The use of functional food products for the prevention of vitamin deficiency in people with increased physical and neuropsychic stress on the example of firefighters-rescuers

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Abstract. Deficiency of vitamins and a number of minerals inevitably leads to disturbances in metabolic processes and physiological functions and, as a consequence, to poor health, a decrease in the body's defenses, and the development of vitamin deficiency diseases. Prevention of vitamin deficiency consists in ensuring full correspondence between human needs for vitamins and their intake with food. The entire set of vitamins necessary for a person can enter the body only if all food groups are used in the diet. Mechanization and automation of the labor process made work easier and reduced energy costs, however the work of firefighters-rescuers has become much more difficult, tense and dangerous. Rescue work is dangerous and requires trusting cooperation - a wrong decision or behavior can endanger the health and life of the rescuer himself, his team, and others. Based on the results of the work, a conclusion was made about the undoubted physiological and energy value of an instant granular drink based on concentrated curd whey and fruit and berry raw materials, as well as the need for its introduction into the diet of firefighters-rescuers, to ensure the normal course of life processes in the body, and mainly for prevention of vitamin deficiency.

1 Introduction

Deficiency of vitamins and a number of minerals inevitably leads to disturbances in metabolic processes and physiological functions and, as a consequence, to poor health, a decrease in the body's defenses, the development of vitamin deficiency diseases (hypo- and avitaminosis).

There is no doubt that the practical use of vitamins and products enriched with them in the nutrition of the population should be based on modern scientific ideas about the physiological functions and mechanisms of action of these natural biologically active compounds. Entering in the form of coenzymes in the structure of various enzymes, vitamins provide the possibility of the normal implementation of the most important

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metabolic processes, on which the growth, development and vitality of a person decisively depend. Insufficient consumption of vitamins inevitably leads to disturbances in the processes and physiological functions that depend on them and, as a consequence, to poor health, a decrease in the body's defenses, the development of vitamin deficiency diseases: hypo- and avitaminosis. In this regard, each person should receive vitamins regularly, in a complete set and in quantities that provide his physiological need for these essential nutrients [1].

Diseases that arise due to the lack of certain vitamins in food are called vitamin deficiencies. If the disease occurs due to the lack of several vitamins, it is called multivitaminosis. However, avitaminosis, typical in its clinical picture, is now quite rare. More often you have to deal with the relative lack of any vitamin; this disease is called hypovitaminosis. If the diagnosis is correct and timely, then vitamin deficiency and especially hypovitaminosis can be easily cured by introducing appropriate vitamins into the body. Excessive intake of certain vitamins into the body can cause a disease called hypervitaminosis.

Prevention of vitamin deficiency is to ensure full compliance between human needs for vitamins and their intake with food. It should be borne in mind that the entire set of vitamins necessary for a person can enter the body only if all food groups are used in the diet, while a one-sided diet, even with foods with high nutritional value, cannot provide the body with all vitamins. In particular, the point of view is erroneous that the main source of vitamins is fresh vegetables and fruits. This group of products, which is really practically the only source of vitamins C and P and one of the sources of folic acid, but it does not fully meet the body's needs for vitamins: A, D, E, K vitamins of group B. At the same time, meat and meat products are the main sources of vitamins of group B. Milk and dairy products supply vitamins A to the body, cereals - vitamin PP and some vitamins of group B, vegetable fats - vitamin E, animal fats - vitamins A and D [1-2].

The high level of technical equipment of modern production has radically changed the conditions and nature of labor of workers and workers of enterprises. Mechanization and automation of the labor process made their work easier and reduced energy costs, however, despite this, the work of firefighters-rescuers, on the contrary, became much more difficult, tense and dangerous, as it is associated with the use of various technical means and special equipment. On the contrary, it increased the physiological requirements for energy, nutrients and vitamins. Employees of this profession are constantly faced with various emergencies, perform rescue operations in case of man-made and natural disasters, and also deal with the elimination of the consequences of accidents. Rescue work is dangerous and requires trusting cooperation - a wrong decision or behavior can endanger the health and life of both the rescuer himself, his team, and other people.

The purpose of the work is to study the value of fortified drinks on the body of people with increased physical and neuropsychological stress.

In accordance with the set goal, the following tasks were solved:

- study the role of vitamins on the human body;
- determine the vitamin and mineral value of an instant drink.

2 Materials and methods

The object of the research is an instant granular drink based on fruit and berry raw materials. The work used modern organoleptic research methods [3]:

- appearance: described the general visual impression of the granulated and finished beverage (surface properties, heterogeneity, shape, presence of impurities);
- colour: determined the colour for the finished beverage, and then deviations from the colour;

- smell: described the aroma and also determined the presence of foreign odors;
- consistency: determined for a granular drink and a finished one, taking into account flow ability, uniformity, the presence of solid particles;
- taste: it was determined whether the taste is typical for a given type of product.

The concentration of vitamins of group B and C was determined, guided by Russian standards, vitamin E - by a method based on the extraction of micronutrients with an organic solvent after alkaline saponification of the substrate or dissolution, evaporation of the resulting product in transferring the dry residue to another solvent, introducing the extract onto a column for chromatographic separation and determination using fluorescence and spectrophotometric detectors.

3 Results and discussion

The work of fire and rescue units is associated with significant physical and neuropsychological stress caused by a high degree of personal risk, responsibility for people and the safety of material assets, with the simultaneous need to make a decision in the face of time pressure.

Large physical exertion is caused by the high pace of work during the evacuation of victims, dismantling structures and equipment, laying hose lines, working with fire-technical equipment, evacuating material assets, etc. In addition, rescue firefighters work in special protective equipment. The standard uniform of a firefighter weighs about 30 kg, and with it you need to move quickly, maneuver during a fire, and walk up to the upper floors on foot. Sometimes you have to work in uncomfortable positions (lying, crawling, etc.), in a confined space, in an environment unsuitable for breathing with a breathing apparatus weighing up to 15 kg (4-5).

Strenuous physical work in conditions of high temperature and humidity can cause disturbances in water-salt balance, thermoregulation of the body, headaches, difficulty in movement, inhibition of reactions.

A firefighter-rescuer must have a strong psyche, high stress resistance, since events can develop unpredictably and be accompanied by the death of people. In addition, the activity of firefighters-rescuers takes place in extremely unfavorable conditions, which are characterized by high temperatures, the presence of toxic substances in the environment, which requires the use of personal protective equipment. And periodic round-the-clock shifts are a violation of the normal sleep pattern, which contributes to the development of pathological processes. When carrying out daily combat duty, firefighters are in a constant alert mode. These circumstances contribute not only to the development of fatigue, negative functional states, but can also be the cause of illness and injury [5].

Under the conditions of a scientific and technological revolution, an increase in neuro-emotional stress, the impact of unfavorable production factors and the external environment, a person's need for micronutrients as the most important protective factor not only does not decrease, but, on the contrary, increases significantly. As a result of these objective and subjective reasons, the problem of rationalizing nutrition and improving the health of the population, bringing the diet in line with the real physiological needs of a person turns out to be insoluble due to a simple increase in the production and consumption of natural vitamin-containing products, and requires qualitatively new approaches and solutions. Foods fortified with vitamins are a reliable way of replenishing vitamin deficiencies in human nutrition. These products include multicomponent products enriched with biologically active additives obtained from plant and animal raw materials, which make it possible to compensate for nutritional problems and exhibit pronounced preventive and medicinal properties.

In other words, multicomponent or functional products are food products of natural origin, with a pleasant taste and a pronounced health effect for humans, easy to use, intended for everyday systematic use and has undergone long-term clinical trials. Foods enriched with vitamins and minerals are part of a broad group of functional foods [5-6].

The consumer properties of functional products include three components: nutritional value, taste, physiological impact. Traditional products, in contrast to functional ones, are characterized only by the first two components. Compared to regular everyday foods, functional foods should be healthy, safe in terms of balanced nutrition and nutritional value. It is important to note that these requirements apply to the product as a whole and not to its individual ingredients. Functional products are not drugs and cannot cure diseases, but they can prevent diseases and aging of the body, under the prevailing conditions of human life.

Currently, in most cases, four groups of functional food are produced: breakfast cereals, dairy products, fat emulsion products, soft drinks. Drinks are the most technologically advanced product for creating new types of functional food, since the introduction of new functional ingredients into them is not very difficult.

The specifics of the work of a firefighter-rescuer (especially the lack of time for full-fledged meals) determine the need to use an instant granular drink with functional properties as a functional food product. Namely, we are talking about a truly Russian drink - jelly, made on the basis of concentrated curd whey and fruit and berry raw materials.

The use of curd whey in the composition of the drink allows you to eliminate the deficiency of missing substances in the human body, since it contains all the essential amino acids. Lactose is also high in whey. It is a source of energy, helps to normalize calcium metabolism, maintains normal intestinal microflora, is a means of preventing cardiovascular diseases and is a powerful stimulant of the nervous system. What is an essential part for firefighters [6].

Natural biologically active substances in the form of natural components of plant origin find therapeutic and prophylactic use. Fruit and berry raw materials contain a wide range of biologically active substances, vitamins, macro- and microelements, organic acids and other ingredients necessary for a balanced diet [7].

The choice of the recipe composition of the instant granular drink was carried out taking into account the content of ingredients that enhance the positive effect on each other and on the body as a whole from the point of view of the prevention of vitamin deficiency in firefighters-rescuers. So, having carried out a number of studies and guided by literature data, the best composition of the drink is as follows: modified potato starch, powdered sugar, concentrated chokeberry juice, black chokeberry cake, thickened curd whey, native curd whey, citric acid [8-9].

The drink achieved a high level of organoleptic characteristics due to the correct choice of ingredients for harmonious compatibility and organoleptic characteristics: taste, colour, consistency and aroma (table 1) [10].

Table 1. Organoleptic characteristics of instant granulated beverage.

Indicator name	Characteristic	
	granules	finished beverage
Appearance	Compact, dense, uniformly colored, rounded granules with a size of 0.5-3 mm	Characteristic of an instant drink prepared according to the method indicated on the label
Colour	Dark burgundy, from more intense in the concentrate to less saturated in the finished drink	
Taste and smell	Typical for chokeberry, foreign smell and taste are not allowed	
Consistency	Loose homogeneous mass of powder	Viscous homogeneous mass with inclusions of fruit pulp

Figure 1 shows the parameters of the technological process for the production of a dry granular drink based on condensed and native curd whey [11].

Fig. 1. Parameters of the technological process for the production of a dry granular drink based on condensed and native curd whey.

Taking into account the data of the chemical composition of raw materials, the composition of biologically active substances, and also, which is important - the temperature regimes for the processing of curd whey and fruit and berry raw materials, namely 50-52 ° C under vacuum evaporation, it can be concluded not only about the high nutritional value , taste, but also undoubtedly about the physiological effect of the proposed drink on the human body. Since, thanks to the minimum processing temperatures in the ready-made instant granular drink, it is possible to preserve natural vitamins and minerals [12-13].

Table 2 shows the vitamin and mineral value of an instant granulated drink based on curd whey and chokeberry juice.

Table 2. Vitamin and mineral value of an instant granulated drink based on curd whey and chokeberry juice.

Object	Content in 1 portion (200 cm ³) of finished drink	Percentage of the recommended adequate consumption level. with heavy physical exertion).%
Vitamins		
vitamin A. mg	0.12	12.0
vitamin D3. mg	0.001	10.0
vitamin E. mg	0.7	5.8
vitamin B1. mg	0.4	30.72
vitamin B2. mg	0.36	21
vitamin B6. mg	0.42	24.56
vitamin B12. mg	0.72	24.0
vitamin C. mg	18.36	26.2
niacin. mg	5.2	28.82
folic acid. mg	0.136	33.9
pantoten. mg	1.52	43.0
biotin. mg	0.04	16.0
Mass fraction of minerals. 100 g of product		
Calcium		70.0±0.40
Phosphorus		13.0±0.08
Potassium		58.0±0.08
Sodium		5.9±0.20
Iron		2.5±0.04

The loads that rescue firefighters experience can be called special, since in addition to great physical and neuropsychiatric stress, there are often extreme loads - high temperature and heat radiation, causing the loss of vitamins with sweat. Therefore, they must receive a daily set of vitamins without fail to prevent vitamin deficiency [13-15].

It can be seen from the above table that a glass (200 ml) of an instant granular drink based on concentrated curd whey and fruit and berry raw materials (chokeberry juice) is a source of vitamin B1, B6, B12, vitamin C (vitamin C is necessary not only for the prevention of colds, but also when the concentration of oxygen in the air decreases, when exposed to high temperatures, when exposed to harmful substances), niacin, folic acid and pantothen and also serves as a source of minerals such as calcium, phosphorus and potassium [16-17].

In a word, an instant granular drink based on concentrated curd whey and fruit and berry raw materials has a balanced nutritional and vitamin composition, which favorably affects the work of vital body systems, correcting and normalizing their work.

4 Conclusions

Thus, we can conclude about the undoubted physiological and energy value of an instant granular drink based on concentrated curd whey and fruit and berry raw materials and the need for its introduction into the diet of firefighters-rescuers, to ensure the normal course of life processes in the body, and mainly for the prevention of vitamin deficiency.

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