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PHYSIOLOGICAL CHARACTERISTICS STUDY OF NORMALIZATION OF CARBOHYDRATES IN FOOD RATIONS

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ИЗУЧЕНИЕ ФИЗИОЛОГИЧЕСКИХ ОСОБЕННОСТЕЙ НОРМАЛИЗАЦИИ УГЛЕВОДОВ В ПИЩЕВЫХ РАЦИОНАХ

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Abstract. Carbohydrates are organic substances with high energy, enter the body with food and satisfy the various needs of the human body. They enter the body mainly with plant products and are the most important source of energy. Approximately half (56-58%) of the energy needed by the body is provided by carbohydrates. Carbohydrates are compounds made up of carbon, hydrogen and oxygen. Here, the relationship between hydrogen and oxygen is the same as in water molecules. That is why they are called carbohydrates. During physical labor, the need for carbohydrates increases. They are also involved in plastic forming processes. Carbohydrates increase the amount of glucose in the blood and increase the amount of glycogen in the liver and muscles, being included in the composition of cells and tissues. Glucose is converted into reserve carbohydrates — glycogen, which is an energy reserve that serves to maintain the level of sugar in the blood at a normal level and ensures the stable functioning of all organ systems.

Аннотация. Углеводы — органические вещества, обладающие высокой энергетикой, поступают в организм с пищей и удовлетворяют различные потребности человеческого организма. Они поступают в организм преимущественно с растительными продуктами и являются важнейшим источником энергии. Примерно половина (56–58%) энергии, необходимой организму, обеспечивается углеводами. Углеводы — это соединения, состоящие из углерода, водорода и кислорода. Здесь соотношение между водородом и кислородом такое же, как и в молекулах воды. Именно поэтому их называют углеводами. Во время физического труда потребность в углеводах возрастает. Они также участвуют в процессах пластической формования. Углеводы увеличивают количество глюкозы в крови, а также увеличивают количество гликогена в печени и мышцах, включаясь в состав клеток и тканей. Глюкоза превращается в запасные углеводы — гликоген, который является энергетическим резервом, служащим для поддержания уровня сахара в крови на нормальном уровне и обеспечивает стабильное функционирование всех систем органов.

Keywords: carbohydrate, glucose, energy, nutrition, oxidation.

Ключевые слова: углеводы, глюкоза, энергия, питание, окисление.

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Carbohydrates are a group of countless organic compounds and are an indispensable part of nutrition. The physiological importance of carbohydrates is mainly determined by their energetic properties, carbohydrates provide 50-60% of the energy reserve. The importance of carbohydrates as an energy source is determined by the fact that they are oxidized both aerobically and anaerobically in the body. The process of intra-tissue oxidation of carbohydrates is divided into 2 stages according to their relationship to oxygen: 1. Anaerobic stage — formation of pyruvic acid. 2. Aerobic stage — pyruvic acid is oxidized and forms carbon dioxide and water.

Under anaerobic conditions, part of the energy released as a result of the breakdown of glucose to lactic acid is collected in the macroergic bond of ATF acid. This energy can be used for any function of cells and tissues. Certain stages of both aerobic and anaerobic decomposition occur under the influence of the same enzymes (kinases, dehydrogenases, mutases, etc.) [6].

Discussion and conclusions of the study

The main role of carbohydrates is determined by their energetic function. The direct source of energy in the body is blood glucose. The rapid breakdown and oxidation of this substance, as well as the ability to quickly remove it from the depots, allow the emergency mobilization of energy reserves (resources) and emotional arousal, intense muscle work, etc. provides rapidly increasing energy consumption in conditions [1-5, 12-16].

The level of glucose in the blood of 4.4-6.7 mmol/l (80-120 mg%) is an important homeostatic constant of the body. The central nervous system is particularly sensitive to a drop in blood sugar. Thus, slight hypoglycemia is soon manifested by general weakness and fatigue. A decrease in the level of sugar in the blood to 2.8-2.2 mmol/l (50-40 mg%) is accompanied by convulsions, alertness, loss of consciousness and autonomic reactions: strong sweating, dilation of blood vessels, etc. accompanied by symptoms. Injecting glucose into the blood or taking sugar quickly eliminates the indicated disorders [7, 8].

Glucose passing from the intestines into the blood is transported to the liver, where glycogen is synthesized from it. When the isolated liver is perfused intravenously with a solution containing glucose, the amount of glycogen in the liver tissue increases. Glycogen is a stored carbohydrate stored in the liver. Its amount can reach 150-200 g in older people. Even if sugar enters the blood gradually, glycogen is formed very quickly, so the introduction of small amounts of carbohydrates does not cause an increase in the amount of glucose in the blood (hyperglycemia). When a large amount of quickly soluble and quickly absorbed carbohydrates are introduced into the digestive tract, the amount of glucose in the blood rises quickly. Hyperglycemia that occurs in such a case is called alimentary or food-related hyperglycemia. As a result, glucose is excreted in the urine (glucosuria). Glucosuria is observed when the blood sugar level reaches 8.9-10.0 mmol/l (160-180 mg%). When there are no carbohydrates in the food, they come from the breakdown of fats and proteins in the body [9].

As blood glucose decreases, glycogen is broken down in the liver and glucose is transferred to the blood (mobilization of glycogen). This ensures the relative stability of glucose in the blood. Glycogen is also stored in muscles, where its amount is up to 1-2%. As a result of eating a lot, the amount of glycogen in the muscles increases, and it decreases as a result of starvation. During muscle work, a strong breakdown of glycogen is observed under the influence of phosphorylase enzyme, which is activated at the beginning of muscle contraction, and this process is one of the energy sources of muscle contraction. The ability of individual organs to absorb glucose brought by the blood is not the same: brain cells absorb 12% of glucose, intestines — 9%, muscles — 7%, kidneys — 5% [10].

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Carbohydrates are broken down into lactic acid in an oxygen-free environment (anaerobic glycolysis) and into CO_2 and H_2O through oxidation (aerobic glycolysis). The main indicator (parameter) in the regulation of carbohydrate metabolism is the blood glucose level of 4.4-6.7 mmol/l. Changes in the amount of glucose in the blood are perceived mainly by glucoreceptors located in the liver and blood vessels, as well as cells of the ventromedial branch of the hypothalamus. The participation of several departments of the central nervous system in the regulation of carbohydrate metabolism has been confirmed. Even in 1849, Claude Bernard showed that inserting a needle into the bottom of the IV ventricle in the medulla oblongata increases the amount of sugar in the blood ("sugar needle"). As a result of hypothalamus irritation, it causes hyperglycemia reaction. The development of hyperglycemia in students, athletes before responsible competitions, and during hypnotic induction indicates that the level of glucose in the blood is regulated by the cerebral cortex. The hypothalamus is the central regulatory stage of carbohydrate and other types of metabolism and the place of formation of signals that control the level of glucose. From here, regulatory effects are carried out by autonomic nerves and humoral way [11].

The presence of carbohydrates in plant and animal foods is one of the factors that increase their value. Carbohydrates provide almost half of the energy the human body needs daily. They are mainly used as a source of energy in the body. Complex carbohydrates (complex sugars, polysaccharides) are absorbed by the body after they are broken down into simple sugars (monosaccharides) in the digestive process. The human body synthesizes some of the complex sugars it needs. Carbohydrates are also used as building materials in the body. These substances and their combinations with protein and fat molecules are included in the composition of many cells and tissues. In humans, simple sugars can be converted into complex sugars, such as glucose and glycogen (animal starch), which are stored as reserves in the liver and muscles. Normally, there is always glucose in the blood. Constantly maintaining the relative stability of the level of glucose in the blood is one of the important indicators of sugar metabolism.

At present, it is common to find cases of excess sugar in people's food. This last result can affect stability and lead to some metabolic disorders in the body, including obesity. The main source of carbohydrates in human nutrition is plant products. Carbohydrates of animal origin are very few, substances such as lactose and glycogen can be examples of this type of carbohydrates. Carbohydrate and fat metabolism in the body have very close interactions. The energy provided by each gram of carbohydrate as a result of oxidation (burning) in the body is equal to 4.0 kcal. In terms of calories, 1 g of protein and 1 g of carbohydrates have the same importance, but sugar is the most labile, reactive component of energy metabolism in humans. According to their chemical structure and degree of assimilation, carbohydrates can be divided into simple and complex sugars. Simple sugars (mono and disaccharides) dissolve well in water and aqueous solutions, are easily absorbed and assimilated. Glucose and fructose are more important than simple sugars in nutrition. Glucose enters the body mainly in fruit and berry foods. Honey, grapes, dates, bananas, etc. such products are rich in glucose. Fructose differs from all other sugars in its sweetness. Fructose food is recommended for adults and elderly people. When fat-fat metabolism is disturbed, fructose helps to normalize it. There is more fructose in honey, grapes, watermelon, nuts, pears, strawberries, etc [15].

Of the disaccharides, lactose and sucrose occupy an important place in nutrition. During digestion, each sucrose molecule is split into two monosaccharide molecules - glucose and fructose. Sucrose is a carbohydrate with good nutritional qualities and high calories. But it also has negative aspects, as when it is taken in excess, it causes a significant increase in calories for a person's daily food ration. This is also undesirable for people who do not engage in physical labor or who engage in little physical work, as well as the elderly. It also causes obesity. The main source of sucrose in

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human food is sugar from sugar cane and sugar beet. After they are cooked, sucrose (sugar powder, sugar used in the household) is purchased and the population's demand for this carbohydrate is met. Lactose, one of the most useful sugars, is milk sugar and is found only in milk. Its sweetness is not that high. Lactose is poorly digested in the body. It is usually recommended for infants and the elderly. When carbohydrates enter the body normally with food, their content in tissues and blood remains stable. Carbohydrates can also be synthesized from the breakdown products of proteins and fats. They also play an important role in the synthesis of nucleic acids, substituted amino acids, glycoproteins and other necessary substances for life. At the same time, when carbohydrates enter the body in excess and are consumed in small amounts, a part of them turns into fat.

Thus, carbohydrate metabolism is closely related to protein and fat metabolism. In the usual mixed food, carbohydrates are more than other organic substances. They mainly enter the body with plant food with a dry content of up to 75%. Foods of animal origin contain a small amount of glycogen and lactose. Carbohydrates enter the body with food in the form of monosaccharides, disaccharides and polysaccharides, and pectin substances. Soluble carbohydrates (mono and disaccharides) have a high nutritional value and energy properties and give a sweet taste to foods.

It has about 2 times more sweetness than fructose sugar and is sweeter than glucose. Glucose is an easily absorbed sugar that is important for brain and muscle nutrition and for maintaining normal blood sugar levels. Compared to glucose, fructose is slowly absorbed in the intestines, quickly released from the blood and easily involved in metabolic processes. Glucose and fructose enter the body with fruits and berries, as well as with honey. Here, the amount of glucose reaches 36.2%, and that of fructose reaches 37.1%. Grapes contain 7.2% fructose and glucose, apples contain 6.5-11.8% fructose and 2.5-5.5% glucose. In watermelon, all sugars are represented in the form of fructose, and its amount reaches 8%.

Of the sugars, galactose is not found in free form in food products, it is considered a breakdown product of lactose. Sucrose is most commonly found in beet and cane sugar. Its amount reaches 13.7% in banana, 10.4% in apricot, 9.3% in plum, 8.5% in walnut, 7.5% in watermelon, and 6.4% in carrot. Lactose reaches 4.91% in milk. It slows down the fermentation processes in the intestines and accelerates the development of lactic acid bacteria useful for the body [16].

Nerve cells need fructose in particular. Entering muscle tissues and other organs, glucose is broken down or converted into glycogen. Mono and disaccharides are the main component of food, but also the nutrition of the heart they are needed for Their disadvantage is that when they enter the body with a large amount of high-calorie food, they accelerate the process of fat formation. In elderly and mature people, excessive sugar intake can accelerate the development of atherosclerotic processes, thereby increasing the level of cholesterol and glucose in the blood. Fructose and lactose are less involved in fat formation and do not increase the amount of cholesterol in the blood.

Complex carbohydrates include starch, glycogen, cellulose and pectin substances. Starch is the main nutrient found in plant foods, mainly grains and legumes. Starch is the main source of glucose for the human body. Starch is insoluble in water, the starch grain contains two of its fractions called amylose and amylopectin. Amylose is soluble in warm water, while amylopectin is subject to swelling. Starch is broken down slowly and gradually in digestive processes.

Cellulose or cell shell tissue refers to carbohydrates that are insoluble in water. Almost half of plant food is cellulose. The molecular spatial structure of this complex polysaccharide differs sharply from the molecular spatial structure of starch due to its rigidity. It is not digested in the human small intestine because there is no enzyme that breaks it down. Cellulose in food is broken down and digested by its microflora only in the large intestine. This applies only to the refined cellulose found in cabbage and potatoes. Hard cellulose is not digestible, it increases the volume of the food mass and nourishes the nerve endings of the intestine. But when there is less cellulose in

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the food, the peristalsis of the intestine weakens, then the movement of the food mass is disturbed, and the body can be poisoned by the toxic effect of some decomposition products formed during protein digestion. Pectin substances also belong to complex carbohydrates. During the digestion process, their partial hydrolysis occurs. Pectin has the ability to dissolve well and is included in the composition of cell juice. It is widely used in the preparation of some confectionery and juicy products (marmalade, jam, etc.). Pectin is found in high amounts in apples, oranges, pears, carrots and other such fruit and vegetable products. Under the influence of pectin, the putrefactive microflora of the intestine is destroyed. Consider this taking, in the treatment of gastrointestinal diseases, food rations dominated by plant products: for example, apple and carrot juices are used.

Only well-soluble monosaccharides are absorbed in the gastrointestinal system. Poly and disaccharides are absorbed only after they are digested and broken down into monosaccharides. After monosaccharides are absorbed in the intestines, they are transported by blood to the liver, where most of them are converted into glycogen. The changed part from the liver enters the bloodstream and is distributed to all tissues and cells. The amount of glucose in the blood is always stable and reaches 80:120 mg%. This happens because the amount of glucose absorbed by the tissues is replenished (replaced) due to the breakdown of glycogen in the liver [7].

Carbohydrates are easily oxidized and 375 kcal of energy is released from 100 g of glucose. In short, 2/3 of the body's energy needs are met. At this time, the final products of oxidation are carbon dioxide and water. The body's daily need for carbohydrates depends on the nature of work and gender. Their amount in the diet should always be 4 times more than the amount of fats and proteins. Sometimes, if necessary, the amount of carbohydrates can be reduced without reducing the amount of protein and fat in the diet in order to reduce calories. For normal life activity in the body, 83-85% of carbohydrates should be made up of polysaccharides, especially starch. The amount of sugary substances in the diet for the elderly population should be close to 15-17%. In the food of children and teenagers, their amount can be increased up to 25%. Di- and monosugars take part in the exchange processes of muscle tissue 15-20 minutes after their intake 8].

As we all know, the source of carbohydrates is bread, bread, cereals, cereals, pasta and potatoes. For example, 40-49% in black bread, 42-50% in white bread, 68% in corn semolina, 68% in semolina, 77.3% in rice, 99.9% in sugar, 19.7% in potatoes, 5.4% in cabbage. %, 9.2% in corn, 7.0% in carrots, 10.8% in beets, 11.3% in apples, etc. According to the intensity of work, the carbohydrate needs of different groups of the population are given in the following Table.

Carbohydrates are mainly absorbed in the small intestine in the form of monosaccharides. Hexoses are the fastest absorbed (glucose, galactose); pentoses are slowly absorbed. Absorption of glucose and galactose is the result of active transport from the apical membrane of the intestine by epitheliocytes. Epitheliocytes are highly sensitive to various carbohydrates. Monosaccharides derived from the hydrolysis of oligosaccharides are absorbed more rapidly than monosaccharides injected into the intestinal tract. The absorption of glucose (other monosaccharides) is activated by the transport of Na+ ions from the epitheliocytes of the apical membrane of the intestine (in the absence of transport of Na+ ions, glucose is absorbed 100 times less quickly, and the transport of glucose is opposite to the concentration gradient). These show that there is a common transporter of glucose and Na-ions.

Glucose is accumulated from intestinal epitheliocytes. From here, glucose passes passively along the concentration gradient through the basal and lateral membrane to the intercellular fluid and blood (active transport process is also possible).

The absorption of carbohydrates from the small intestine is enhanced by the effect of some amino acids. Inhibitors of tissue respiration sharply slow down this process, ATF deficit also has a retarding effect [12].

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Table

CARBOHYDRATE REQUIREMENTS FOR DIFFERENT POPULATION GROUPS

Population groups according to labor intensity	*Men*		*Women*	
	Gender and age	*Carbohydrates, in grams*	*Gender and age*	*Carbohydrates, in grams*
I group				
	18-29	378	18-29	324
	30-39	365	30-39	310
	40-59	344	40-59	227
II group				
	18-29	412	18-29	351
	30-39	399	30-39	347
	40-59	378	40-59	323
III group				
	18-29	440	18-29	371
	30-39	426	30-39	358
	40-59	406	40-59	394
IV group				
	18-29	508	18-29	441
	30-39	504	30-39	427
	40-59	483	40-59	406
V group				
	18-29	602	18-29	
	30-39	574	30-39	
	40-59	546	40-59	

The rate of absorption of individual monosaccharides in different departments of the small intestine is not the same and depends on the concentration of monomers derived from the hydrolysis of sugars, the presence of other nutrients, as well as the characteristics of the transport system of intestinal epitheliocytes. The rate of glucose absorption in the small intestine is 3 times higher than in the large intestine. Diet and many other factors affect the absorption of sugars. That is, there is a complex neural and humoral mechanism that regulates the absorption of carbohydrates. Alteration of their absorption through the cerebral cortex, subcortical derivatives, cerebral column and spinal cord has been proven by a number of studies. Based on most experimental evidence, it is known that parasympathetic influences enhance the absorption of carbohydrates, while sympathetic influences slow it down. The involvement of endocrine glands in the absorption of carbohydrates from the small intestine is great. Adrenal, pituitary, thyroid, and pancreatic hormones enhance glucose absorption. Serotonin and acetylcholine enhance the absorption of glucose. Histamine slows down this process a bit, somotastatin significantly slows it down. Regulatory effects on glucose absorption are manifested in several factors: physiologically active substances affect various transport mechanisms, including the movement of piles, the activity of transporters and intracellular metabolism, cell permeability, and the level of local blood flow (microcirculation) [14].

Monosaccharides absorbed in the intestines enter the liver through the portal vein. Here, a large part of them is stored and converted into glycogen. A certain part of glucose is distributed in the body with blood and is used as an energy material. Some of the glucose is converted into triglycerides and stored in fat stores. Regulation of absorption of glucose, synthesis of glycogen in the liver, generation and consumption of glucose from its breakdown ensures a relatively stable concentration of glucose in the circulating blood. Metabolism of carbohydrates is carried out with the help of the nervous system with the participation of internal sequestration glands. Irritation of

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the nerve center brain substance causes the secretion of adrenaline. This hormone, entering the blood, enables the breakdown of glycogen into glucose in the liver. On the other hand, carbohydrate metabolism is also affected by insulin, which is produced in the pancreas. It has the opposite effect on the conversion of glycogen into glucose and helps its use by tissues. When insulin is injected into the body (as a medicine), the amount of sugar in the blood decreases. Carbohydrate metabolism is also influenced by the hormones of the pituitary gland and other glands. Disruption of carbohydrate metabolism in the body leads to diabetes. 400-500 g of carbohydrates in a person's daily diet is considered physiologically appropriate. Although this norm is much less for people who do not engage in physical labor, it leads to the formation of large amounts of substances that strengthen the vessel wall, such as compounds with high-level properties.

Conclusions

1. Carbohydrates are used as a source of energy in the body. They cover 56-58% of the energy demand of the human body. Complex carbohydrates are broken down into monosaccharides in the digestive process and absorbed by the body. Carbohydrates are also used as building materials in the body. These substances and their combinations with protein and fat molecules are included in the composition of many cells and tissues.

2. According to their structure and absorption, carbohydrates are divided into simple (mono and disaccharides) and complex (starch and glycogen) sugars. Glucose and fructose are more important than simple sugars. Both are mostly found in fruits and berries. Food with fructose is recommended for mature and elderly people. When the body's fat metabolism is disturbed, lactose normalizes it.

3. Lactose and sucrose from disaccharides are broken down into glucose and fructose in the digestive process. Sucrose intake in excess increases a person's energy requirements, which leads to obesity. Lactose is milk sugar and is poorly digested in the body. Carbohydrates, entering the composition of cells and tissues, increase the amount of glucose in the blood, and are stored in the form of glycogen in the liver and muscles. They play an important role in the synthesis of nucleic acids, substituted amino acids, and glycoproteins.

4. Carbohydrates enter the body with food in the form of monosaccharide, disaccharide and polysaccharide. Glucose is an easily absorbed sugar that is important for brain and muscle nutrition and for maintaining normal blood sugar levels. Entering muscle tissues and other organs, glucose is broken down or converted into glycogen. Fructose has about 2 times more sweetness than sugar and is much sweeter than glucose. Fructose is necessary for the nutrition of nerve cells. Mono and disaccharides are the main components of food and are necessary for the nutrition of the heart. When it enters the body too much, it accelerates the formation of fats. In the elderly, the intake of excess sugar accelerates the development of the atherosclerotic process, which increases the level of cholesterol and glucose in the blood.

5. Complex carbohydrates include starch, glycogen, cellulose and pectin substances. Starch, being in plant food, is a source of glucose for the body. Starch contains amylose and amylopectin. During the digestion process, starch is broken down slowly and gradually. Cellulose is not digested in the small intestine, it is broken down and digested only by microflora in the large intestine. Pectin is included in the composition of cell juice. Due to the effect of pectin, the putrefactive microflora of the intestine is destroyed. Pectin is mainly found in apples and carrots.

6. In order for the normal life activity of the organism to continue, 83-85% of the carbohydrates included in food should consist of polysaccharides. The amount of sugar in food for elderly people should be 15-17%. Their amount is increased by 25% in the food of children and

teenagers. Depending on age, gender, geographical conditions, labor intensity and physical load, the daily carbohydrate requirements of the population are different.

References:

1. Gurbanov, N. Kh., Khalilova, U. I., & Gurbanova, A. A. (2003). Fiziologiya pitaniya. Baku. (in Russian).

2. Mikailov, V. S. (2012). Degustatsiya produktov pitaniya. Baku. (in Russian).

3. Isfandiyarov, S. Kh. (1991). Zagryaznenie pishchevykh produktov. Baku. (in Russian).

4. Rubina, E. A. (2014). Fiziologiya pitaniya. Moscow. (in Russian).

5. Abramova, Zh. I., & Linich, E. P. (1986). Fiziologiya pitaniya. Moscow. (in Russian).

6. Martynchik, A. N., Korolev, A. A., & Nesvizhskii, Yu. V. (2013). Mikrobiologiya, fiziologiya pitaniya, sanitariya. Moscow. (in Russian).

7. Emel'yanova, T. P. (2001).Vitaminy i mineral'nye veshchestva. Moscow. (in Russian).

8. Dotsenko, V. A., Kononenko, I. A., Mosiichuk, L. V., Argunova, E. V., Dolotov, S. A., & Sirotkin, O. G. (2016). Osobennosti upotrebleniya peterburzhtsami vitaminov i produktov, obogashchennykh biologicheski aktivnymi veshchestvami. *Gigiena i sanitariya*, *95*(5), 479-483. (in Russian).

9. Rubina, E. A., & Malygina, V. F. (2008). Mikrobiologiya, fiziologiya pitaniya, sanitariya. Moscow. (in Russian).

10. Kunilova, O. V. (2023). Mikrobiologiya, fiziologiya pitaniya, sanitariya i gigiena v obshchestvennom pitanii. Moscow. (in Russian).

11. Ibn Sina, Abu Ali (1982). Kanon meditsinskoi nauki. Tashkent. (in Russian).

12. Chernysheva, Yu. S., Gornostaeva, Zh. V., & Zhidkov, V. E. (2020). Nauchno-prakticheskie osnovy proizvodstva i otsenki effektivnosti spetsializirovannoi pishchevoi produktsii. *Kant*, (2 (35)), 79-84. (in Russian).

13. Popova, A. Yu., Tutel'yan, V. A., & Nikityuk, D. B. (2021). O novykh (2021) Normakh fiziologicheskikh potrebnostei v energii i pishchevykh veshchestvakh dlya razlichnykh grupp naseleniya Rossiiskoi Federatsii. *Voprosy pitaniya*, *90*(4 (536)), 6-19. (in Russian).

14. Reznikova, M. V., Lepeshkin, A. I., & Nadtochii, L. A. (2016). Ratsional'noe pitanie-klyuch k zdorov'yu cheloveka. *Novaya nauka: sovremennoe sostoyanie i puti razvitiya*, (2-1), 193. (in Russian).

15. Kakadzhanova, K. K., Akmammedov, D. A., & Akmukhammedov, M. A. (2024). Osobennosti khimicheskogo stroeniya i mezhkletochnye funktsii uglevodov. *Vestnik nauki*, *1*(4 (73)), 558-561. (in Russian).

16. Seyidova, L. (2024). The Role of Patiral Hormones in Metabolism. *Bulletin of Science and Practice*, *10*(7), 324-333. https://doi.org/10.33619/2414-2948/104/34

17. Seyidova, L. (2024). Hormonal Regulation of the Amount of Sugar in the Blood Converter. *Bulletin of Science and Practice*, *10*(9), 287-296. https://doi.org/10.33619/2414-2948/106/29

Список литературы

1. Гурбанов Н. Х., Халилова У. И., Гурбанова А. А. Физиология питания. Баку, 2003.

2. Микаилов В. С. Дегустация продуктов питания. Баку, 2012. 384 с.

3. Исфандияров С. Х. Загрязнение пищевых продуктов. Баку, 1991. 108 с.

4. Рубина Е. А. Физиология питания. М., 2014.

5. Абрамова Ж. И., Линич Е. П. Физиология питания. 1986. М., 151 с.

6. Мартынчик А. Н., Королев А. А., Несвижский Ю. В. Микробиология, физиология питания, санитария. М., 2013.

7. Емельянова Т. П. Витамины и минеральные вещества. М., 2001.

8. Доценко В. А., Кононенко И. А., Мосийчук Л. В., Аргунова Е. В., Долотов С. А., Сироткин О. Г.Особенности употребления петербуржцами витаминов и продуктов, обогащенных биологически активными веществами // Гигиена и санитария. 2016. Т. 95. №5. С. 479-483.

9. Рубина Е. А., Малыгина В. Ф. Микробиология, физиология питания, санитария. М., 2008. 238 с.

10. Кунилова О. В. Микробиология, физиология питания, санитария и гигиена в общественном питании. М., 2023. 333 с.

11. Ибн Сина Абу Али. Канон медицинской науки. Ташкент, 1982. 832 с.

12. Чернышева Ю. С., Горностаева Ж. В., Жидков В. Е. Научно-практические основы производства и оценки эффективности специализированной пищевой продукции // Kant. 2020. №2 (35). С. 79-84.

13. Попова А. Ю., Тутельян В. А., Никитюк Д. Б. О новых (2021) Нормах физиологических потребностей в энергии и пищевых веществах для различных групп населения Российской Федерации //Вопросы питания. – 2021. – Т. 90. – №. 4 (536). – С. 6-19.

14. Резникова М. В., Лепёшкин А. И., Надточий Л. А. Рациональное питание-ключ к здоровью человека // Новая наука: современное состояние и пути развития. 2016. №2-1. С. 193.

15. Какаджанова К. К., Акмаммедов Д. А., Акмухаммедов М. А. Особенности химического строения и межклеточные функции углеводов // Вестник науки. 2024. Т. 1. №4 (73). С. 558-561.

16. Seyidova L. The Role of Patiral Hormones in Metabolism // Бюллетень науки и практики. 2024. Т. 10. №7. С. 324-333. https://doi.org/10.33619/2414-2948/104/34

17. Seyidova L. Hormonal Regulation of the Amount of Sugar in the Blood Converter // Бюллетень науки и практики. 2024. Т. 10. №9. С. 287-296. https://doi.org/10.33619/2414-2948/106/29

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