Influence of milk enriched with a mineral and vitamin complex on some hematological markers and intestinal microbiocenosis in children

L.E. Gromova, N.A. Nazarenko, O. V. Lebedeva
(GOU VPO "Northern State Medical University of the Federal agency for health care and social development ", Arkhangelsk)

SUMMARY

The study of a new mineral and vitamin complex containing vitamin C, heme iron and fluoride added to milk has shown its effectiveness in normalizing blood mineral composition and intestinal microbiocenosis in children, which makes it possible to recommend the introduction of this natural product into the diet of the population of the northern territories, whose activities associated with harsh climatic conditions.

Key words: vitamin C, heme iron, fluorine, mineral and vitamincomplex.

Systematic studies carried out in various regions of Russia over the past few years indicate that the nutritional structure of the population has significant deviations in the level of consumption of micronutrients - vitamins, minerals, organic compounds of plant origin, which are of great importance in the regulation of metabolic processes and the functions of individual organs and systems [1, 8, 9].

A significant deficiency of most vitamins is revealed, including the antioxidant series - C, E, A and microelements: selenium, calcium, iron, iodine, fluorine. As a result, the corresponding protective systems of the body cannot adequately respond to adverse environmental influences, which sharply increases the risk of developing many diseases [4, 1].

Artificial enrichment of drinks, i.e. their fortification with vitamins, microelements, dietary fiber and other natural biologically active substances is one of the promising ways to rationalize nutrition [3]. Therefore, the aim of this study was to test new mineral and vitamin complexes as biologically active substances and their effect on the indicators of the mineral composition of blood and intestinal microbiocenosis in children.

Materials and research methods

It was advisable to monitor the effectiveness of mineral and vitamin complexes in children, since they are a unique marker for identifying health status when exposed to any negative environmental factors. As an object, we took children aged 9-10 years - students of the municipal educational institution "Secondary School No. 10" (Arkhangelsk). To conduct this study, permission was obtained from the Ethics Committee of the SSMU

(Minutes No. 3 of 2005). All examinations were carried out with the consent of the parents and the children themselves.

The mineral and vitamin complex included three important components: vitamin C, heme iron, and fluorine. Milk was fortified with this natural complex. Volunteers received 1 glass of milk (200 ml) 3 times a week (milk is a natural product most widely used in the diets of both children and adults). 200 ml of milk contained 0.5 mg of sodium fluoride and 30 mg of vitamin C, which corresponded to half of the recommended age-specific daily requirement [7]. Additionally, 50 g "Hematogen for children" was added 2 times a week, manufactured by OOO "Gemakon" (Moscow) (with a content of heme iron 12 mg / 100 g and vitamin C 40 mg / 100 g). Technical specifications for milk have been developed (TU 9222001-03084302-04) and a sanitary-epidemiological conclusion No. 29.01.03.922 has been received. T.000226.04.04 from 28.04. 2004 "Pasteurized and sterilized cow's milk, fluorinated and fortified". The study was carried out in two stages: before and after a three-month correction.

In venous blood, the concentrations of calcium, phosphorus, iron and the iron-binding capacity of blood serum were determined. The markers under study were determined by standard methods on an analyzer "Cobas mira" (Austria), using diagnostic kits from the firm "Sormay" (Poland). Microbiocenosis studies were carried out according to the generally accepted method with the determination of the main parameters of the microflora of the large intestine: bifidobacteria, lactobacilli, enterococci, E. coli, bacteroids, clostridia, opportunistic enterobacteria of the genus Proteus, Staphylococcus aureus and fungi of the genus Candida.

Statistical methods. The obtained results of the study were subjected to complex statistical processing using the SPSS package.

Research results and their discussion

Depending on the concentration of hemoglobin in the blood, according to the results of the primary sampling, 2 groups of subjects were identified, equal in sex and age. The first group included 20 people with a hemoglobin level below 120 g / l (111.1 ± 1.7), i.e. with signs of anemia; in the second group 20 - with a hemoglobin level of 120-130 g / l (125.5 ± 1.4), i.e. belonging to the risk group for the development of anemia. Analysis of life history data did not reveal pathological conditions in the examined children, pathogenetically associated with the development of anemia (infection, intoxication, metabolic diseases, digestive organs). Deviations in the hemogram in the first group are etiologically caused primarily by an unbalanced diet.

A preliminary study of the venous blood of schoolchildren showed that in the groups the concentration of calcium ions, phosphate ions, and iron ions in the blood serum was within the normal range (Table 1). A repeated study after correctional nutrition of schoolchildren revealed a significant increase in these indicators.

Calcium and phosphorus ions are not only the basis of the mineral

a component of bone tissue, but also necessary for the regulation of many physiological and biochemical processes. Calcium plays a central role in the stabilization of cell membranes, occupies a key position in the regulation of the activity of many enzymes, and is necessary for the mechanisms of synaptic transmission and muscle contraction. Phosphate ions are a necessary component for the synthesis of high-energy compounds, are involved in the regulation of the acid-base balance of the blood. An increase in the level of calcium ions and phosphate ions in the blood creates a favorable background for the accelerated growth rates of children in the prepubertal period.

Table 1

Changes in the concentration of calcium, phosphorus, iron and iron-binding abilities before and after correction

		Кальций (ммоль/л)	Фосфор (ммоль/л)	Железо (ммоль/л)	Железосвязывающая способность (ммоль/л)
1-я группа	До проведения	2,35 ± 0,03	1,21 ± 0,05	11,6 ± 0,8	53,7 ± 1,0
	После проведения	2,57 ± 0,04 ×××	1,57 ± 0,08 ×××	17,7 ± 1,27 ×××	62,6 ± 1,4 ×××
2-я группа	До проведения	2,29 ± 0,03	1,17 ± 0,05	12,2 ± 0,8	55,9 ± 1,3
	После проведения	2,53 ± 0,05 ◊◊◊	1,44 ± 0,08 ◊◊	19,1 ± 1,1 ◊◊◊	63,1 ± 1,3 ◊◊◊
Норма		2,1–2,6 моль/л	1,09–2,0 ммоль/л	7,7–33 мкмоль/л	50–72 мкмоль/л

Достоверность различий по t критерию Стьюдента:
- Между показателями до и после проведения коррекции в группе 1:
××× – $p < 0,001$;
- Между показателями до и после проведения коррекции в группе 2:
◊◊ – $p < 0,01$; ◊◊◊ – $p < 0,001$;

Simultaneously with an increase in the concentration of iron ions in the blood serum, an increase in the iron-binding capacity of blood serum was revealed, due to the presence of reserve, free transferrin molecules. The increase in the amount of iron ions in the blood is most likely a consequence of an increase in its consumption during the period of correctional nutrition, and is also due to the effect of fluoride ions. An increase in the content of iron ions can be considered as a factor necessary for the functioning of respiratory enzymes associated with internal cell respiration [5]. We assume that the increase in the iron-binding capacity of blood serum was a consequence of an increase in the synthesis of iron-binding proteins, including plasma beta-globulin - transferrin, for increased transport of absorbed iron, which is due to the body's adaptive response to an increased intake of iron from food. Another factor contributing to an increase in transferrin synthesis was the effect of fluoride ions, which promotes the synthesis of beta globulins [6].

In addition, the changes identified here (an increase in the concentration

macronutrients in the blood and the iron-binding capacity of blood serum) can be caused not only by the amount of iron consumed, but also by an increase in the intake of vitamin C, which is a component of the antioxidant system. By protecting membranes from lipid peroxidation, vitamin C indirectly improves their structure, increasing the lifespan of body cells.

Analysis of the data obtained made it possible to reveal the presence of dysbiosis of the studied biotope in 96.1% of children before the start of experimental feeding. After consuming pasteurized milk, dysbiotic shifts were found somewhat less frequently - in 72.7% of cases. The greatest decrease in dysbiotic disorders was noted in children who were given milk with the addition of vitamin C and fluoride; dysbiosis was observed only in 45.4% of children ($P < 0.01$). Therefore, small doses of fluoride in combination with vitamin C contribute to the normalization of intestinal microflora. After consuming ordinary pasteurized milk, 88.9% of the children in this group had a normal level of E. coli, and when combined supplements of vitamin C and fluoride were used, 100% of children in this group had a normal number of E. coli ($P < 0.05$).

When studying the quantitative content of bifidobacteria, it was found that in children using ordinary milk, the normalization of the number of bifidoflora was recorded in 11.1% of cases, with the combined action of vitamin C and fluorine in milk, the normalization of bifidoflora was 64.2% ($P < 0.01$). As for opportunistic microorganisms such as Staphylococcus aureus, its number sharply decreased in children receiving fluoride and vitamin C in 66.7% ($P < 0.05$). A similar pattern was observed in relation to fungi of the genus Candida, their number significantly decreased in 75.0% of the examined children ($P < 0.05$).

No cases of deterioration of clinical, laboratory and other studied parameters in the dynamics of the introduction of milk enriched with a mineral and vitamin complex into the diet were found in schoolchildren. The use of fortified milk demonstrated biological effectiveness and had a positive effect on the intestinal microflora.

Thus, as a result of the correction, there is a normalization of the electrolyte composition of the blood and intestinal microbiocenosis.

Mineral and vitamin complexes that have been tested in the children's contingent can be recommended for introduction into the diet in order to increase the body's resistance and quickly adapt to the harsh conditions of the North, as well as to correct alimentary-dependent conditions under unfavorable climatic and industrial working conditions, including in shift workers. workers.

conclusions

1. Introduction to the diet of primary schoolchildren of milk, enriched with a mineral and vitamin complex including vitamin C, heme iron and fluoride improve the electrolyte composition of the blood.

2. The addition of vitamin C, heme iron and fluoride to milk promotes normalization of the microflora of the large intestine in children.

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Author's address

Ph.D. Gromova L.E.

Associate Professor of the Department of Pharmacy and Pharmacology, SSMU (Arkhangelsk)

gromovaa@atknet.ru.

Dr. med. Nazarenko N.A.

Professor of the Department of Pharmacy and Pharmacology, SSMU (Arkhangelsk)

nasarenko_n_a@mail.ru

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