2018–2019, differences in the ratio of insufficient and excessive body mass (including obesity) was found among inhabitants of the KR as compared with KHMAO small settlements ($p = 0.004$), cities ($p = 0.017$) and villages.

[1] https://yandex.ru/search/?lr=213&text=04.rospotrebnadzor.ru date of referral 02.07.2022

[2] https://www.garant.ru/hotlaw/federal/1195467/ date of referral: 22.07.2022

[3] https://www.nsportal.ru/detskiy-sad/raznoe/2017/12/03/organizatsiya-kormleniya-v-inklyuzivnoy-gruppe date of referral: 22.07.2022

Children from the KR have a higher percentage of excessive weight and obesity (26.6 vs 25.7 and 24.8% in cities and villages of the KHMAO respectively) but a significantly lower percentage of insignificant weight (1.9 vs 5.0 and 6.8%). In remote areas of the KR, a number of schoolchildren with obesity is higher than in large settlements of the KHMAO and large areas of the KR (13.1, 7.7 and 9.2% respectively). It should be noted that no significant differences were found between the ethnic groups [17].

A relevant area includes organization of nutrition of children who visit sports sections and schools. Popov OS and Shatnova AA carried out research related to analysis and estimation of risks during organization of nutrition, labor and rest of adolescents who go in for sports. During the research, it was found out that adolescents who go in for sports have food 4–5 times a day, whereas schoolchildren who are not professional sportsmen eat 3–4 times a day. The regimen of nutrition is used because energy expenditure among sportsmen is much higher and they require energy to maintain a physical form [18]. Schoolchildren who do not go in for sports have 5–6 hour-intervals between food intakes. In the majority of cases, sportsmen have supper at least 2 hours before sleep. Intense trainings without qualitative restoration including good nutrition can reduce the physical level of a sportsman. To the contrary, training sessions combined with proper nutrition improve results of sportsmen consistently [19].

New standards of nutrition are accepted in developed countries. According to the new standards in the USA, schoolchildren can be offered skimmed flavored milk (1%) in addition to other variants of skimmed and low-fat milk. Breakfasts and lunches at school should include whole-grain products with at least 80% of grains. Meanwhile, it is planned to decrease the amount of salt in school breakfasts and lunches by 10%. According to the Ministry of Agriculture of the USA, a weekly limit of sodium for 2022–2023 remains at the same level [20]. In 2024, introduction of supplementary long-term standards related to school nutrition in the USA is expected.

In recent decades, many developing countries could significantly improve their position in the area of nutrition.

Both malnutrition, and incidence of obesity constitute a serious problem. In some countries it currently reaches the level of developed countries.

Information about double malnutrition (DBMN) (i. e. excessive/insufficient weight), and delay in the growth was updated. In developing countries, the DBMN ratio was increased as per capita income. In its turn, poor nutrition in early childhood is one of the leading obesity factors among children and adolescents in future [21].

Another nutritional constituent is use of drinking water. Survey of schoolchildren and parents from two schools in Zapopan (Mexico) has shown that total consumption of drinking water by children aged 9 to 18 years reaches just 30% of the total liquid consumption [22].

Use of the so-called functional food products such as products with certain specified properties (for instance, sweet sausages for dessert) is currently relevant. According to GOST, the product has an updated technology of making and changing organoleptic values while introducing biologically active substances such as Perga, a beekeeping product [23]. In the Republic of Kazakhstan, technologies of getting fruit and vegetable jams, puree, fruit and vegetable juices (apples, carrots, table beet, etc.) enriched with pectin extract from secondary raw products of sugar industry with functional, bioecological and natural healing properties were developed. The products containing pectin extract make it possible to create more acceptable compositions to achieve an effective balanced composition of the target product [24].

It is known that temperature and way of preparation produce a great effect on organoleptic properties and taste of food products. In another research, the effect of thermal treatment and addition of sunflower oil on the functional properties of meat products was assessed. During the work, data indicating that temperature and duration of cooking influence the physical properties and taste of meat and meat products were obtained. Properties of processed meat products (juiciness and taste) depend on the functional properties of meat protein. Modern manufacturers use a wide specter of herbal supplements including vegetable oil to improve both organoleptic and functional properties of these products [25]. In the Russian market, the functional products are divided into four groups: grain products (porridge, flakes), including bakery and confectionary; soft drinks; milk products; oil and fat products. There are a few products related to other subbranches of food industry. In 2007 to 2013, manufacture of functional products increased by 160% [26].

Food of a functional purpose (for instance, local fruits of sea buckthorn) can be found among recipes and production technologies of desserts. It should be noted that the product was dehydrated at 45°, with no addition of sugar, making it possible to reduce the calorie content and create a functional dessert [27]. New fruit and vegetable pectin-containing drinks with milk serum are found in nutrition of schoolchildren. The product value consists in a balanced composition of micronutrients, functional activity and good taste. Moreover, the product contains an optimal amount of fruit and vegetable fillers and milk serum. Model samples contained 0–24% of fruit juice, 0–24% of pumpkin juice (puree) and 0–24% of serum fermented with Bifilact-Plus sourdough [28]. The product was rated on a 10-point scale with assessment of color, taste, aroma and consistency.

The samples having fruit and pumpkin juice in their recipe in the ratio of 16 to 4 and 4 to 16 are considered the best by their organoleptic properties. They had a pronounced taste and odor, natural color typical of this raw material. Pectin-containing drinks of a functional purpose require no complex production technology and special conditions of storage. They improve health of schoolchildren at the expense of functional constituents and can/should be used in school nutrition as well [29].

Other studies have shown that addition of GBF (guava peel and flesh flour) into guava juice increases acidity and changes color and rheological parameters, especially in higher concentrations (3% and 5%). It should be noted that the product has an increased content of food fibers, anthocyanins and antioxidants when GBF is added, with no changes in soluble dry substances, total amount of phenol compounds and content of ascorbic acid [30]. In the literature, possible use of pectin extract of fruits of forage watermelon as a biologically active supplement is described to enrich flour and production of bread with functional properties. During the study of this bread, a positive effect of pectin extract on physical properties of dough and bread quality was established. The use of pectin extract as an enriching additive enables to expand the range of preventive purpose bread products, which is associated with necessary correction of micronutrient deficiency in the body [31]. Besides, principal requirements to quality of food products of a functional purpose on the basis of products obtained after conversion of grains are described in literature [31].

School nutrition under modern conditions is optimized using novel recipes of dishes (combined products) with

an optimal and balanced amino acid composition. In the context of steamed beef, lamb and cabbage balls it has been established that they are better than steamed beef and lamb balls by 7.61% and as compared to steamed beef balls by 9.38%. The products have a high biological value (95 to 99%). Amino acid analysis of these balls displayed a maximum specter of amino acids for steamed balls with beef, lamb and cabbage. The authors have found out that meat minced products made of beef, lamb and plants (carrots, pumpkin, white cabbage) have a better balance of amino acids and biological value [32].

The next publication was about development of functional melted cheese products for specialized food for children. The products created using a complex technology have high quality, nutritional value, safety, and content of special food substances such as bioflavonoids and food fibers to improve absorption. All formulation components are selected based on the product designation: food for schools, nutrition for older and elderly people, sports nutrition, massive nutrition, etc. [33].

Perspective trend of expanded assortment of food products for functional and specialized purposes consists of the use of germinated seeds of cereal crops as part of multi-component food supplement (phospholipid nutritional complex). The technology of obtaining a complex and physiologically functional ingredient made of sprouted seeds of naked oats, non-fat rape phospholipids and melissa and succinic acid concentrate was developed. Combination of components in these food products enables to increase resistance to stress and exercise intolerance, which is essential under modern conditions [34].

## CONCLUSION

Optimized nutrition of modern schoolchildren includes a set of measures aimed at provision of students with good nutrition that corresponds to physiological standards and rules of balanced nutrition. The fact is displayed in respective sanitary norms and rules [35].

It should be noted that schoolchildren require nutrition which is similar to the one provided at school to prevent alimentary-dependent disorders among healthy children and reduce the risk of exacerbation of the principal disease in children with such diseases.

Moreover, proper nutrition plays a leading role in normal functioning of various organs and systems of a child's growing body, including alimentary, endocrine, cardiovascular, urinary, locomotor, nervous, reproductive and other systems.

Modern technologies of nutrition optimization, including enrichment, up-to-date ways of treatment of products and dishes while storing, instruments on learning about and motivation for proper nutrition and a healthy way of life can be used to create an environment for healthy growth of children and adolescents reducing the risk of alimentary-dependent diseases.

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