FSBI Research Institute of Normal Physiology named after N.I. PC. Anokhina RAMS

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Limited Society Responsibility "PharmIntelTech", gen. director	Director of the Research Institute of Normal physiology them. PC. Anokhina RAMS, Corresponding Member of the RAMS
I.B. Povazhnaya	
________________ **I.B. Povazhnaya**	____________________ **S.K. Sudakov**

Report

Subject: "Study of the effect of" light water "on physical performance highly qualified athletes "

Responsible executor,
Corresponding Member of the Russian Academy of Medical Sciences

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Performers:

S.K. Sudakov - Corresponding Member RAMS A.A.

Khadartsev - Doctor of Medical Sciences, Professor

Vagin Yu.E. - Doctor of Medical Sciences, Professor

Klassina S.Ya. - Ph.D., Leading Researcher Pigareva

S.N. - Candidate of Biological Sciences, Senior

Scientist Cherkasov A.D. - Candidate of Biological Sciences, Researcher

Chernyshev S.V., - Doctor of Biological Sciences,

Professor Abramova A.Yu. - Researcher, doctor

Vasilyuk N.A. - Ch. engineer Slezina

A.O. - laboratory assistant Nesterenko

V.A. - laboratory assistant Nafeeva

A.A. - laboratory assistant

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Introduction

Water is the basis of life on the planet. Covering two-thirds of the Earth's surface, water affects almost all vital processes of living organisms and plants. Water for the human body is the second most important substance after oxygen. Water regulates body temperature, is an integral part of the body's liquid biological media, and performs transport and excretory functions in the body.

Water is a widespread, simple, but at the same time the most complex and mysterious substance on Earth. A huge number of scientific works are devoted to water, but so far it remains insufficiently studied. Previously believed what water is a compound, described the only possible formula H_2O. Today, up to 135 isotopic varieties of water are known, of which the most famous are deuterium and tritium.

Drinking water is water that is intended for daily, unlimited and safe human consumption. There are many varieties of drinking water, one of which is light water.

Light water is a product with a complex structure and composition, which has a polyphysiological effect on the human body. In this regard, it is important to assess what effect the purification of drinking water from heavy molecules will have on the body while maintaining all other water components at the levels regulated by hygienic standards. Considering the role of water in the body, it can be expected that such purification can have the greatest effect on the properties of biological membranes, regulatory systems and the energy apparatus of a living cell.

Light water is water that is partially or completely purified from heavy water and, thanks to such purification, acquires unique biological properties. The main effect of "light drinking water "on the human body - a gradual decrease in the content of deuterium in biological fluids of the body. It is natural to assume that the daily consumption of light drinking water allows a natural decrease in the content of heavy water in the human body due to isotope exchange reactions. This kind of purification of body fluids will help normalize the functioning of cell membranes, improve well-being, increase immunity and physical performance.

It was found that light water has a lower viscosity than natural water. This allows it to more easily penetrate cell membranes and increase the rate of water exchange in the body. The solubility of substances in light water is higher than in natural water, which makes it possible for it to more fully and quickly remove metabolic products from the body, while cleaning it from heavy metal salts, toxins and other harmful substances. The rate of enzymatic (catalytic) reactions in "light water" is higher than in ordinary water. This allows you to intensify metabolic processes and helps the body recover faster after heavy exertion.

Thus, the spectrum of action of light water is very wide. With regular consumption of light water, a gradual cleansing of the whole body occurs from heavy water, what accompanied by increase functional activity of cells, organs, tissues and various functional systems organism. Is happening normalization metabolic processes, self-regulation processes are activated and the body's resistance to the damaging influences of the external environment increases.

Literature review

Light water: physical, chemical and biological properties

Chapter 1. The role of water in the body and formation biological fluids

On planet Earth, most of the water is in the form of vapor in the earth's atmosphere. Liquid water occupies 70% of the earth's surface in the form of huge masses of snow and ice on mountain tops and in polar countries, in the form of liquid in oceans, lakes, seas and rivers. In the bowels of the Earth, water permeates the soil and rocks. The hydrosphere of our planet serves as an accumulator of inorganic and organic matter introduced into the ocean and other bodies of water by rivers, atmospheric currents and forming in the water bodies themselves. The water cycle in nature makes the hydrosphere a planetary transport system in relation to cations, anions, various substances and elements (Losev K.S., 1989).

Water is of great importance in the origin and life of plants, animals and humans. People use different sources of drinking water throughout their lives. Each mineral spring has its own composition of water, differs in smell and acid-base balance. Water from a number of sources is useful for diseases of the gastrointestinal tract, joints, vascular, urinary and other systems. From the standpoint of health benefits, natural water with a high content of mineral components is classified into four groups: mineral medicinal water with a total mineralization of more than 8 g / l; mineral medicinal table waters with a total mineralization of 2-8 g / l; mineral table water with a salinity of 1-2 g / l and table water with a salinity of less than 1 g / l.

Water makes up about 3/4 of the Earth's biomass, being the simplest chemical compound found in living organisms.

About 1000 years ago, Avicenna came to the conclusion that many diseases are associated with the state of the water that a person consumes. According to the WHO, about 80% of all diseases are associated with the use of poor-quality drinking water. In the developing crisis, the relationship between the human community and the natural environment is becoming increasingly important depletion and pollution of fresh water, which is the basis of life on Earth. Millions of people suffer from the lack of quality drinking water and from its pollution. The earth becomes "the planet of polluted waters." By polluting rivers, man pollutes the seas. Everything that is extracted from the bowels of the Earth and from which then modern society seeks to get rid of is concentrated in the oceans. Negative changes in the World Ocean are accumulating - a complex balanced system, in many respects, defining the unity of the geophysical environment of our planet. Waste from modern industries flows into the ocean. Spontaneous water use is currently closely intertwined with the problems of ecology, economics, sociology and culture and is becoming a key problem of our time (UN Report, 2003, Lalayants Yu.V., 2007, Losev K.S., 1989).

Of particular interest is the distribution in the body and the function of water, including the function of dissolution and crystallization. Water makes up most of a person's mass, and an embryo is 95% water. Tissues lose water as they age. The water content in various tissues is distributed as follows: lungs, heart and kidneys (80%). skeletal muscles and brain (75%), skin and liver (70%), bones (20%), adipose tissue (10%). It follows from this that people with a predominance of muscle tissue over adipose tissue, the body contains more water. In general, thin people have less fat and more water. For men, water accounts for 60%, for women - 50% of body weight. Older people have more fat and less muscle. On average, the body of men and women over 60 contains 50% and 45% of water, respectively.

The total water content in the body includes water inside and outside the cells. The total water content is 60% of the body weight, and the cellular and extracellular fluid is 40% and 20% of the body weight, respectively. The extracellular fluid consists of both interstitial (15%) and intravascular (5%) water. Thus, a man weighing 70 kg has a total volume of water - 42 liters, cellular fluid - 28 liters and extracellular fluid - 14 liters. Interstitial water is 10.5 liters and intravascular (blood plasma) - 3.5 liters. Therefore, two thirds of the total volume of water is cellular fluid and one third is extracellular fluid. Normally, blood plasma is 93% water and 7% proteins and lipids. Bones are poor in water (20-30%) and especially adipose tissue (10-12%). For the cells of the body, water is a medium of existence, since all basic chemical and biochemical processes take place in biological fluids (BF). In these processes, water plays an important role as a solvent. In terrestrial animals, the ability to store water is not expressed, although its supply still exists in the form of fats, which, when oxidized, decompose to water and carbon dioxide with the release of energy. This metabolic water is able to maintain the water exchange of some desert inhabitants, camels, goats, sheep for several days (Sadchikova E.V., Selezneva I.S., 2005). The daily exchange of water consumed by a person is 2.5-3.0 liters. Excess and lack of water is dangerous for health. So with a loss of water by 5-8% more than normal, muscle weakness, dizziness, headache and other phenomena occur. The loss of 10% of the liquid leads to the pathology of dehydration, and the loss of 15-20% of the water is deadly. A local lack of water can cause pain in the corresponding anatomical structure, accompanied by pain from a local excess of water (edema). In animals and humans, the total volume of fluid intake is regulated by complex systems of neurohumoral control and special osmotic receptors located in the hypothalamus, liver, cerebral vessels and other organs. TO the appearance of thirst is caused by an increase in the osmotic pressure of the blood. Thirst increases as the concentration of ions in it increases. An important element of water exchange is the secretion of saliva. Drying of the mouth is a clear signal of a lack of water. Animals often drink cold water of natural reservoirs, but its absorption into the blood occurs only after the temperature of the water in the stomach and intestines equals the temperature of the blood, which takes 5-10 minutes. Reflex activity of the nervous and endocrine systems protects the body from lack and excess of water (UN Report, 2003, 2007, Losev KS, 1989).

The body of a healthy person maintains a stable water-salt homeostasis. Conditions for maintaining water-salt homeostasis: 1) constancy of intracellular and extracellular volumes, which is maintained by water and electrolytes (Na, K, C1, P and proteins); 2) constancy of pH. The constancy of the internal environment includes the concepts: isovolemia - the constancy of the volume of extracellular fluid, isoosmia - the constancy of osmotic pressure and isohydration - the active reaction of the medium (pH). The maintenance of pH is provided by buffer systems: extracellular (hemoglobin and bicarbonate), intracellular (phosphate and protein), physiological (respiratory, excretory, etc.). In the body, water is distributed unevenly: 1.27% is on the extracellular space: extravasal fluid is 9-21%, connective tissue fluid is 4-5%, bone fluid is 4-5%, interstitial fluid is 10-12%); intravasal fluid - 5-7% (blood vessels fluid - 4-5%, lymphatic vessels - 1-2%). The transcellular fluid accounts for 1-2% (fluid of the pleural, abdominal, joints, cerebrospinal fluid, glandular secretions). All intracellular water on the scale of the organism is 33% (Sadchikova E.V., Selezneva I.S., 2005).

The cellular substance is a complex polyphasic colloid, that is, it is a system of two immiscible phases. One of these phases is structurally the cytoplasmic matrix and performs the role of the aqueous phase with transitions from liquid to solid state, while the other is a membrane system and plays the role of a relatively liquid phase. The cytoplasm is practically colorless and has the character of a solution. In the cells, from 70 to 90 of the 110 elements that make up the periodic system of D.I. Mendeleev. Approximately 40 nutrients are involved in metabolic processes and have pronounced biological activity. Reflexes to volume and osmotic pressure are protected from excess water. If the osmotic pressure in the blood falls below normal, then this includes diuretic stimuli. Water-mineral exchange is largely provided by the kidneys. Their vigorous activity also ensures the reabsorption of ions and organic substances necessary for the body, amino acids, glucose, peptides, hormones. In one minute, about 125 ml of blood plasma filtrate is formed in the kidneys of a person, and only 1 ml of liquid is released from it into urine. The rest of the water is reabsorbed and returned to the bloodstream. The same thing happens with other beneficial components of the filtrate. Harmful components - ammonium, urea, uric acid, nitrates and toxins, etc., on the contrary, are concentrated. The administration of excess water regardless of the feeling of thirst leads to an increase in the excretion of water in the renal tubules. In such situations, water does not become a solvent of harmful substances, but itself is excreted through the kidneys. Usually this is the result of a blockade of the synthesis of the antidiuretic hormone of the pituitary gland - vasopressin. In this case, it is not the body's cleaning of toxins that occurs, but the disposal of toxic water, and poorly concentrated urine is excreted from the body.

According to the degree of connectivity, the body's water is divided into the following types:

- hydration (chemically bound water);
- mobile (free water);
- immobile (semi-bound water).

Table 1

The content and distribution of water in the human body, depending on from age (in% of body weight)

Age	General water	Intra-tap-room water	Water outside the cells	
			intercellular liquid	in plasma
Newborn th	75	35	35	five
about 1 year	70	35	thirty	five
1-10 years old	60-65	35-40	20-25	five
10-50 years	55-60	40-45	fifteen	five
> 50 years	50-55	35-40	10	five

In a state bound to protein molecules, there is 4-5% of water. This is the so-called solvated water, which forms hydration shells around protein molecules, isolating them from each other, and preventing their aggregation, and also binds to some ions, for example [Na (H$_2$O) x] + [Cl (H$_2$ ABOUT)$_{Y]}$ -. Solvate water differs in its chemical and physical properties from free water. So, for example, it does not dissolve salts, but freezes at temperatures close to -40 ° C.

95% of the water is free and performs the following functions:

- plays the role of a solvent for chemicals, enveloping them with a hydrated (aqueous) shell, which gradually turns into an aqueous the environment, the substance dissolves, the rate of the chemical reaction increases;

- is the environment for vital physical and chemical processes;

- is included as an active component in some enzymatic reactions (hydrolysis, hydration, dehydration, etc.);

- performs transport functions, due to low viscosity, mobility, ability to dissolve organic and inorganic compounds, provides an influx of substances into the cell, removal of waste products from it;

- determines the turgor pressure of the cell;

- due to its high heat capacity and thermal conductivity, it ensures slight fluctuations in temperature inside the cell and an even distribution of heat throughout the cell and throughout the body, protects it from overheating;

- serves as the basis for liquids that wet (lubricate) the integument where there is friction of one organ against the surface of another, for example, in the joints;

- participates in the formation of cellular structures.

Semi-bound water is contained in the pores of cellular organelles, between fibrous protein molecules, between glycogen molecules. When shredding tissues, it does not flow out, because is a solvent and freezes.

The main water-dispersed systems of the human body are blood, saliva, lymph, urine. The incoming water in the body is distributed between the liquid media as follows: about 60% inside the cells, ~ 15% - in the intercellular fluid, ~ 8% is contained in the blood and lymph.

Discussions continue about the rate of water consumption by people of different ages. Recommendations to increase consumption appeared in 1990 water required experimental verification. It is known that in children by the age of 5, the blood supply to the kidneys decreases by almost 50%. In the presence of liver, kidney and heart disease, excess water becomes dangerous. If the volume of the lungs decreases, then, accordingly, the release of water during breathing decreases. With age, the total number of sweat glands decreases, from about 2 million in young people to 1 million in old people. All these changes can lead to water retention in the body. An adult healthy person needs, according to the WHO, 30 ml of fluid for each kilogram of body weight per day. For those who are underweight or thin, experts suggest a different formula: 100 ml per kg for the first 10 kg of weight, 50 ml for the next 10 kg and 15 ml per kg for the rest of the weight. Features of the physiology of water exchange at different ages can affect the ability of BZ to crystallize (Lvovich M.I.,

The properties of water are determined by its structural and chemical formula. The concept, which has been established so far, interprets the structure of the light water molecule in the following way. According to some calculations, it has an angular structure; those. its constituent parts form an isosceles triangle with a base of two protons and with an apex from the nucleus of an oxygen atom. The O-H internuclear distance is about 0.1 nm, the distance between the nuclei of hydrogen atoms is 0.15 nm. Of the eight electrons that make up the outer electron layer of the oxygen atom in a water molecule, two electron pairs form covalent O-H bonds, and the remaining four electrons are two lone electron pairs. The oxygen atom in this molecule is in a state of sp2 hybridization. Therefore, the bond angle HOH (104.3 °) is close to tetrahedral (109.5 °). Electrons, generators connections IS HE, displaced to more electronegative oxygen atom. Hydrogen atoms acquire effective positive charges because they create two positive poles. The centers of negative charges of the lone electron pairs of the oxygen atom located in hybrid orbitals are displaced relative to the atomic nucleus and in turn create two negative poles. The molecular weight of vaporous water is 18 units. Liquid water has a higher molecular weight, which is determined by examining solutions of water in other solvents. This is a consequence of the association of individual water molecules into complex aggregates (clusters). It is believed that the association of water molecules is caused by the formation of hydrogen bonds between them. However, recent research by the Synchrotron Laboratory Stanford university much change existing ideas about the structure of water. Chemical physicists Andrei Nilsson and his colleagues studied water on an X-ray machine and found that water molecules, contrary to ideas, do not have the shape of tetrahedrons - small pyramids with bases in the form of triangles. Water is more like an ocean in structure, consisting of rings and chains, where most of the molecules are tightly bound to each other. Avoiding the chemical concept of water connection, having pyramidal structure, is, in their opinion, "an extremely important event" because such water can behave differently, which can turn key concepts in science. At the same time, unusual physical and chemical properties of water are discussed. Its density during the transition from a solid to a liquid state does not decrease, as in other substances, but increases. When the temperature of water rises from 0 to 4 ° C, its density also increases, to a maximum at 4 ° C, and with further heating, its density decreases. If, with a decrease in temperature and with a transition from a liquid state to a solid, the density of water changed, as happens with the overwhelming majority of substances, then when winter approaches, the surface layers of natural waters would cool to 0 ° C and sink to the bottom, freeing up space for warmer layers. and so it would go on until until the entire mass of the reservoir has acquired a temperature of 0 ° C. Then the water would freeze, the formed ice floes would sink to the bottom, and the reservoir would freeze to its entire depth. Many life forms would be are impossible. But since the highest density of water is formed at 4 ° C; then the movement of its layers caused by cooling ends when this temperature is reached. With a further decrease in temperature, the cooled layer, which has a lower density, remains on the surface, freezes and thereby protects the underlying layers from further cooling and freezing. Light water also has an abnormally high heat capacity. Due to this property, at night, as well as during the transition from summer to winter, the water cools slowly, and during the day, or during the transition from winter to summer, it also heats up slowly. Due to these properties, water acts as a temperature regulator on Earth.

Chapter 2. Historical data about the research and the use of light water

Mankind did not suspect anything about the presence of so-called heavy water (deuterium oxide) in any natural water until the 1930s.

century. Until 1932, no one had a clue that nature could also contain heavy water, which could contain heavy isotopes of hydrogen, deuterium and tritium, even in miniscule amounts. It was this circumstance that was the reason that these elements were "hiding" from scientists, disguising themselves as experimental errors and insufficient measurement accuracy.

Heavy hydrogen - deuterium was discovered by the American physicochemist Harold Urey (1893-1981) in 1931. G. Yuri instructed one of his assistants to evaporate six liters of liquid hydrogen, and in the last fraction of 3 cm3, spectral analysis for the first time revealed a heavy isotope of hydrogen with an atomic mass twice the known protium.

This discovery made a stunning impression, first of all, on atomic scientists all over the world, and a little later on scientists in various fields of science. True, even earlier, in the same 1931, Berger and Mendel discovered that the atomic weight of hydrogen, measured by chemical methods, differs from the results obtained using mass spectrometers. Although this difference turned out to be small, it was repeated from experiment to experiment. Scientists came to the conclusion that, apparently, there is a heavy isotope of hydrogen with an atomic weight of 2. In 1932 G. Uri and EF Osborne first discovered heavy water in natural water. Harold Urey was awarded the Nobel Prize two years later. The discovery of the third superheavy hydrogen isotope, tritium with an atomic weight of 3, was kept secret for the first years for strategic reasons until 1951.

In 1951, tritium water was obtained and studied. If deuterium water is now well studied practically in all branches of science and technology, then the "starry" hour of tritium water has not yet arrived. And the reason is that tritium on Earth is vanishingly small (only about 25-30 kg) and it is contained mainly in water (only about 20 kg). Unlike protium and deuterium, tritium is a radioactive element with a half-life nine years. In its properties, superheavy tritium water differs from protium (light) water more than deuterium water.

Tritium is generated in the ultra-high layers of the atmosphere mainly when nitrogen nuclei are bombarded by cosmic-ray neutrons. In natural water, the tritium content is negligible - only 10-18 atomic percent. And, nevertheless, it is also in drinking water. In terms of its properties, T2O differs even more noticeably from H2O than heavy water: it boils at 104 ° C, has a density 1.33, ice from it melts at 9 ° C.

Tritium water is used in thermonuclear reactions, and in addition, like heavy water, is used in chemical and biological research as a labeled one. As an isotope indicator, tritium is more acceptable than deuterium due to its high sensitivity and ease of determination.

In addition to hydrogen, isotopes were also found in oxygen, with as many as six, in addition to the well-known O16 (with a molecular weight of 16). Three of them turned out to be radioactive - O14, O15 and O19, and O16, O17 and O18 were stable. O16, O17 and O18 are contained in all natural waters, and their ratio (with fluctuations up to 1%) is as follows: for 10,000 parts of O16 there are 4 parts of O17 and 20 parts of O18.

In terms of physical properties, heavy-oxygen water is less different from ordinary water than heavy-hydrogen water. It is obtained mainly from natural water by fractional distillation and is used as a source of drugs with labeled oxygen.

Thus, taking into account all the diversity of the isotopic composition of hydrogen and oxygen, we can talk about 36 isotopic varieties of water. Nine of them include only stable isotopes and constitute the main content of natural water. It is dominated by ordinary water H12O16 (99.73%), followed by heavy-oxygen waters H12O17 (0.04%) and H12O18 (0.2%), as well as the isotopic variety of heavy water H1D1O16 (0.03%). In what follows, speaking about water and calling it the well-known formula H2O, we we will keep in mind that its composition is diverse, but the main component is H12O16.

The discovery of heavy water then caused a real scientific sensation. Academician N. D. Zelinsky wrote in 1934: “Who would have thought that there is still another water in nature, which we did not know anything about until last year, water, which we daily introduce into our body in very small quantities together with drinking water. the quantities of this new water consumed by a person during his life are already an order of magnitude, which cannot be ignored. " This idea of Academician N.D. Zelinsky became even more relevant after a detailed study of the properties of heavy water.

It was found that the physical properties of heavy water are quite different from light (protium) water: the boiling point of light water is 100 ° C, its melting point is 0 ° C, the boiling point of heavy water is 101.435 ° C, and the melting point is 3.815 ° FROM. The density and heat capacity of heavy water at 20 ° C is 10% higher than that of light water, the mobility of D + and OD- ions is almost 50% less than that of hydrogen and OH- ions. Heavy isotopic water molecules are a pollutant of the internal environment of the human body and cause numerous unexplained malfunctions. Water with a high content of heavy molecules makes it difficult biochemical processes, what lowers functional capabilities of cellular systems and the body as a whole. So in 1962, a WHO committee of experts banned drinking desalinated water. And the sailors of ships that have desalination plants even avoid washing in such water. The reason for the ban was not advertised, but it was clear to literate people, because there is about twice as much deuterium (heavy water) in seawater than in river water. And heavy water, as it was widely known at that time, is very harmful, since biomolecules containing deuterium lose their activity, i.e. deteriorate without changing outwardly. MPC (maximum permissible concentration) for heavy water and deuterium was not established only because that, the control is rather difficult, large fluctuations in the level of deuterium were considered unrealistic, which means that constant monitoring of the content of deuterium in food or water is unjustified. Deuterium damage to biomolecules has been proven in hundreds of works and is not denied by anyone! It is clear that the effect of such spoilage is a matter of chance. Everything can be limited to the death of cells and a temporary breakdown of one of the body systems, but the effect can be fatal, as a lymphocyte with a defective enzyme loses its competence, skipping the disease, the worst of which is cancer. Therefore, it is likely that cases of spontaneous (not induced) cancer are caused by deuterium. And even if cancer is induced by a carcinogen, its development is also possible only in the absence of a normal immune response, i.e. with a defective immune lymphocyte. It must also be taken into account - this is the most dangerous type of their defects, only it is not recognized by the body, and a defective cell with deuterium is not replaced by a normal one. Each biomolecule is also important in the development of the egg, and deuterium is the cause of the deformities.

When studying the biological effects of heavy water, it was found that, unlike light natural water, which is the source of life, heavy water in its pure form is a poison for all life on Earth - from protozoa and plants to higher animals and humans. Even with a large dilution (35 times), it is capable of causing irreversible changes in the body of higher animals, which lead to their death. Nevertheless, the question of the effect of natural-level heavy water on human health and life expectancy was not raised until the 60s of the twentieth century, when Soviet scientists B.N. and Toroptsev I.N. were the first to put forward a hypothesis that purification of water from deuterium would dramatically improve its properties, turning water into a life stimulator. But only in the early 90s of the twentieth century, works appeared that experimentally confirmed this hypothesis.

It is possible to remove heavy isotopologues of water from the body only with the help of isotope exchange reactions, for which light water should be used.

In the 60s of the last, XX century, Tomsk scientists BN Rodimov and IN Toroptsev published the first works on the amazing properties of water with a reduced, in relation to natural, content of deuterium - a heavy isotope of hydrogen. It has been shown that such water, obtained from snow and relic ice, has a beneficial effect on plants, animals and humans.

In the seventies, the Soviet scientist V. M. Mukhachev in his book "Living Water" was the first to suggest that light water can help in the fight against one of the deadly dangers of our time - cancer. But at that time, this bold hypothesis did not arouse much interest in the scientific world.

Interest in light water reappeared only in the 90s - in connection with large-scale research related to the creation of the most favorable habitat for astronauts during long space flights. It has been proven that light water not only improves metabolic processes, but also helps to increase the body's defenses.

In the West, interest in light water manifested itself only in 1993, when its anti-cancer properties were discovered in experiments on tumor cells. For the first time, the antitumor properties of light water were discovered in 1993 by the Hungarian microbiologist G. Shomlai. This scientist did a lot to study the anti-cancer properties of light water, who considers it a completely new tool of submolecular medicine for the treatment and prevention of cancer. It should be noted that, simultaneously with foreign scientists, the antitumor properties of light water in experiments on animals were discovered by a group of scientists led by I.N. Varnavsky, who worked in close contact with scientists

Institute of Biomedical Problems, led by Professor Yu. N. Sinyak. Later, at the Research Institute of Carcinogenesis of the Russian Cancer Research Center named after V.I. N.N.Blokhin's experiments on mice, conducted jointly with the State Scientific Center of the Russian Federation “Institute of Medical Biological Problems,” confirmed the inhibitory effects of light water on the growth of transplanted tumors and the onset of the tumor process.

In Europe, light water is already being produced and used in the complex treatment of tumor diseases, significantly increasing a person's chances of recovery. In the United States, light water is marketed as a prophylactic anti-cancer agent. In the United States, "light water" is recommended as a daily prophylactic anticancer agent.

Abroad, "light water" is known as DDW (Deuterium Depleted Water). It is marketed in Europe under the brand name "Preventa" with a residual deuterium content of 125 to 75 ppm.

Chapter 3. Physical properties of light water

Light water - isotopologue of water H_2O [1] [2] formed by light stable isotopes of its constituent elements, the content of which in natural water is 99.73 - 99.76 mol.%. Isotopes are varieties of atoms of the same chemical element, which have the same charge of the nucleus and the structure of the electron shells, differing in the mass of the nuclei. The difference in masses is due to the fact that the nuclei of isotopes contain the same number of protons p and a different number of neutrons n. Combinations of different atom isotopes give a set of isotopologic molecules. Isotopologues are molecules that differ only in the isotopic composition of the atoms of which they are made. An isotopologue contains at least one atom of a certain chemical element, which differs in the number of neutrons from the rest. A water molecule is made up of two hydrogen atoms and one oxygen atom. Hydrogen has two stable isotopes - protium (H) and deuterium (D).

Oxygen has three stable isotopes: 16O, 17O, and 18O (Table 1).

Table 1.

Isotopes water

Element	Hydrogen	Deuterium	Oxygen	Oxygen	Oxygen
Isotope	H	D	16O	17O	18O
number protons in core	one	one	eight	eight	eight
number neutrons in core	0	one	eight	nine	10
Atomic mass	one	2	sixteen	17	eighteen

Combinations of 5 stable isotopes of hydrogen and oxygen give a set of 9 water isotopologues (Table 2).

table 2

Isotopologues of water

Isoto canopy	1HD1 6O	D216 O	1H21 7O	1HD1 7O	D217 O	1H21 8O	1H 218	1HD1 8O	D218 O
Isotopes hydrogen	1H	1H, D	D	1H	1H, D	D	1H	1H, D	D
Isotopes oxygen	16O	16O	16O	17O	17O	17O	eighteen O	18O	18O
Molecule weight	18	nineteen	twenty	nineteen	twenty	21	twenty	21	22

The 1H216O molecule is the lightest of all water isotopologues. It is water 1H216O that should be considered classical or light water. Light water as a monoisotopic composition 1H216O is the limiting case of isotopic purity. Under natural conditions, such pure light water does not exist. To obtain the isotopologue 1H216O, a fine multistage purification of natural waters is carried out or synthesized from the initial elements 1H2 and 16O2. Natural water is a multicomponent mixture of isotopologues. The content of the lightest isotopologue in it significantly exceeds the concentration of all the others combined. In natural waters, 1,000,000 molecules on average contain 997,284 1H216O molecules, 311 1HD16O molecules, 390 1H217O molecules, and about 2005 1H218O molecules. Concentration of water molecules containing heavy isotopes D, 17O, 18O,

Table 3.

The weight amount of isotopologues in natural water that meets the international SMOW standards (average molecular weight = 18.01528873) and SLAP (average molecular weight = 18.01491202) 1H216O ... (Patent RU 2295493)

Water isotopologue	Molecular weight	Content, g / kg	SMOW SLAP
1H216O	18.01056470	997.032536356	997.317982662
1HD16O	19.01684144	0.328000097	0.187668379
D216O	20.02311819	0.000026900	0.000008804
1H217O	19.01478127	0.411509070	0.388988825
1HD17O	20.02105801	0.000134998	0.000072993
D217O	21.02733476	0.000000011	0.000000003
1H218O	20.01481037	2.227063738	2.104884332
1HD18O	21.02108711	0.000728769	0.000393984
D218O	22.02736386	0.000000059	0.000000018

As can be seen from Table 3, in natural water, the weight concentration of heavy isotopologues can reach 2.97 g / kg, which is a significant value comparable, for example, with the content of mineral salts.

Natural water, which is close in the content of the 1H216O isotopologue to the SLAP standard, and also specially purified with a significantly increased proportion of this isotopologue in comparison with the SLAP standard, is defined as extra pure light water (a less strict definition that is applicable in real life).

In light water, the fraction of the lightest isotopologue is (mol%): 99.76 <1H216O ≤ 100. If all heavy molecules with a mass content of 2.97 g / kg are removed from water meeting the SMOW standard and replaced with 1H216O, then the mass of 1 liter of such light and isotopically pure water will decrease by 250 mg. Thus, the parameters of light water, first of all, its "lightness" and isotopic composition can be measured using such methods, as mass spectrometry, gravimetry, laser absorption spectroscopy, NMR (Lis G., Wassenaar LI, Hendry MJ 2008).

Isotopologues differ from each other in physical, chemical and biological properties (Table 4).

Table 4.

Change in the physical properties of water upon isotopic substitution

Physical properties	1H216O	D216O	1H218O
Density at 20 ° C, g / cm3	0.9970	1.1051	1.1106
Temperature maximum density, ° C	3.98	11.24	4.30
Melting temperature at 1 atm, ° C	0	3.81	0.28
Boiling point at 100 1 atm, ° C		101.42	100.14
Steam pressure at 100 ° C, Torr	760,00	721.60	758.10
Viscosity at 20 ° C, centipoise	1.002	1.247	1,056

The equilibrium vapor pressure for water isotopologues is different and very significant. The smaller the mass of a water molecule, the higher the vapor pressure, which means that vapor, in equilibrium with water, is always enriched in light isotopes of oxygen and hydrogen. Relatively low mass of elements, the difference in masses of isotopes is large, therefore they are able to strongly fractionate in natural processes: D / H → 100%, 18O / 16O → 12.5%. Isotopes of hydrogen and oxygen are most efficiently fractionated in the processes of evaporation-condensation and crystallization of water. Heavy isotopologues in natural water are impurities with respect to 1H216O, which, according to some studies, can be considered as structural defects (Smirnov A.N. et al., 2005; Smirnov A.N. et al., 2004).

Elimination of water heterogeneity in isotopic composition leads to an increase in its homogeneity. Light water is a more homogeneous liquid. Heavy isotopic molecules contained in water in natural concentrations have practically no noticeable effect on inanimate systems. The effects of light water are most pronounced on biological objects, which are characterized by cascade reactions. The reaction of biosystems when exposed to water can change depending on the quantitative and qualitative changes in its isotopic composition. In the course of the evolution of living organisms, a selection of biochemical processes took place with their tuning to only one isotope, as a rule, a light one (Sinyak Yu.E., Grigoriev A.I., 1996). In the human body, there is "fractionation of isotopes, accompanied by the removal of heavy stable isotopes of hydrogen and oxygen of water" (Sinyak Yu. E. et al., 2005). The use of water with an increased concentration of heavy isotopes, in particular, deuterium, causes pronounced toxic effects at the level of the organism (Denko E.I., 1970; Lobyshev V.I., 1987). In the same time on different objects registered positive biological activity of waters belonging to the category of isotopic lungs Gleason JD, Friedman I., 1975; Bild W, Năstasă V, Haulică I., 2004). Systematic studies conducted at the State Research Center of the Russian Federation “Institute of Biomedical Problems” of the Russian Academy of Sciences to create a habitat for cosmonauts with an optimal isotopic composition of biogenic chemical elements have shown that water with a reduced content of heavy isotopic molecules in comparison with the natural content of heavy isotopic molecules is a necessary component of the life support system of astronauts during long flights (Sinyak Y. et al., 2003).

Chapter 4. Differences in the chemical properties of light and heavy water

In the body of animals, the isotopic composition of water is close to the composition of rainwater in their habitats. For humans, significant adjustments to this dependence are made by vegetables and fruits grown in other climatic and geographical conditions. Thus, tropical fruits and vegetables grown close to the equator have lower D, O17 and O18 values and are more beneficial for health than those grown in temperate latitudes. The isotopic ratio of protium: deuterium H: D in mainland waters is 4700: 1. In seawater, there are 6800 H atoms per 1 D atom, i.e. the D content is 0.0135 atomic%, or 0.015 wt%. All or most of the D in ordinary water is in the form of HDO, and not in the form of D_2O. At normal temperature, the hydrogen bond energy in heavy water is 340 cal / mol more than in protium water. Compounds dissolve worse in heavy water. With the exception of chloroform $CHCl_3$-$CDCl_3$ and tetrabromoethyl, the viscosity of deuterium compounds is 10-15% higher than protium ones, and the rate of their reactions slows down 6-8 times even at room temperature. In most chemical reactions, with rare exceptions, D reacts more slowly than protium. For heavy isotopes (deuterium and tritium), the difference in the rates of the reactions in which they participate is due both to the difference in the masses of the atoms and those molecules into which they enter, and to changes in the activation energy. At 0 ° C, H interacts with chlorine in in which they participate, is due both to the difference in the masses of atoms and those molecules in which they enter, and to changes in the activation energy. At 0 ° C, H interacts with chlorine in in which they participate, is due both to the difference in the masses of atoms and those molecules in which they enter, and to changes in the activation energy. At 0 ° C, H interacts with chlorine in

13.4 times faster than D. Since D displaces H from the active zones of catalysts, the removal of even trace amounts of deuterium from them dramatically increases the rate of catalytic and enzymatic reactions. The viscosity of heavy water is 10-20% higher than that of light water, and the density is 10% higher. Heavy water is a worse solvent than light water. It has a higher temperature and heat of evaporation than the light one: at 3.82 ° C, 11109 cal / mol instead of 10702 cal / mol. Higher by 5.5% and the heat of fusion of heavy water.

Since water in the cell acquires the properties of ice, and H2O and D2O in the solid phase differ more from each other, the effect of D on biochemical reactions in the cell is stronger than in plain water.

As a universal medium in which all biological reactions take place, light water increases the rate of these reactions in comparison with water of natural isotopic composition. This effect is known as the kinetic isotope effect of the solvent (Reichardt K., 1991). Less structuredness, viscosity, density, etc. of light water as a solvent lead to the acceleration and specificity of enzymatic reactions.

Light water, purified from heavy isotopologues, effectively removes toxins and metabolic products from the body due to its transport properties. The toxicoprotective properties of light water have been confirmed by experimental studies (Doina PM et al., 2008).

Chapter 5. Biochemical properties of light water

Water with a concentration of deuterium reduced to 30% (the so-called "light water" water) promotes an increase in the biomass and number of seeds, accelerates the development of genital organs and stimulates spermatogenesis in birds. A decrease in the content of deuterium by 25% below the norm in the water that was given to the animals had a beneficial effect on their development: pigs, rats and mice gave birth to offspring many times more numerous and larger than usual, and the egg production of chickens doubled.

A unique 240-day experiment to study changes in the isotopic composition of biogenic chemical elements in the human body was carried out at the State Research Center of the Russian Federation "Institute of Biomedical Problems" of the Russian Academy of Sciences. It turned out that under conditions of severe stress and harmful external influences, our body, first of all, "gets rid" of heavy isotopes, including deuterium and oxygen-18. This means that in order to increase vitality and mobilize them to fight against unfavorable external influences, we need to cleanse the body of heavy isotopes in the same way as we cleanse it of toxins. Obviously, it is precisely with such purification that the positive effect of light water on a person is associated.

In Japan, the USA and some other countries, light water is used for the prevention of neoplastic diseases. At the same time, a decrease in the risk of cancer with regular use of light water is directly associated with the deuterium removal of the body.

Basic biochemical properties of light water. Light water has a lower viscosity than natural water. This allows it to more easily penetrate cell membranes and increase the rate of water exchange in the body. The solubility of substances in light water is higher than in natural water, which makes it possible for it to more fully and quickly remove metabolic products from the body, while cleaning it from heavy metal salts, toxins and other harmful substances. Enzymatic (catalytic) speed reactions in light water are higher than in ordinary water. This allows you to intensify metabolic processes and helps the body recover faster after heavy exertion.

Light water allows in a natural way, without the use of any pharmaceuticals, to significantly increase the energy resources of the body. As studies of the laboratory of membranology of the Scientific Center of Children's Health of the Russian Academy of Medical Sciences have shown, the level of ATP in the cells increases significantly (by 30%) in light water. At the same time, cells are more actively resisting the effects of various poisons on them. So, when a cell is exposed to chemicals that suppress cell respiration, the survival rate of cells in light water in an hour is 2 times higher than in bidistillate.

When acting on animals **γ-** irradiation at a dose of LD50, it was found that the survival rate of animals that consumed light water for 15 days before irradiation was 2.5 times higher than in the control group, which indicates the strong radioprotective properties of light water. This means that the use of "light" water for residents of large cities, in conditions of increased background radiation, is certainly useful.

Thus, the spectrum of action of light water is very wide. The fact is that with regular consumption of light water, there is a gradual purification of the whole body from heavy water. This is accompanied by an increase in the functional activity of cells, organs and various body systems. There is a normalization of metabolic processes, an increase in the body's defenses and resistance to damaging influences. The rate at which the body is cleared of heavy water depends on the person's body weight and the amount of light water consumed. On the example of a person weighing 75 kg, it is shown how the content of heavy water in the body changes at an initial standard level of 145 relative units. It is known that most of the long-livers in our country live in Dagestan and Yakutia - 353 and 324 people per million inhabitants, while the average for Russia

- only 8 people. Note that lighter drinking water in these regions naturally reduces the content of heavy water in the body to 130 units.

The main effect of light drinking water on the human body is a gradual decrease in the deuterium content in body fluids. The analysis of the results obtained allows us to say that the purification of the body's water from heavy water with the help of light drinking water improves the functioning of the most important body systems. The properties of light water discovered in recent years allow us to reasonably speak of good prospects for the use of light water in medicine and the food industry.

Chapter 6. Effect of heavy water on biochemical processes in living organisms

Heavy water (deuterium oxide) - has the same chemical formula as ordinary water, but instead of hydrogen atoms it contains two heavy hydrogen isotopes - deuterium atoms. The formula for heavy hydrogen water is usually written as: D2O or 2H2O. Externally, heavy water looks like ordinary water - a colorless liquid without taste and smell, but in terms of its physicochemical properties and negative effects on the body, heavy water is very different from light water. The first results of studying heavy water show how many unusual properties are concealed by such an ordinary substance as water.

Russian researchers have long discovered that heavy water inhibits the growth of bacteria, algae, fungi, higher plants, and animal tissue culture. It is well known, for example, that under the influence of heavy water, glucose-initiated release of insulin from the tissue of the pancreas and the islets of Langerhans is inhibited, and the rate of oxygen absorption by the mitochondria of cells decreases.

Abroad, they tried to give heavy water to mice with malignant tumors. But that water turned out to be really dead: it killed both tumors and mice. Various researchers have found that heavy water has a negative effect on plant and living organisms. The experimental dogs, rats and mice were given water to drink, a third of which was replaced with heavy water. After some time, the metabolic disorder of animals began, the kidneys were destroyed. With an increase in the proportion of heavy water, the animals died. It is interesting that after the exchange of H ± D enzymes do not stop their function (Thomson et al., 1966; Denko, 1974), but changes as a result of isotopic substitution due to primary and secondary isotope effects (Thomson, 1963; Halevy, 1963), as well as the action of heavy water as a solvent (high structure and viscosity compared to ordinary water) lead to a change in the rates (slowdown) and specificity of enzymatic reactions in heavy water.

At high concentrations of heavy water (deuterium) in the body, carbohydrate metabolism and synthesis of nucleic acids are suppressed. The presence of deuterium in biological systems leads to changes in structure and properties vital macromolecules such as deoxyribonucleic acids (DNA) and proteins. At the same time, primary and secondary isotopic effects of deuterium are distinguished depending on the position of the deuterium atom in the molecule. The most important bonds for the structure of the macromolecule are dynamic short-lived hydrogen (deuterium) bonds. They are formed between neighboring deuterium (hydrogen) atoms and heteroatoms of oxygen, carbon, nitrogen, sulfur, etc. and play a major role in maintaining the spatial structure of macromolecular chains and how these structures interact with other neighboring macromolecular structures, as well as with the heavy aquatic environment.

The structural and dynamic properties of the cell membrane, which mostly depend on the qualitative and quantitative composition of lipids, can also change in the presence of heavy water. The obtained result is explained by the fact that the cell membrane is one of the first cell organelles that is exposed to heavy water, and thereby compensates for the real parameters of the membrane (viscosity, fluidity, structuredness) by changing the quantitative and qualitative composition of lipids.

The effects observed during adaptation to heavy water are associated with the formation in heavy water of conformations of molecules with different structural and dynamic properties than those formed with the participation of hydrogen, and therefore having different activity and biological properties. So, according to the theory of absolute rates, the breaking of CH bonds can occur faster than CD bonds, the mobility of the D + ion is less than the mobility

H +, the ionization constant of heavy water is less than the ionization constant of ordinary water. All this is reflected in the kinetics of chemical bonds and the rate of chemical reactions in heavy water.

The amount of deuterium in natural water is comparable to the content of such important trace elements as sodium and potassium, and far exceeds the permissible level of water pollution with iron, aluminum, chromium and copper taken together. It is well known that even minor fluctuations in the content of trace elements in water can seriously affect human health. Deuterium in this sense was no exception. According to Professor G.D. Berdyshev, even shallow (by 5 - 10%) water purification from deuterium (heavy water) can significantly improve it, giving the water immunostimulating and rejuvenating properties, not to mention deep water purification.

When studying the biological effects of heavy water, it was found that, unlike light natural water, which is the source of life, heavy water in its pure form is a poison for all life on Earth - from protozoa and plants to higher animals and humans. Even with a large dilution (3 ÷ 5 times), it is capable of causing irreversible changes in the body of higher animals, which lead to their death. Nevertheless, the question of the effect of natural-level heavy water on human health and life expectancy was not raised until the 60s of the twentieth century, when Soviet scientists B.N. and Toroptsev I.N. were the first to hypothesize that the purification of water from deuterium would dramatically improve its properties, turning water into a stimulant of life. But only in the early 90s of the twentieth century, works appeared that experimentally confirmed this hypothesis.

In terms of chemical properties, deuterium is identical to the hydrogen atom and, when it enters the body, is capable of replacing it in all vital compounds, including RNA and DNA chains. This can lead to an increase in the number of genetic defects during cell division and disruptions in the work of finely tuned body systems, since biologically such a replacement is far from equivalent.

According to the observations of Israeli scientists (V.E Vetshtein and others), with the constant use of desalinated sea water, the overall morbidity and mortality of newborns increases. The number of stillborn children is increasing. This is because desalinated seawater has a higher heavy water content than fresh river water. It has been established that the constant use of water containing 1.5% of heavy water leads to death in higher organisms.

Abroad, they tried to give heavy water to mice with malignant tumors. But that water turned out to be truly dead: it killed both tumors and mice. Various researchers have found that heavy water has a negative effect on plant and living organisms. The experimental dogs, rats and mice were given water to drink, a third of which was replaced with heavy water. After some time, the metabolic disorder of animals began, the kidneys were destroyed. With an increase in the proportion of heavy water, the animals died.

The doctors' hopes for the anticancer properties of heavy water did not come true. Unfortunately, although heavy water inhibits the development of all studied tumors, it does not prolong the life of experimental mice. Once in the body, heavy water can cause metabolic disorders, kidney function, hormonal regulation and a decrease in immunity. At the same time, when cells enter a deuterated heavy hydrogen medium, protonated water not only disappears from them due to the H2O-D2O exchange reaction, but also a rapid H ± D exchange occurs in the hydroxyl, sulfhydryl and amino groups of all organic compounds, including proteins, nucleic acids, lipids, Sahara. Only the C – H-bond does not undergo exchange and compounds of the C – D type are synthesized "de novo".

Interestingly, after the exchange of H ± D enzymes do not stop their function (Themson et al., 1966; Denko, 1974), but changes as a result of isotopic substitution due to primary and secondary isotope effects (Thomson, 1963; Halevy, 1963), while Also, the action of heavy water as a solvent (greater structure and viscosity in comparison with ordinary water) leads to a change in the rates (slowdown) and specificity of enzymatic reactions in heavy water.

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The structural and dynamic properties of the cell membrane, which mostly depend on the qualitative and quantitative composition of lipids, can also change in the presence of heavy water. The obtained result is explained by the fact that the cell membrane is one of the first cell organelles that is exposed to heavy water, and thereby compensates for the real parameters of the membrane (viscosity, fluidity, structuredness) by changing the quantitative and qualitative composition of lipids. This heavy water impairs the body's metabolism.

The effects observed during adaptation to heavy water are associated with the formation in heavy water of conformations of molecules with different structural and dynamic properties than those formed with the participation of hydrogen, and therefore having different activity and biological properties. So, according to the theory of absolute rates, the breaking of CH bonds can occur faster than CD bonds, the mobility of the D + ion is less than the mobility of H +, the ionization constant of heavy water is less than the ionization constant of ordinary water. All this is reflected in the kinetics of chemical bonds and the rate of chemical reactions in heavy water.

The amount of deuterium in natural water is comparable to the content of such important trace elements as sodium and potassium, and far exceeds the permissible level of water pollution with iron, aluminum, chromium and copper taken together. It is well known that even minor fluctuations in the content of trace elements in water can seriously affect human health. Deuterium in this sense was no exception. According to Professor G.D. Berdyshev, even shallow (by 5 - 10%) water purification from deuterium (heavy water) can significantly improve it, giving the water immunostimulating and rejuvenating properties.

Chapter 7. Biological properties of light water.

Light water is natural water, partially or completely purified from heavy water molecules, and, thanks to such purification, acquires unique properties. According to Professor G.D. Berdyshev, who has been actively using light water in his practice for many years, even shallow water (total on the 5-10%) cleaning water from deuterium gives water immunomodulatory and anti-aging properties of the body. Purification of water from heavy isotopologues has the strongest effect on the energy apparatus of a living cell. The respiratory chain of mitochondria is characterized by cascade reactions. Heavy isotopologues slow down the rate of reactions in the respiratory chain. By the example of the reaction of hydrogen peroxide generation by mitochondria with succinic acid as a substrate, the general inhibitory effect of heavy water isotopologues has been experimentally proved. Reducing their content in water to a level below natural concentrations deinhibits and authentically accelerates studied reaction (Doina PM et al., 2008). Under the influence of light water, the glucose-initiated release of insulin from the tissue of the pancreas and the islets of Langerhans is de-inhibited and the uptake of glucose by cells increases. Light water increases the rate of metabolic reactions, for example, during aging, metabolic syndrome, diabetes, etc. (Patent RU 2270017).

Studies carried out at the Institute for Biomedical Problems of the Russian Academy of Sciences have shown that light water has a protective effect when animals are irradiated with gamma rays in low doses, which manifests itself in a decrease in the severity of radiation damage and activation of recovery processes. The mechanisms of the influence of light water on the organism of experimental animals are associated with an increase in the general resistance of the organism, part of which is also radiation resistance (Rakov D.V. 2007). It was shown that water with a reduced content of heavy isotopologues in comparison with the level of their natural concentrations during prolonged use does not have a toxic effect on the organism of experimental animals.

Light water has immunomodulatory, antitumor, geroprotective and radioprotective properties, enhances the effect of drugs.

What is the effect of light drinking water on the human body?

Light drinking water quickly and effectively removes metabolic products from the body, normalizes metabolism, blood pressure and blood sugar, increases the body's energy resources, and promotes rapid recovery of the body after heavy exertion.

Today it is proven that light water contributes to:

- normalization of metabolism, elimination of toxins, toxins and radionuclides from the body;

- treatment and prevention of oncological diseases, diabetes mellitus, kidney and liver diseases;

- restoring the body under stress and overwork;
- normalizes blood pressure, lipid and carbohydrate metabolism;
- has a powerful cosmetic effect;
- slows down the aging process and increases life expectancy.

Chapter 8. Clinical trials of light water

Heavy isotopic water molecules are a pollutant of the internal environment of the human body and cause numerous unexplained malfunctions. Water with a high content of light molecules facilitates biochemical processes, which increases the functionality of cellular systems and the body as a whole. It is possible to remove heavy isotopologues of water from the body only with the help of isotope exchange reactions, for which light water should be used. An increase in the proportion of light molecules provides a new degree of purity of drinking water, which, with daily use, is realized in an increase in working capacity, physical activity, endurance and resistance of the body (Mukhachev V.M., 1975).

To study the effect of light drinking water on the human body, clinical trials of light drinking water "Langvey-100" were carried out in the Department of Endocrinology of the Russian Research Center for Restorative Medicine and Balneology of the Ministry of Health of the Russian Federation. The trials involved 50 patients with type I and II diabetes mellitus (DM) and 40 patients with various manifestations of metabolic syndrome. Clinical trials were carried out in the framework of a simple blind study, where drinking water "Sofrinskaya" was used as a placebo, which was close in salt and trace element composition to the tested water. All water was given to patients in the same package without labels. In the experimental groups, patients received basic therapy and light water "Langvey-100" (1 liter per day), in the control groups - basic therapy and water placebo.

During water tests on patients with various manifestations of metabolic syndrome, it was found that the test water has reliable hypoglycemic, hypolipidimic and hypotensive effect on the organism of the examined patients. This means that water with a reduced, in relation to the natural level, content of deuterium and oxygen-18 affects, first of all, on metabolic processes. In 34 (85%) patients, an increase in the concentration of the end product of lipid peroxidation, malondialdehyde, was revealed. On average, this value was 7.8 μmol, which is more than 47% more than the norm. After a course of taking light water, the concentration of malondialdehyde decreased by an average of 18%, and in 40% of patients in the experimental group, the content of malondialdehyde decreased to the upper limit of normal values. The results obtained may indicate the antioxidant effect of light water.

Chapter 9. Antineoplastic properties of light water.

For the first time the antitumor properties of light water were discovered in 1993 by the Hungarian microbiologist G. Szomlai. In his opinion, light water is an extremely original approach to the issue of slowing down the rate of reproduction of cancer cells in the body. He argues that regular consumption of light water can reduce the concentration of deuterium in the cells of the body and, thereby, slow down and even stop the development of cancer.

Light water exhibits antitumor activity, which is shown in the works of scientists carried out in research centers in different countries (Gyöngyi Z. et. Al., 2000; Berdea P, 2001; Krempels K. et al., 2008; Cong F.-S., et al., 2010).

According to G. Shomlai, the results of clinical trials conducted in 1994-2001. in Hungary, showed that the survival rate of patients who used light water in combination with traditional methods of treatment or after them is significantly higher than that of patients who used only chemotherapy or radiation therapy (Somlyai G., 2001).

As a result of the experiments, it was established: in an environment with a lower than natural content of deuterium, division of MCF-7 tumor cells (adenocarcinoma of the mammary glands) begins with a delay of 5-10 hours; in almost 60% of mice with immunosuppressed and transplanted human breast tumors MDA and MCF-7, the intake of light water (30 ppm) caused complete tumor regression; in mice with transplanted PC-3 tumors (human prostate tumor), the intake of light water (90 ppm) increased the survival rate by 40%, while the ratio of the number of dividing cells to those killed in tumors of the experimental group was 1.5: 3, and the control groups - 3.6: 1.

In the course of clinical trials of light water, conducted in Hungary in 1994-2001, it was revealed that:

- the survival rate of patients who used light water in combination with traditional methods of treatment or after them is significantly higher than that of patients who used only chemotherapy or radiation therapy;

- the survival rate of patients with stage 4 breast cancer who consumed light water during treatment turned out to be 3 times higher after two years than among patients who used only traditional methods of treatment;

using light water during or after sessions chemotherapy allows partially or wholly take away the immunosuppressive effect of a cytostatic agent, to reduce or completely remove the adverse side effects of the use of chemotherapy drugs.

At the same time, in all cases there was a significant increase in the duration and improvement in the quality of life of patients.

Studies of light water at the Moscow Scientific Research Institute of Oncology. Herzen P.A. (in vitro) and the Research Institute of Carcinogenesis of the Russian Cancer Research Center named after V.I. N.N. Blokhin Russian Academy of Medical Sciences (in vivo) (together with the State Scientific Center of the Russian Federation "Institute of Biomedical Problems") confirmed the inhibitory effects of light water on the processes of tumor cell multiplication and tumor growth.

In conclusion, I would like to cite excerpts from the report of Alexander Timakov at the Russian Scientific Center "Kurchatov Institute" (Moscow). “The results of clinical trials and studies of the biological activity of water with a reduced content of heavy hydrogen isotope, obtained by Russian and foreign scientists, show that such water has a pronounced anticancer and antimetastatic effect and can be successfully used for the prevention and treatment of cancer and other diseases. In addition, long-term consumption of light water has a beneficial effect on the vital activity of the body as a whole, causes the effect of rejuvenation of the body.

A detailed analysis of domestic and foreign literature devoted to the study of the influence of "light water" is replete with scientifically confirmed facts of the positive effect of its intake on the physiological functions of a person. There are convincing data obtained by a number of authors on the positive effect of taking "light water" in psychosomatic deviations and human diseases. However, in the available domestic and foreign scientific literature, we did not find studies devoted to the influence of "light water" in physical culture and sports. Laboratory "Systemic Mechanisms of Sports Activity" Research Institute of Normal Physiology named. PC. Anokhina of the Russian Academy of Medical Sciences investigated the effect of "light water" under various drinking regimes on highly qualified athletes, using this complex biochemical and biomedical informative tests.

Research methodology

The surveys involved 19 practically healthy persons aged 18-27 years old, going in for sports. For 28 days, they were asked to drink "light water" instead of ordinary drinking water.

The course reception of "light water" was carried out by them in various volumes, depending on which the subjects were divided into 3 groups:

- Group 1 (7 people) - took "light water" daily for 28 days in accordance with individual needs.

- Group 2 (7 people) - took "light water" dosed for 28 days - 200 ml of "light water" immediately before training and 200 ml of "light water" immediately after training.

- Group 3 - control (5 people) - drank ordinary drinking water, packaged in the same dishes as "light water". The drinking regimen was the same as in the 1st group, however, the subjects were not informed that this was ordinary drinking water.

Before and after the course of taking "light water", the subjects of all groups were examined.

Before the examination, each subject was examined by a doctor, as a result of which information about the subject, his anamnesis (transferred and accompanying diseases), measured anthropometric indicators (age, body weight, height), on the basis of which the body mass index (BMI) and the proper basal metabolic rate (ECE, kcal) were calculated. Based on this information the subject was admitted to examination.

Before and after the course of taking "light water", the subjects of all groups assessed the psychological and vegetative status, examined the lung volumes in the background and during exercise, conducted laboratory blood tests (clinical and biochemical blood tests, blood tests for immune and hormonal status, diagnostics of anemia, antioxidant activity).

Assessment of psychological status the subjects were carried out both on based on psychological questioning, where the subjects were offered the SAN questionnaire and the Spielberger test in order to assess the state of health (C, points), activity (A, points) and mood (H, points) (Doskin V.A., Lavrentyeva N.A., Miroshnikov M. N. et al., 1973), as well as the levels of personal (LT, points) and situational (ST, points) anxiety (Khanin Yu.L., 1977), and on the basis of a subjective feeling of well-being (sam, points). Subjective well-being (sam) was assessed by the subjects themselves on a 5-point scale. Subjective well-being, in our opinion, was an integral characteristic of the subjects' perception of their own state in the process of taking "light water".

For *assessment of vegetative status* ECG registration was carried out (I, Leads II, III) (Fig. 1) for 5 minutes using the VNS-Spectrum complex (Neurosoft, Ivanovo). On the basis of the cardiointervalogram, the heart rate (HR, beats / min) was calculated and the indicators of heart rate variability were calculated (SDNN, ms; D, ms; Mo, ms; Δ X, ms; AMo,%; CV,%, etc.), the stress index of R.M. Baevsky (IN, conventional unit) (Baevsky R.M., Kirillov O.I., Kletskin S.Z., 1984). A spectral analysis of the heart rate was carried out on the basis of the fast Fourier transform calculated as the total power of the spectrum (Tp, ms^{2}), and spectral powers in three frequency ranges (in ms^{2} and in% of Tp): high-frequency - HF, low-frequency - LF, ultra-low-frequency - VLF (Task Force of the European Society of Cardiology ..., 1996). Moreover, blood pressure was measured using an AND UA-767 automatic meter (Japan) (ADS, ADP, mm Hg). Based on the values of heart rate and blood pressure, the stroke volume of the heart (SV, ml), total peripheral vascular resistance (TPR, dyn * s / cm five), minute volume of blood circulation (IOC, l / min) (Karpman V.L., Lyubina B.G., 1982). Kerdo's vegetative index (VIC,%) was assessed (Vein A.M., Solovyova A.D., Kolosova O.L., 1981).

Fig. 1. Assessment of the athlete's vegetative status

Besides Togo, in background condition examined were carried out *studies of pulmonary volumes,* for which the Spiro-Spectrum device (Neurosoft, Ivanovo) and the computer-controlled device Quark b2 (Cosmed, Italy) were used. Moreover, in the background, everyone the subject in a standing position was asked to tightly clasp the mouthpiece with his lips and breathe calmly with the clamp on his nose (Fig. 2). After completing 8-10 breathing cycles, the subject was asked to take a sharp deep breath followed by a full exhalation. Then return to calm breathing. This kind of test made it possible to measure the vital capacity of the lungs (VC, L), the reserve volume of inspiration (RO in., L) and the reserve volume of exhalation (RO out, l), tidal volume (TO, l), as well as knowing the respiratory rate (RR, 1 / min), calculate the minute breathing volume (RR = RR * DO, l / min).

Fig. 2. Study of pulmonary volumes in an athlete

Were carried out *laboratory blood tests (Fig. 3).* Evaluated clinical and biochemical blood tests, blood tests for immune and hormonal status, antioxidant activity was assessed and anemia diagnosed.

Fig. 3. Room for taking blood for laboratory research

Clinical blood test included the following blood parameters: concentration hemoglobin, quantity erythrocytes, hematocrit (the ratio of formed elements and plasma), the average volume of one erythrocyte, the average content of hemoglobin in the erythrocyte, the average concentration of hemoglobin in the erythrocyte, the number of leukocytes, percentage content stab neutrophils, percentage segmented neutrophil content, percentage of eosinophils, percentage of basophils, percentage of lymphocytes, percentage of monocytes, erythrocyte sedimentation rate, platelet count, hemoglobin, erythrocyte count, hematocrit, leukocyte count, stab neutrophils, erythrophilia, and segmented basophils, lymphocytes, monocytes, erythrocyte sedimentation rate (ESR), platelets.

Blood chemistry included the following indicators: concentration glucose, common bilirubin, cholesterol, squirrel, albumin, globulin, uric acid, urea. The amount of ions in blood plasma was measured: potassium, sodium, chloride, calcium, magnesium. The concentration of pancreatic enzymes was determined: alpha-amylase, pancreatic amylase and lipase. The concentration of rheumatoid factor was recorded.

Analysis blood on the immunity: immunoglobulin-G (Ig-G), superoxide dismutase (SODM), total antioxidant activity (AOA).

Diagnosis of anemias was carried out using the following indicators: folic acid, erythropoietin.

Blood test for hormonal status included the following indicators: total T3, TSH, prolactin, testosterone, cortisol, insulin.

To assess the effect of the course intake of "light water" *for physical performance* the subjects were asked to perform running work to failure on a treadmill at a speed of 10 km / h with a treadmill angle of 6 degrees. Such a load provided a long-term physical load that did not reach the near-limit level, which corresponded to the task of studying endurance during prolonged physical work. At the same time, the time of physical work with a running load took an average of 7.5 minutes, i.e. the test corresponded to the state of the aerobic gas exchange regime. Before performing running work to failure, the volume of ventilation of the lungs was measured as an indirect indicator of oxygen consumption, and heart rate. In the process of performing running work, the subjects were measured the same parameters. These parameters were used as indicators of endurance and physiological responses. All indicators were taken in tests preceding the one-month course of taking "light water" and immediately after its completion (Fig. 4).

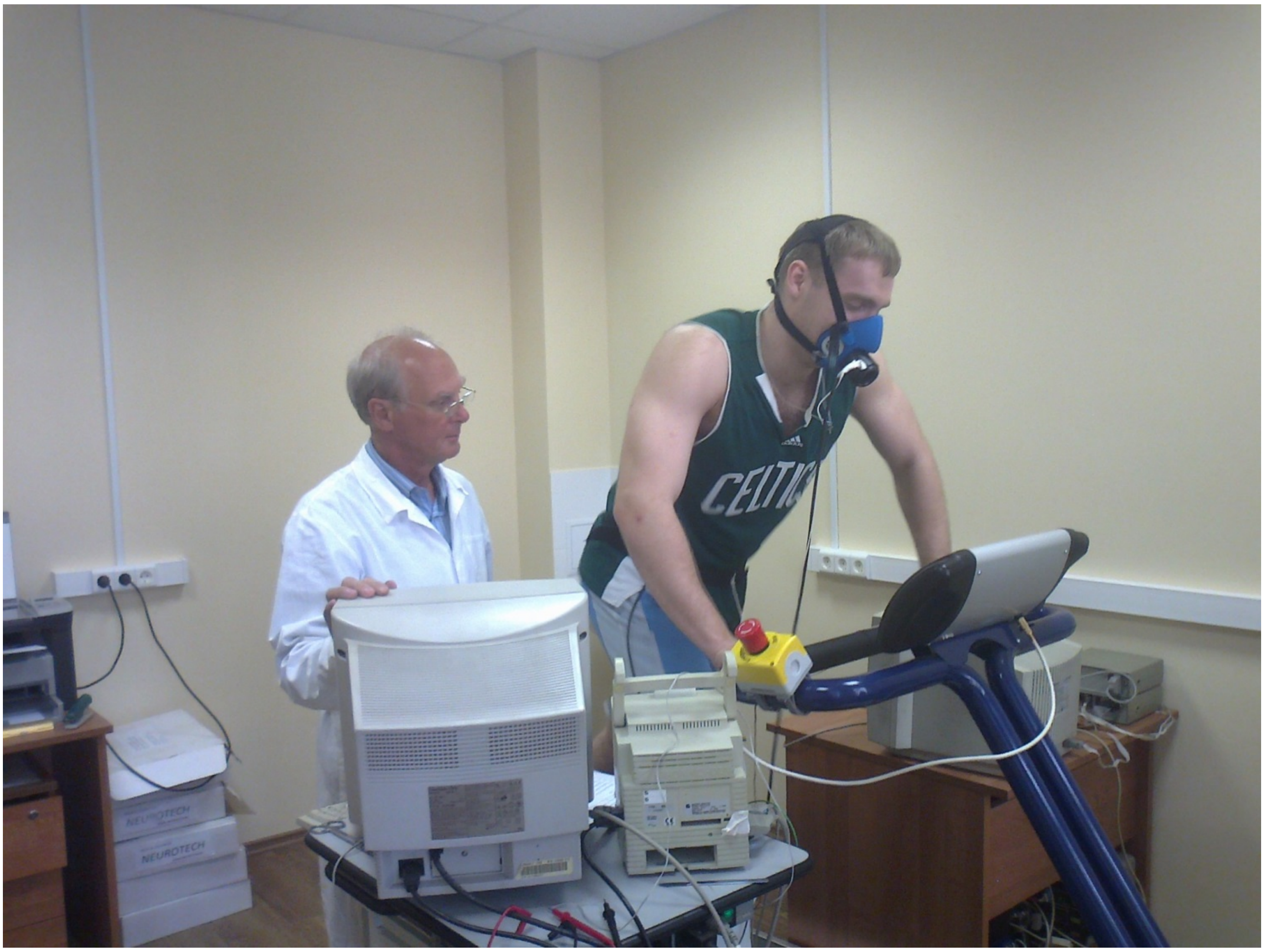

Fig. 4. Work of an athlete on a treadmill with control of the volume of ventilation of the lungs and heart rate

In addition, all the subjects before and after taking water for three minutes were asked to perform the maximum possible number of squats (speed-strength physical work in the zone of increasing hypoxia), which was counted. Before and after the load (the maximum number of squats in three minutes, holding the breath while inhaling and expiration before and after physical work), they measured their systolic (ABP, mm Hg) and diastolic (BPP, mm Hg) blood pressure, heart rate (HR, beats / min) (Fig. 5), the time of maximum voluntary breath holding on inhalation (t in, s) and on exhalation (t out, s) (Fudin N.A., Khadartsev A.A., Orlov V.A., 2011).

Fig. 5. Removal of the main hemodynamic parameters from the athlete after the load

During the course of taking "light water", the subjects of all three groups filled in individual maps of subjective sensations every day, in which all subjective sensations that appeared during the period of taking light water were recorded. In addition, the subjects of all groups monitored the amount of water they drank on a daily basis.

Statistical processing of the obtained data was carried out using the STATISTICA 6.0 package. To compare intragroup and intergroup differences, the nonparametric Wilcoxon and Mann-Whitney tests were used.

Chapter 1. Influence of "light water" on the functional state of highly qualified athletes

The importance of water for living beings is due to the fact that it was in water that the first living systems arose, and which can no longer do without it. Despite the fact that water is closely related to all physiological processes of living organisms, it is still insufficiently studied. Water has a high heat capacity, the highest surface tension, it is ionized, and the structure of water is due to its small size, the polarity of the molecule and its hydrogen bonds.

Water is capable of dissolving many substances in itself, acquiring certain properties. Depending on the mineral composition of the water, soft and hard water is emitted (contains calcium and magnesium cations), in depending on the salt composition - fresh, rain, sea, distilled, drinking and mineral water, and depending on the isotopes - "light" (with a low deuterium content), "heavy" (with a high deuterium content), "superheavy" (contains tritium).

"Light water" is water that is partially or completely purified from deuterium and, thanks to such purification, acquires unique properties. The main effect of "light drinking water" on the human body is a gradual decrease in the content of deuterium in the body fluids due to isotope exchange reactions. We believe that the course intake of "light drinking water" will improve the work of the whole organism of the subjects.

1.1. Influence of light water on changes in body weight and psychological status of the subjects

In this survey, 19 highly qualified athletes - volunteers took daily in different amounts of "light water". The surveyed groups 1 took "light water" in an unlimited amount in accordance with the individual need, and group 2 - dosed (200 ml before and after training). The third group of subjects was control. These subjects took ordinary drinking water also in unlimited quantities in accordance with their individual needs.

The anthropometric characteristics of the above groups of subjects are presented in Table 1.1.

Table 1.1.1

Anthropometric data										
Groups	**age, year**		**height, cm**		**body mass, Kg**		**BMI**		**DOO, kcal**	
	M	m	M	m	M	m	M	m	M	m
one	23.6	1.4	188	3	84.6	4.2	23.9	0.5	2009	75
2	21	0.5	186	3	83.6	3.6	24	0.7	2006	62
3	21.4	0.5	184	2	77	2.1	22.8	0.3	1900	40

From the data shown in Table 1.1.1, it can be seen that the groups of the surveyed were homogeneous in terms of anthropometric parameters, since there were no significant differences in age, height, and body weight.

Analysis of the volumes of water drunk in these groups revealed that, on average, the 1st group of the surveyed drank 3.4 ± 0.5 l / day of "light water", the 3rd group - 3.3 ± 0.6 l / day of ordinary water, and the 2nd group - 0.4 l / day of "light water".

It can be seen that the subjects of the 1st and 3rd groups drank significantly more water per day than the subjects of group 2 ($p < 0.05$). The volumes of water drunk by the subjects of the 1st and 3rd groups differed insignificantly (Fig. 1.1.1). Figure 1.1.1 shows that the surveyed groups 1, on average, drank a little more "light water" than the surveyed groups 3 of the usual. This allows us to assume that at the organoleptic level it was “light water” that athletes preferred.

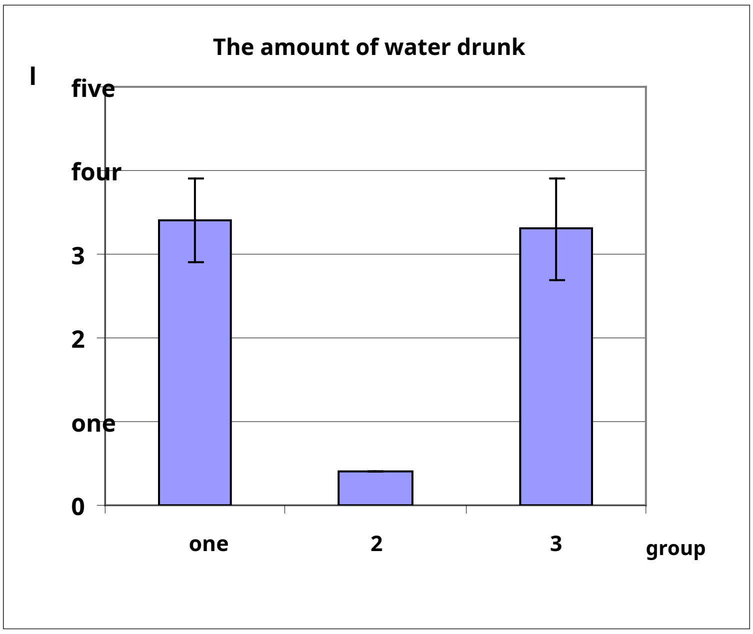

Figure 1.1.1. Average values of the volumes of water drunk in the 1st and 3rd groups of subjects.

Table 1.1.2. and in fig. 1.1.2. the average values of body weight in the examined groups listed above are presented.

Table 1.1.2

Average values of body weight in the examined groups 1,2.3 before (weight-1) and after (mass-2) course water intake				
group	**body weight -1**		**body weight-2**	
	M	m	M	m
one	84.6	4.19	84.3	4.19
2	83.6	3.58	84.5	3.41
3	77.0	4.8	77.0	4.0

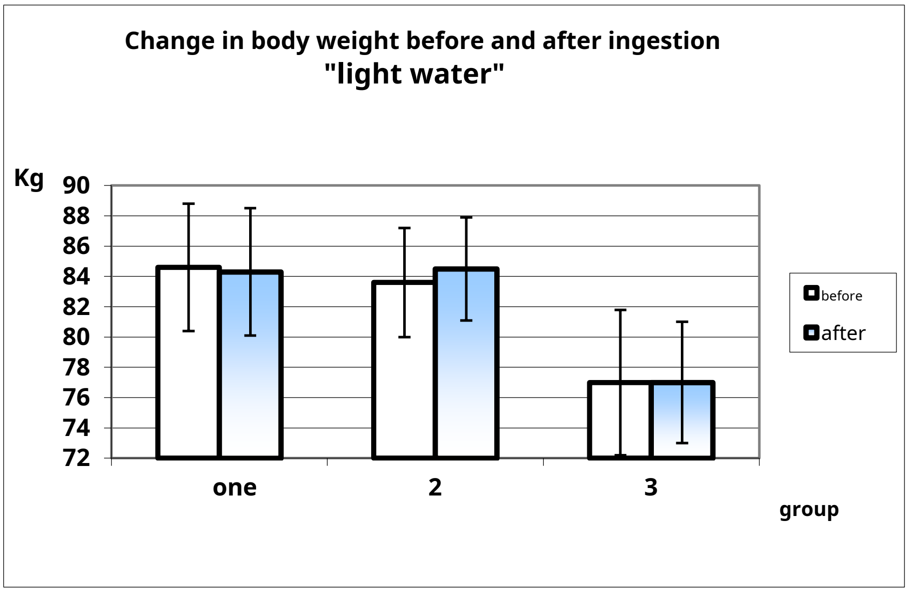

Fig. 1.1.2. Average values of body weight in the surveyed groups 1,2.3 before (light bars) and after (filled bars) course water intake

It can be seen that the body weight of the subjects of group 1 and group 3 practically did not change, while the subjects of group 2 showed a weak tendency to an increase in body weight.

Correlation analysis revealed that body weight by the end of the course intake of "light water" (body weight-2) is reliably related to body weight before water intake (body weight-1, $r = 0.97$, $p < 0.05$), with the initial BMI indicator (r = 0.66, p <0.05), with the baseline PEO (r = 0.96, p <0.05), however, no relationship with the amount of water drunk was found.

It is natural to assume that taking "light water" can affect *subjective psychological state* surveyed. IN Table 1.2.1 and Figures 1.1.3-1.1.6. the psychological characteristics of the examined selected groups are presented.

Table 1.2.1

Average values (M ± m) of subjective well-being (C, points), activity (A, points), mood (H, points) and the level of situational anxiety (ST, points) in examine selected groups 1,2,3 before (before) and after (after) a course of water intake

group		FROM		BUT		H		ST	
		M	m	M	m	M	m	M	m
one	before	5.5	0.2	5.2	0.2	5.7	0.2	35	3.4
	after	5.6	0.2	4.9	0.3	5.3	0.6	thirty	1.3
2	before	4.6	0.3	4.7	0,4	5.2	0.3	37	2.8
	after	4.6	0.7	4.8	0.6	5.5	0,4	33	2.5
3	before	5.5	0.3	five	0.2	5.8	0.2	32	0.9
	after	5.7	0,4	5.2	0,4	6	0.3	thirty	3.1

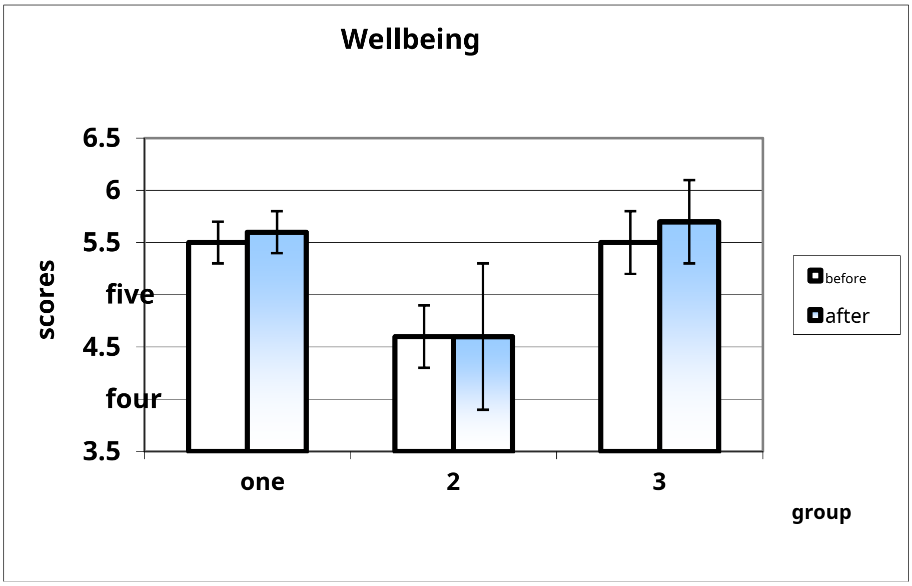

Fig.1.1.3 Average values of the level of well-being (C, points) in the surveyed groups 1,2, 3 before (light columns) and after (flooded columns) water intake.

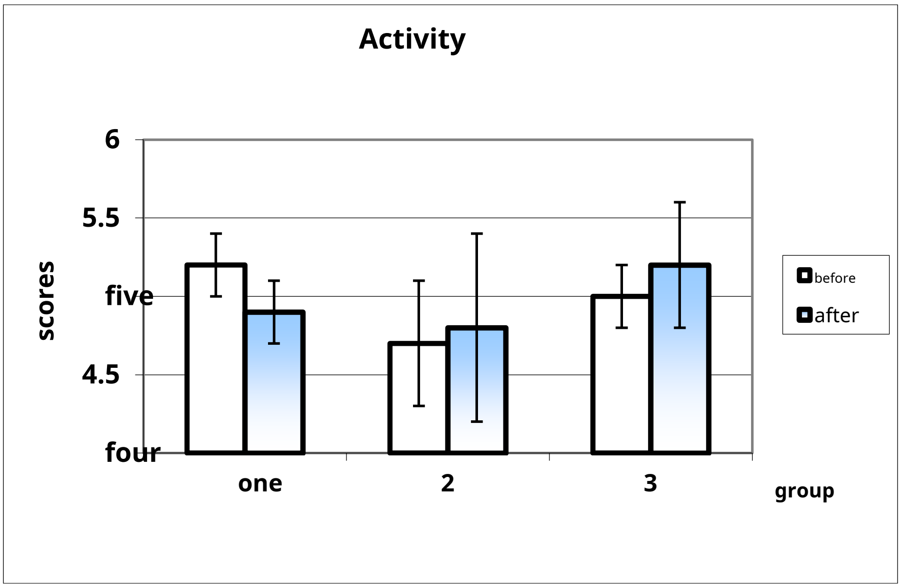

Figure 1.1.4. The average values of the level of activity (A, points) in the surveyed groups are 1,2, 3 before (light bars) and after (flooded bars) drinking water.

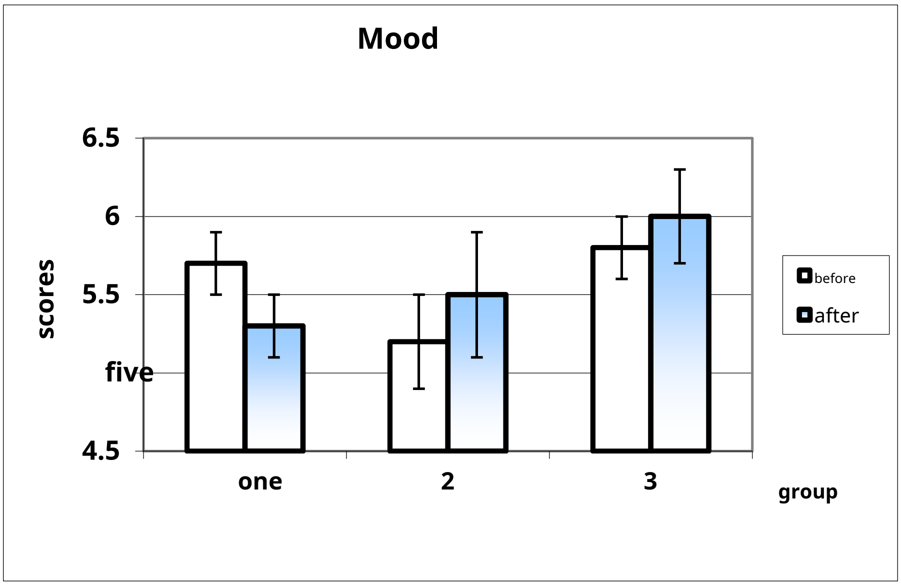

Figure 1.1.5. The average values of the mood level (H, points) in the surveyed groups are 1,2, 3 before (light bars) and after (flooded bars) drinking water.

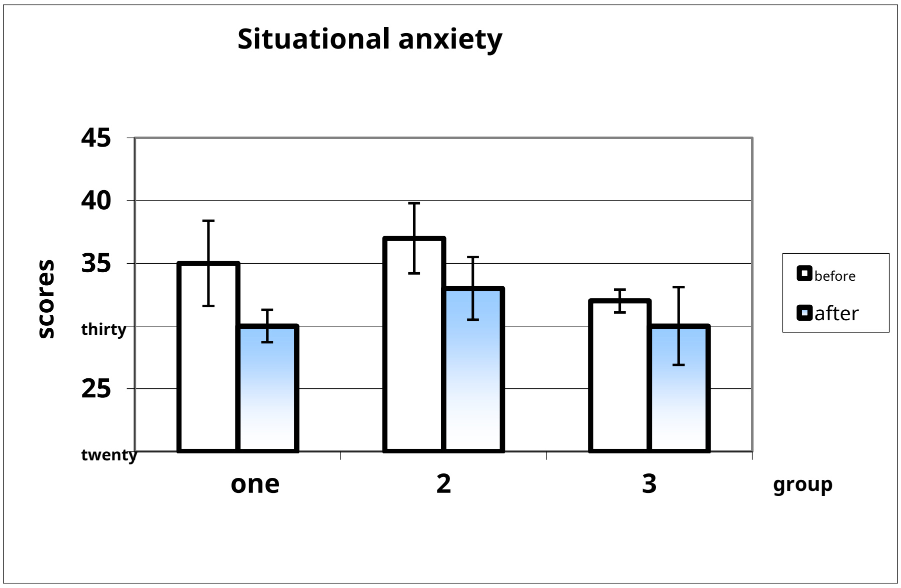

Figure 1.1.6. The average values of the level of situational anxiety of well-being (ST, points) in the surveyed groups 1,2, 3 before (light columns) and after (flooded columns) water intake.

It can be seen that neither ordinary water, nor "light water" led to a significant change in the psychological status of the subjects of all three groups. At the same time, the examined groups 1 and 2 showed a tendency towards a decrease in the level of anxiety against the background of an improvement or preservation of the initial level of well-being. In the 3rd group, a weak tendency to a decrease in the level of activity and mood was manifested after a course of taking ordinary water. In general, the changes are insignificant, and therefore it can be concluded that "light water" has an insignificant effect on the psychological status of the subjects.

Thus, "light water" has practically no effect on the psychological status of the subjects. With unrestricted intake of "light water", the surveyed group 1 drank more of it than the surveyed group 3, who took ordinary water. This is probably due to the fact that "light water" did not contain chlorine and deuterium, and therefore, according to its taste, it seemed preferable to the subjects.

1.2. The effect of the course intake of "light water" on the vegetative status, cardiac activity and hemodynamic parameters of the subjects before and after taking "light water"

The vital activity of the organism is possible only under the condition of adequate provision of metabolism, namely, when nutrients, oxygen, water enter the cells and remove carbon dioxide and metabolites from them. This function in the body is performed by the circulatory system, the main components of which are the heart and the blood vessel system.

System circulation located under control CNS and neurohumoral mechanisms of regulation. She is very sensitive to changes in the state of the internal and external environment. Optimal adaptation of the circulatory function is possible only with strict coordination of the work of all its links - the heart and the vascular system.

Electrocardiography. ABOUT work hearts can judge by electrocardiogram **e** (ECG). ECG - this is curve, reflecting bioelectric activity of the heart. When the heart is excited, a potential difference arises on its surface and in its tissues, which naturally changes in magnitude and direction as new areas of the heart are involved in the excitation. Bioelectric activity of different parts of the heart occurs in a strictly defined sequence, which is repeated in each cardiac cycle of excitation. The resulting changes in the charges of the surface of the heart create a dynamic electric field in the conductive medium surrounding the heart, which can be recorded from the surface of the body after a corresponding amplification in the form of a variable potential difference. In this case, a characteristic curve is obtained, consisting of several teeth, separated by certain intervals. This curve is called the electrocardiogram - ECG. The ECG waves are designated by the Latin letters P, Q, R, S and T, and the corresponding intervals, or segments, are PQ, ST, QT. ECG waves and intervals reflect activation and recovery processes in different parts of the heart.

In the human heart, excitement arises in the sinoauricular node. On the ECG, the excitation of this node is not recorded, it is detected only by special methods. The beginning of atrial excitation corresponds to the P wave. It is followed by the PQ interval, during which time the excitation is transmitted to the atrioventricular node. The QRS complex corresponds to the coverage of the excitation of the working myocardium of the ventricles. After the QRS complex, the isoelectric ST interval is recorded, during which the entire surface of the ventricles remains excited. Normally, the ST segment deviates from the isoelectric level by no more than 0.1 mV. The beginning of the recovery process in the ventricles corresponds to the appearance of the T wave, at the end of which the recovery is completely completed. After the T wave, an isoelectric interval corresponding to relaxation is recorded.

The amplitude and duration of the teeth, as well as the size of the ECG intervals, naturally change with various physical and physiological effects on the heart - during physical exertion, changes in body position, etc. These changes can be caused, on the one hand, by purely physical phenomena, for example, a change in the position of the heart in the chest during breathing, with a change in posture, a change in the electrical conductivity of tissues between the heart and the abduction electrodes during breathing. On the other hand, they can also be due to physiological reasons: a change in venous inflow, reflex influences on the work of the heart and on the rate of conduction in it. Thus, with normal functioning of the heart, the shape of the ECG can vary within certain limits.

The average values of heart rate and time durations of ECG segments before and after the course of taking "light water" are presented in table 1.2.1.

Table 1.2.1

Average values of heart rate and ECG intervals in subjects 1, 2, 3 groups before and after course water intake

group		**Heart rate, beats / min**		**t (PQ), ms**		**t (QRS), ms**	
		M	m	M	m	M	m
one	before	69.4	6.1	301	94	91	five
	after	66.3	4.4	231	73	94	four
2	before	65.0	3.0	288	90	102	five
	after	68.0	2.8	229	79	99	four
3	before	68.8	1.8	159	nine	91	five
	after	68.2	2.1	306	104	87	3
					$p < 0.05$		

From the data given in Table 1.2.1, it follows that the course intake of "light water" did not cause significant changes in ECG parameters in groups 1 and 2.

The PQ interval corresponds to the transit time of excitation through the atria and the atrioventricular node to the ventricular myocardium. Normally, the PQ interval is 0.12-0.2 seconds, and with bradycardia it lengthens to 0.21-0.22 seconds (Doshchitsin V.L., 1999). Figure 1.2.1 shows histograms reflecting the dynamics of changes in the duration of the PQ interval after the course of taking "light water" for all groups of subjects.

It can be seen that initially in the individuals of group 3, the PQ interval was in the normal range, which cannot be said about the rest of the subjects. After a course intake of "light water", the direction of the processes changes. In the examined groups 1 and 2, there is a tendency towards a decrease in the initially high PQ interval from 301 ± 94 to 231 ± 73 ms and from 288 ± 90 to 229 ± 79 ms, respectively. However, in group 3 (control, drank plain water), on the contrary, was noted a significant increase in the PQ interval from 159 ± 9 to 306 ± 104 ms ($p < 0.05$), which can be interpreted as a deceleration of conduction in the AV node (Fig. 1.2.1). This *the fact testifies in favor of the positive influence of "light water", which contributes to the restoration of the initially low conductivity in the AV-node.*

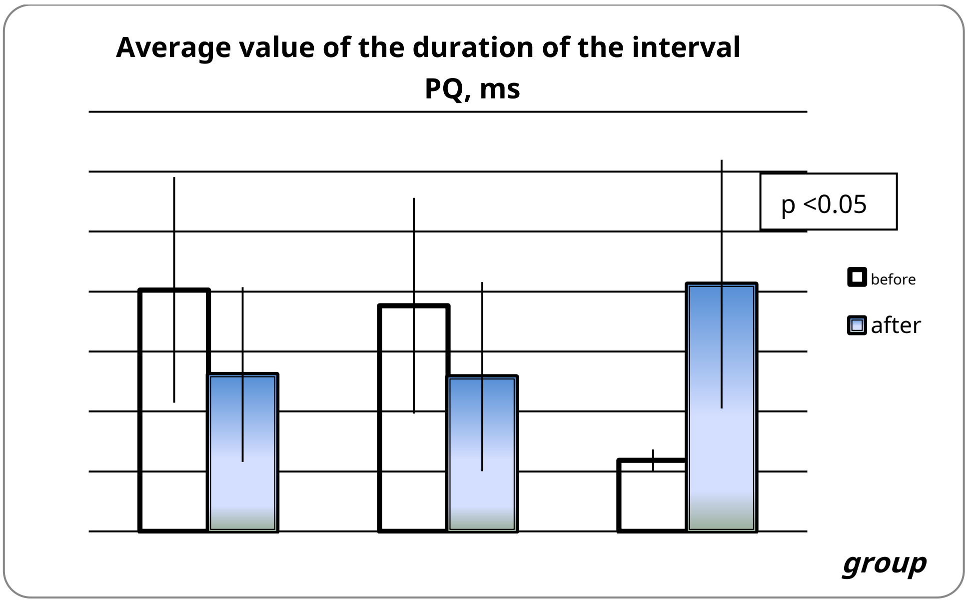

Fig. 1.2.1. Average values of the PQ interval durations (ms) for the examined groups 1, 2 and 3 before (light bars) and after a course of water intake.

Legend: p <0.05 - significant changes in the indicator after a course of water intake.

Table 1.2.2. the average values of the amplitudes of the ECG waves are presented.

Table 1.2.2

Average values of the amplitudes of the ECG teeth in the examined groups 1, 2, 3 before and after a course water intake

group		P, mV		Q, mV		R, mV		S, mV		ST, mV		T, mV	
		M	m	M	m	M	m	M	m	M	m	M	m
one	before	0.184	0.055	-0.002	0.001	0.977	0.094	-0.186	0.102	0.089	0.041	0.357	0.060
	after	0.120	0.027	-0.010	0.010	0.934	0.064	-0.177	0.094	0.091	0.020	0.323	0.048
2	before	0.167	0.080	-0.062	0.022	1.354	0.141	-0.094	0.045	0.059	0.022	0.323	0.051
	after	0.110	0.010	-0.077	0.022	1.286	0.149	-0.091	0.037	0.071	0.018	0.249	0.046
3	before	0.128	0.020	-0.030	0.027	1.042	0.203	-0.122	0.058	0.055	0.029	0.364	0.056
	after	0.234	0.094	-0.046	0.024	1.000	0.189	-0.106	0.057	0.094	0.019	0.398	0.050

It can be seen that before and after the course water intake, no significant changes were noted in the dynamics of the amplitude values of the ECG teeth, i.e. all changes did not go beyond the normal range and were in the nature of trends.

Note that of all ECG teeth, the T-wave is the most sensitive to changes in physicochemical processes in the myocardium. It is known that changes in the T wave can occur due to changes in the pH of the blood, disturbances in the electrolyte composition, hypoxia of the heart muscle (Dekhtyar G. Ya, 1955).

Figure 1.2.2 shows the average values of the T wave amplitude for the examined groups.

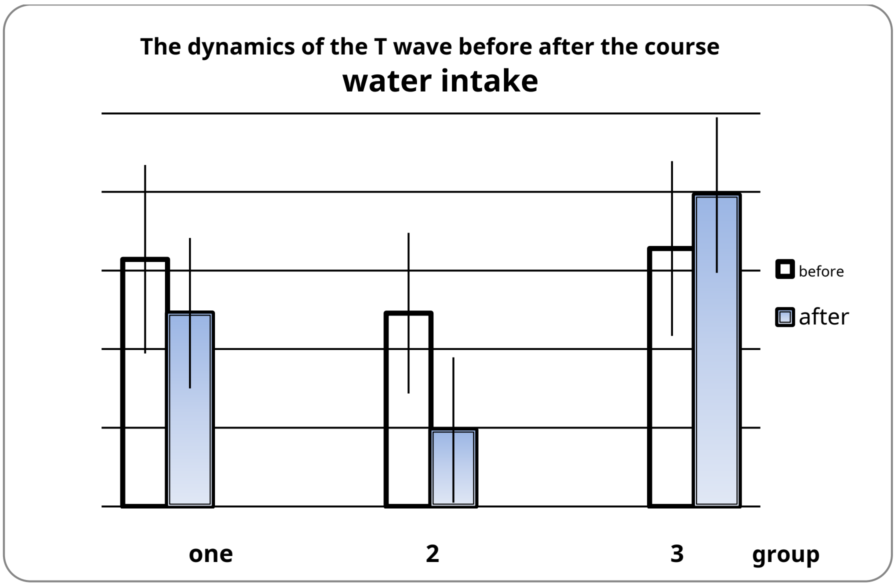

Fig.1.2.2 Average values of the amplitude of the T wave (mV) for the examined groups before (light bars) and after (filled bars) course water intake.

It can be seen from the figure that the values of the T waves in the examined groups did not go beyond the normal range - 0.25 - 0.6 mV (Doshchitsin V.L., 1999). However, it should be noted that by the end of the course water intake, in persons who took "light water" (groups 1 and 2), there was a tendency to a decrease in the T-wave, and in those who took ordinary water (group 3), on the contrary, a tendency to increase T-prong. We believe that this kind the multidirectional dynamics of changes in the T wave can be a consequence of both a violation of electrolyte metabolism when taking "light water" and changes in the autonomic tone of the subjects (Dekhtyar G. Ya, 1955).

Heart rate variability method is effective a means of assessing the state of autonomic regulation, the degree of tension of regulatory systems and the state of various links of the cardiorespiratory system. For this purpose, temporary (assessment of heart rate variability) and frequency (assessment of spectral indicators of heart rate) analysis methods are used.

It is known that the heart rate is under the control of regulatory systems at various levels (cortex, hypothalamus, vital centers of the oblong brain), which often render on the him multidirectional modulating influences. This can explain the occurrence of heart rate variability. It was found that the higher the heart rate variability, the higher the activation of the parasympathetic division of the autonomic nervous system in the regulation of the heart rhythm, and, conversely, the more stable the heart rhythm, the higher the activation of the sympathetic division (Baevsky R.M., Kirillov O.I., Kletskin S. .Z., 1984).

Spectral analysis of the ECG is designed to identify and quantify the periodic processes of the heart rhythm and assessing the activity of various levels of regulation. The spectral analysis of ECG is based on the fast Fourier transform method, which makes it possible to single out individual harmonic components of the heart rate. IN in accordance with the developments of the Task Force group of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (Task Force of the European...., 1996), the following spectral components of cardiac rhythm have been identified: total spectrum power - TP; HF-waves, reflecting the activation of the respiratory center of the medulla oblongata; LF-waves reflecting the activation of the vasomotor center of the oblong brain; VLF waves reflecting the activation of subcortical structures in mainly the hypothalamus. This approach allows you to diagnose early manifestations changes mechanisms vegetative regulation, preceding energy and metabolic disorders.

Average values of indicators of heart rate variability (HRV) and spectral indicators are presented in table 1.2. 3. As can be seen from the table, the course intake of "light water" did not cause significant changes in both HRV indices and spectral analysis indices. Moreover, all the changes were in the nature of trends. The subjects who took ordinary water showed a significant increase in LF-waves in the heart rate structure ($p < 0.05$), which is probably associated with an increase in the activity of the vaso-motor center.

Next, we will give a more detailed analysis of the observed changes.

Table 1.2.3

Average values of heart rate variability in subjects

group		***sdnn, ms***		***cv,%***		***40, ms2***		***6, F, ms2***		***LF, ms2***		***HF, ms2***	
		100-180ms				*2400-4500*		*580-1250*		*745-1200*		*750-1600*	
		-	m	-	m	-	m	-	m	-	m	-	m
one	before	64.0 11.9 6.9			1.1	5080 1576 2153		745 4306		2193 715		734	289
	after 73.0 13.6 7.8				1,2	1019 1753 461		▨	▨	1869 477		684	189
2	before	87.6 13.1 9.7			1.3	9433 2453 4056		1129 4206 1319		1172 349 9473		2228 3676	
	after 96.9 12.7 10.7 1.2					700		▨	▨	4237 1173 1560		512	
3	before	75.0 11.2 8.3			1,2	5959 1533 3152		1121 1858 334		6068 357		949	479
	after 99.6 20.5 11.4 2.5							2622 397		2492 265		954	471
										$p < 0.05$			

Legend: Shading indicates significant differences 8p <0.05) between groups according to the Mann-Whitney criterion

Continuation of table 1.2.3 m

group		*Lfnorm*		*HF norm*		*, F / HF*		*% 6, F*		*%, F*		*% HF*		*IN*	
						1.5-3.0		*15-30*		*35-40*		*15-25*		*50-150*	
		-	m	-	m	-	m	-	m	-	m	-	m	-	
one	before	76.6	3.9	23.4	3.9	3.9	0.7	42	6.9	42.8	3.7	14.8	4.0	97.3	42.7
	after	72.1	4.3	27.9	4.3	3.4	1.0	38.5	4.4	44.9	5.0	16.6	2.6	84.7	34
2	before	77.0	3.0	23.0	3.0	3.9	0.7	45	4.3	42.8	4.8	12.0	1.0	38.7	9.9
	after	75.9	2.7	24.1	2.7	3.6	0.6	42.5	5.6	43.3	4.0	14.2	2.4	38.2	12
3	before	71.7	7.0	28.3	7.0	3.3	0.8	fifty	7.5	34.9	5.9	14.7	5.6	49.6	16.0
	after	76.0	7.6	24.0	7.6	4.3	0.9	43.6	7.1	41.9	5.7	14.5	6.0	39.5	four
										p <0.05					

One of the most reliable indicators of changes in the autonomic tone of the subjects is the indicator of the value of the standard deviation of the RR - intervals - sdnn. In fig. 1.2.3. shows the dynamics of the sdnn indicator, ms for the examined different groups before and after the course of water intake.

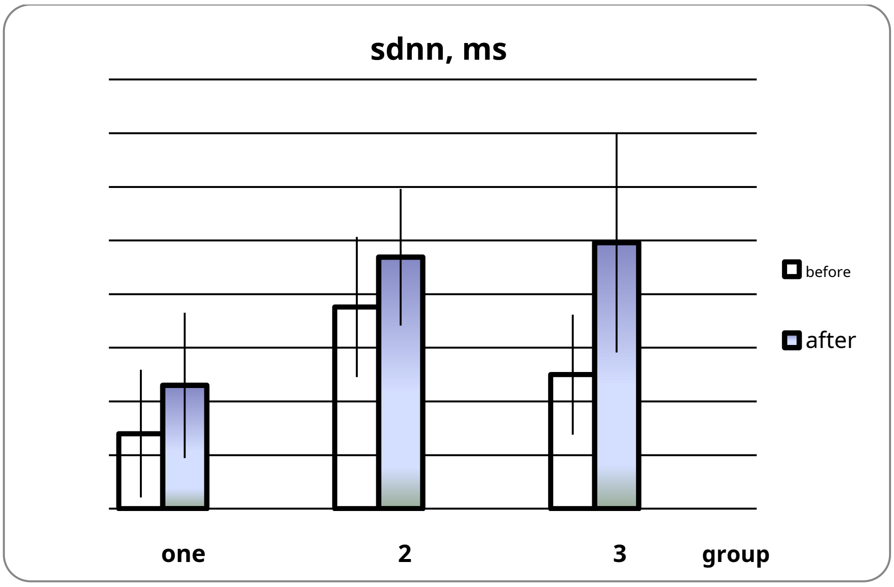

Fig. 1.2.3. Average values of the sdnn indicator (ms) before and after a course of water intake for the examined different groups (1,2, 3).

From the data in the figure it follows that all the subjects were initially sympathicotonic (sdnn index less than 100ms), however after course intake of any type of water in the surveyed all groups there is a tendency to an increase in the sdnn indicator, which allows us to speak strengthening their parasympathetic influences. Note that the normal range of this indicator is 100-180ms, which allows us to unambiguously state that all our subjects initially had a predominance of sympathetic influences on the heart. However, the intake of water of any kind contributed to a shift in the vegetative balance towards an increase in parasympathetic influences, which, as a result, made it possible to normalize the vegetative tone in the examined groups 2 and 3. The vegetative tone of persons in group 1 was stable and remained sympathetic.

The most informative indicators of spectral analysis are the total spectral power of heart rate (HR) and spectral the power of its individual components - HF-, LF- and VLF- waves. In fig. 1.2.4 shows the dynamics of changes in the spectral power of the HR cardiac rhythm under the influence of regular (group 3) and "light water" (groups 1 and 2).

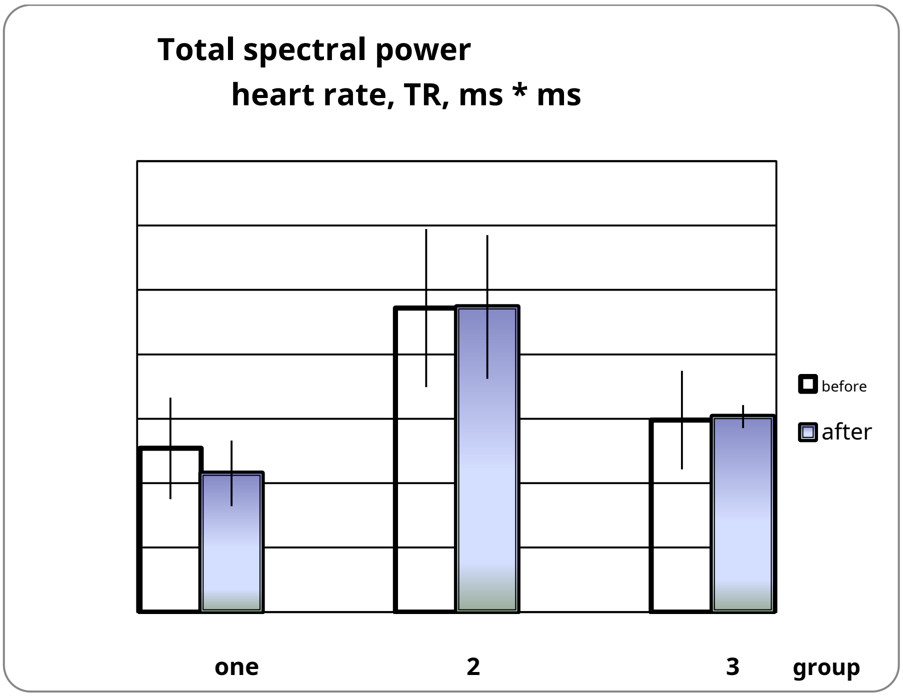

Fig. 1.2.4 Average values of the total spectral power of the HR heart rate in the examined different groups (1,2.3) before (light bars) and after (filled bars) course water intake.

It can be seen that initially in all subjects this indicator exceeded the norm (2500 - 4500 ms 2), however, under the influence of the course intake of "light water" in the subjects of group 1, this indicator returned to normal, which cannot be said about the rest of the subjects.

Arises question: as correlate separate mechanisms neurohumoral regulation in the examined different groups?

Comparative analysis of the absolute values of the spectral powers of VLF-, LF- HF-waves makes it possible to assess the change in the ratio of the spectral components of the heart rate after a course intake of “light” and ordinary drinking water.

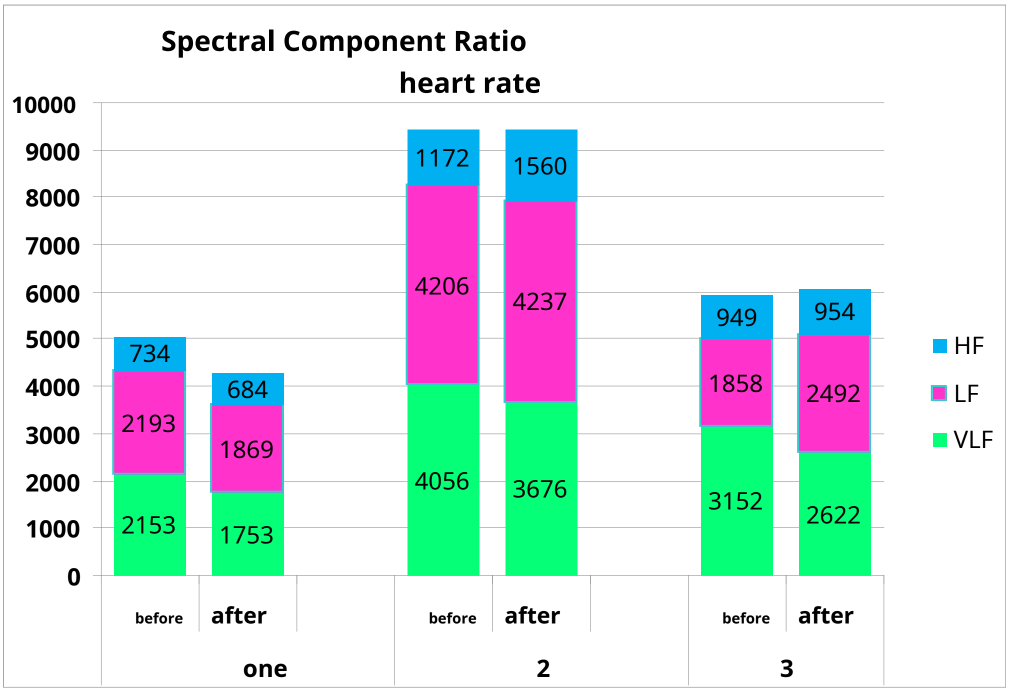

Fig. 1.2.5 The ratio of the absolute values of the spectral powers of VLF-, LF- HF-waves (in ms * ms) in the structure of cardiac rhythm in the examined different groups (1, 2, 3) before and after the course of water intake.

It can be seen that the subjects of group 1 (took "light water" in accordance with the individual need ") against the background of a tendency to decrease in the total spectral power of the solid solution (Fig. 1.2.4), the ratio of the spectral components remained. In the structure of the cardiac rhythm of these subjects, VLF-waves continued to prevail, which can be regarded as the preservation of the initial level of sympathetic influences.

In the examined group 2 (they took “light water dosed, 200 ml each before and after training) against the background of maintaining the total spectral power of the heart rate the ratio of its individual components changed: the spectral power of HF-waves increased and decreased - VLF waves, which can be regarded as an increase in parasympathetic influences on the heart in these subjects.

In the examined group 3, against the background of maintaining the total spectral power of the heart rate, the ratio of its individual components also changed, however, the spectral power of LF waves increased significantly and the spectral power of VLF waves decreased, which can be regarded as an increase in vasomotor activity. amid activation vaso-motor center.

Thus, the course intake of "light water" in unlimited quantities (in accordance with the individual need) contributed to the preservation of the initial level of sympathetic influences on the heart of the subjects, and hence the preservation of their physical performance. Dosed intake of "light water", on the contrary, contributed to a decrease in the initial level of sympathetic influences on the heart and an increase in parasympathetic influences, which makes one think about a decrease in the initial level of physical performance in these individuals. Taking ordinary water in unlimited quantities (in accordance with individual need), contributed to an increase in the activation of the vasomotor center in these subjects, which causes an increase in vasomotor activity.

Course reception "light water" was reflected in the change in the level of psychoemotional stress. In fig. 6 the dynamics is presented index R.M. Baevsky, reflecting the level of psychoemotional stress of the subjects. It is known that the normal range for this index is 50-150 conv units. The figure shows that all of our subjects were initially within the normal range. Unrestricted intake of "light water" (group 1) and ordinary water (group 3) caused a tendency to decrease the level of psychoemotional stress in the examined groups, while the dosed intake of water had practically no effect on the level of psychoemotional stress.

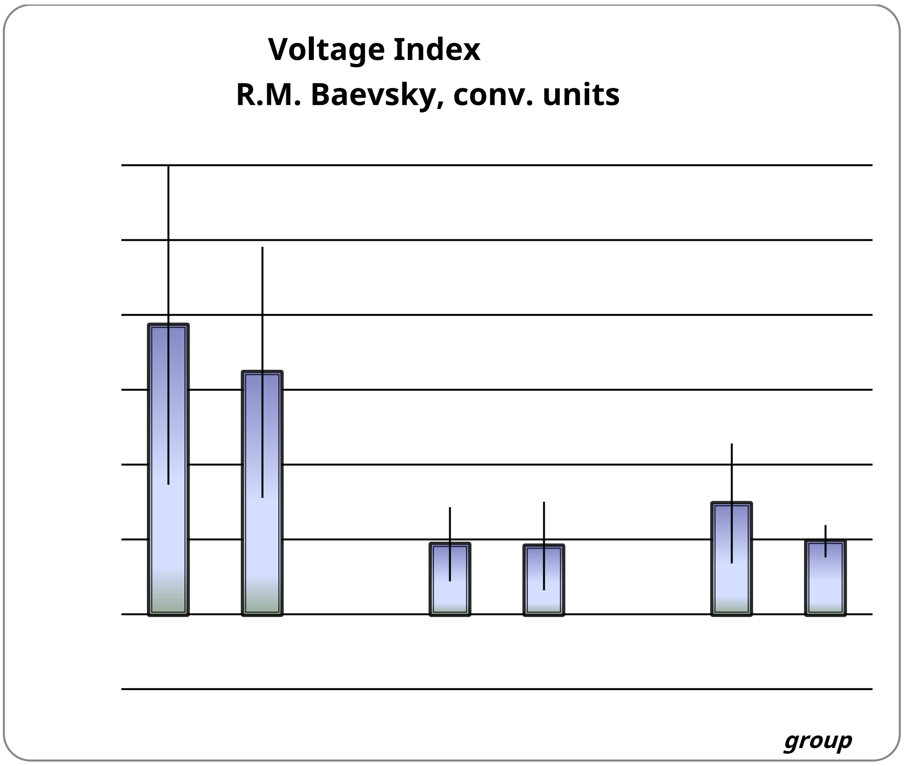

Figure 1.2.6. Average values of the R.M. Baevsky (IN, conventional units) in the surveyed groups 1, 2. 3 before and after taking "water".

Hemodynamic security muscular work is an a predictor of an athlete's subsequent sporting achievements. Without an analysis of hemodynamic parameters, it is impossible to scientifically reasonably achieve the most complete disclosure of the physical capabilities of the human body (Karpman V.L., Lyubina B.G., 1982).

Hemodynamics is the movement of blood through the vessels, resulting from the difference in hydrostatic pressure in different parts of the circulatory system (blood moves from the high pressure area to

low area). Depends on the resistance to blood flow of the walls of blood vessels and the viscosity of the blood itself. The main indicators of hemodynamics are stroke volume of blood and minute volume of blood circulation.

Stroke blood volume (SVV) is the volume pumped by each ventricle into the great vessel (aorta or pulmonary artery) during one heartbeat. Regulatory influences on the heart are realized in changing the stroke volume by influencing the contractile force of the myocardium. With a decrease in the power of the heartbeat, the stroke volume decreases.

Circulatory minute volume (CVM) characterizes the total amount of blood pumped by the right and left heart during one minute in the cardiovascular system. The factors that determine the value of the minute volume of blood circulation are stroke volume of blood, heart rate and venous return of blood to the heart.

Table 1.2.4 and Figures 1.2.7-1.2.13 show the background averages meaning frequency heart reductions (Heart rate) and hemodynamic parameters in the observed groups before and after a course of "light" and regular water.

Table 1.2.4

Hemodynamic parameters in the examined groups 1, 2, 3 before and after a course of water intake

group	**ADS**, mmHg		**ADD**, mmHg		**Heart rate**, beats / min		**PD**, mmHg		**UOK**, ml		**IOC**, l / min		**OPSS**, dyn * s / cm5	
	M	m	M	m	M	m	M	m	M	m	M	m	M	m
one up to	124.6	4.7	76.9	3.2	68.4	6.1	47.7	3.2	63.6	2.7	4.3	0,4	1803	199
after	125.6	3.6	73.6	4.3	67.6	4.6	52.0	6.5	67.7	6.2	4.6	0.6	1717	188
2 before	125,7	5.6	79.7	2.1	68.7	2.9	46.0	4.1	62.5	1.2	4.3	0.2	1756	59
after	132.1	5.1	80.3	3.9	64.9	3.4	51.9	3.3	65.2	3.1	4.2	0.1	1877	101
3 before	99.8	22.3	73.8	2.0	66.8	2.8	46.0	2.3	65.9	1.7	4.4	0.2	1631	85
after	121.6	3.1	76.4	1.6	66.6	3.1	45.2	1.8	63.9	0.9	4.3	0.2	1723	44
				$p < 0.05$										

Figure 1.2.3.7 shows the dynamics of heart rate in the surveyed observed groups before and after taking "light water". It can be seen that the course intake of "light water" in the examined groups 1 and 2 caused a weak tendency to a decrease in heart rate, and for the persons of group 2 who took "light water" it was dosed, it was more pronounced. Drinking regular water (group 3) practically did not affect the heart rate.

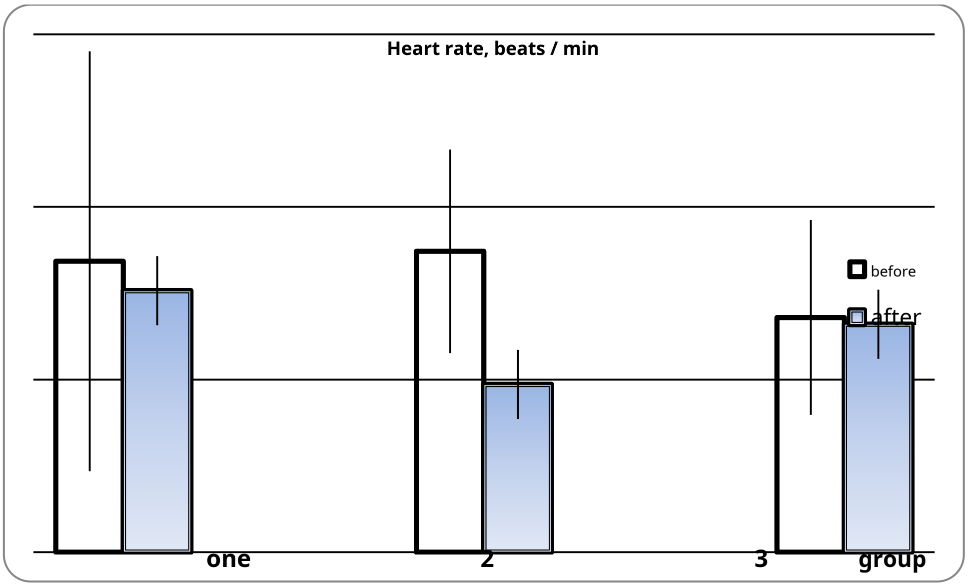

Fig. 1.2.7 Average values of heart rate (heart rate, beats / min) for the examined groups 1, 2, 3 before (light bars) and after (filled bars) course water intake.

It is easy to understand that fluid intake is always a factor in increasing blood mass, and if it is taken in large volumes, then under certain conditions this can cause an increase in blood pressure. Figures 1.2.8-1.2.9 show the dynamics of changes in systolic blood pressure (ABP, mm Hg) and diastolic blood pressure (BPP, mm Hg) in the examined groups before and after a course of water intake.

It can be seen that the course intake of "light water" in unlimited quantities (group 1) practically did not change the blood pressure, but caused a tendency towards a decrease in blood pressure. which led to an increase in pulse pressure in these subjects from 47.7 ± 3.2 to 52.0 ± 6.5 mm Hg. Course intake of the same volumes of ordinary water (group 3) led to a simultaneous increase in both blood pressure and blood pressure, which not only did not allow maintaining the initial level of pulse pressure, but also led to its tendency to decrease from 46.0 ± 2.3 to 45, 2 ± 1.8 mmHg Reception of "light water" in small volumes (group 2) also has led to an upward trend systolic and diastolic blood pressure, however, the pulse pressure in these subjects tended to increase with
46.0 ± 4.1 to 51.9 ± 3.3 mm Hg

Note that the value of the pulse pressure directly correlates with the stroke volume of blood, and, therefore, it can be assumed that the intake of "light water" contributes to an increase in the stroke volume of blood.

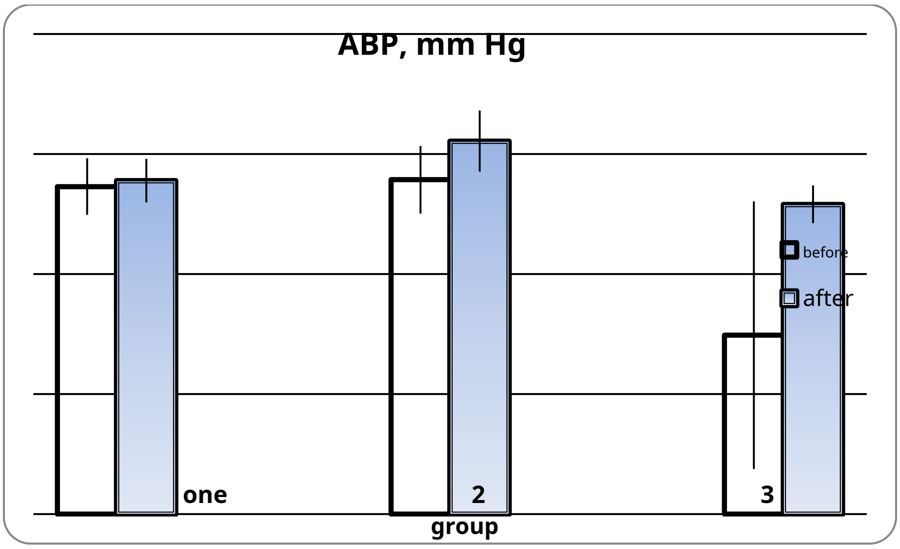

Fig. 1.2.8 Average values of the frequency of systolic blood pressure (ABP, mm Hg) 1, 2, 3 before (light bars) and after (filled bars) course water intake.

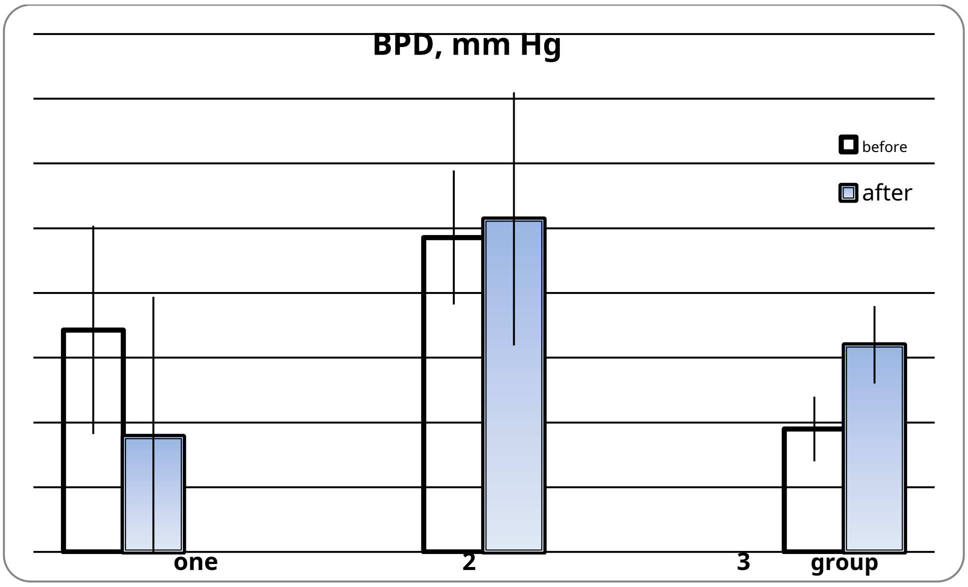

Fig. 1.2.9 Average values of diastolic blood pressure (BPP, mm Hg) for the surveyed groups 1, 2, 3 before (light bars) and after (flooded bars) course water intake.

Figure 1.2.10 shows the dynamics of the SV for the observed groups of subjects before and after the intake of "light water".

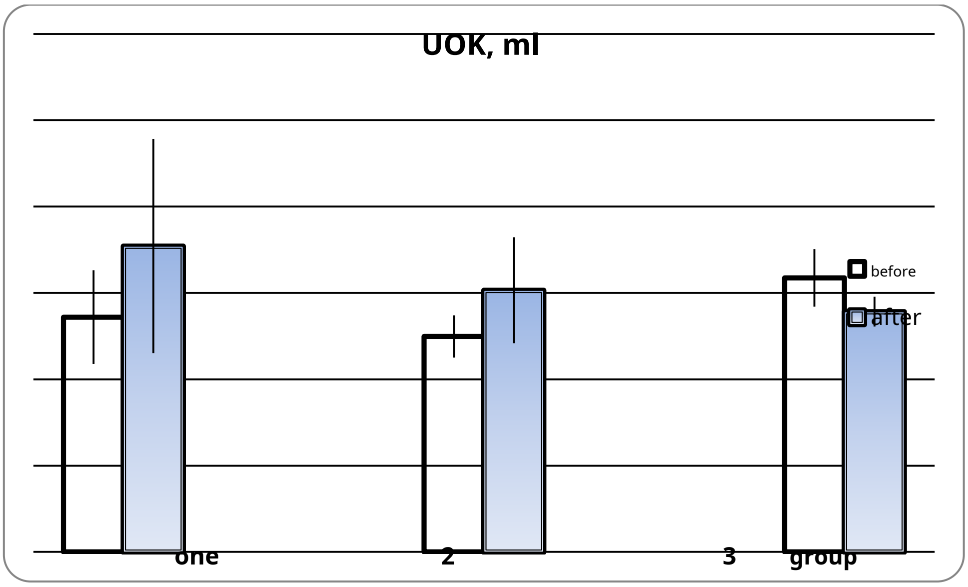

Fig. 1.2.10 Average values of stroke volume of blood (SVV, ml) for the examined groups 1, 2, 3 before (light columns) and after (filled columns) course water intake.

It can be seen that the intake of "light water" contributes to an increase in the stroke volume of blood.

The minute volume of blood flow is a hemodynamic parameter directly proportional to the level of physical performance of the subject. Figure 1.2.11 shows the dynamics of the minute volume of blood flow (IOC, l / min) for the examined groups 1, 2, 3 before and after a course of water intake. It can be seen from the figure that only in persons of group 1, who took "light water" without restriction (in accordance with individual need), the minute volume of blood flow tended to increase after a course of taking "light water".

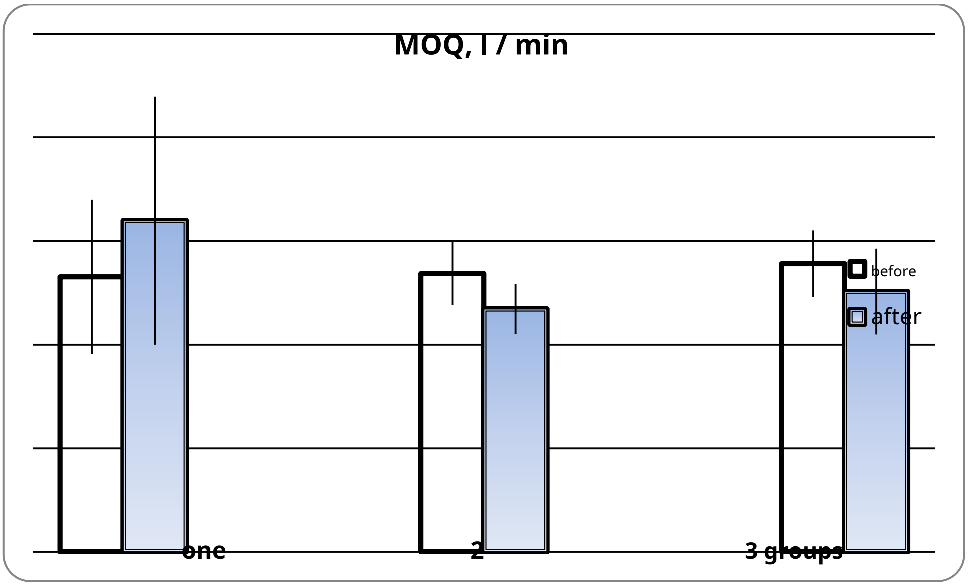

Fig. 1.2.11 Average values of the minute volume of blood flow (IOC, l / min) for the examined groups 1, 2, 3 before (light bars) and after (filled bars) course water intake.

It is known that the higher the level of the minute volume of blood flow, the better the oxygen is utilized by the tissues of the body and the higher the physical performance of the individual (Karpman V.L., Lyubina B.G., 1982). Note that only in the surveyed group 1, the total peripheral vascular resistance decreases after the course of taking "light water" (Fig. 1.2.12). Thus, we can conclude that *unlimited (in according to individual needs) taking "light water" helps to increase the level of physical performance of a person.*

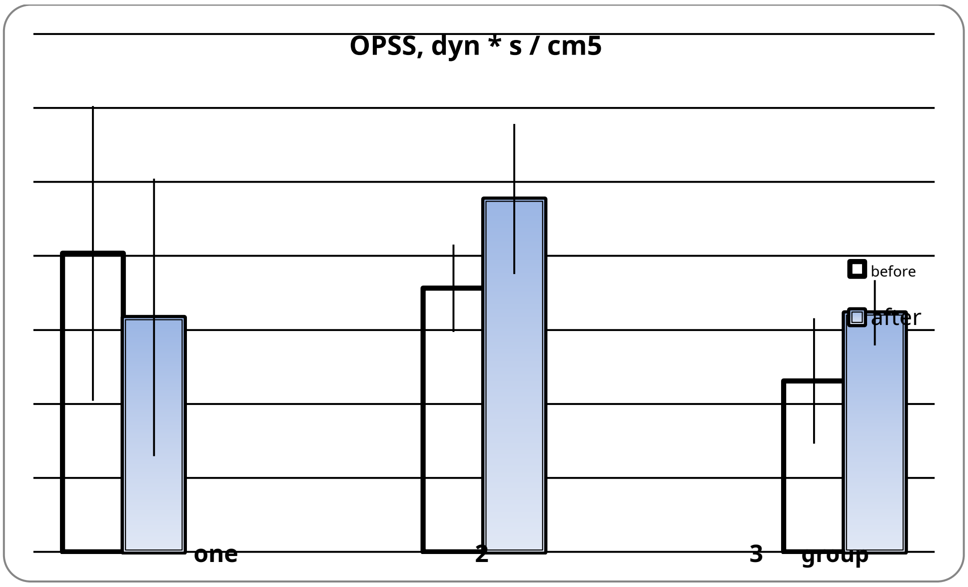

Fig. 1.2.12 Average values of total peripheral vascular resistance (OPSS, dyn * s / cm five) for the surveyed groups 1, 2, 3 before (light columns) and after (filled columns) course water intake.

Figure 1.2.13 shows the dynamics of the level of subjective well-being of the surveyed observed groups before and after a course of water intake.

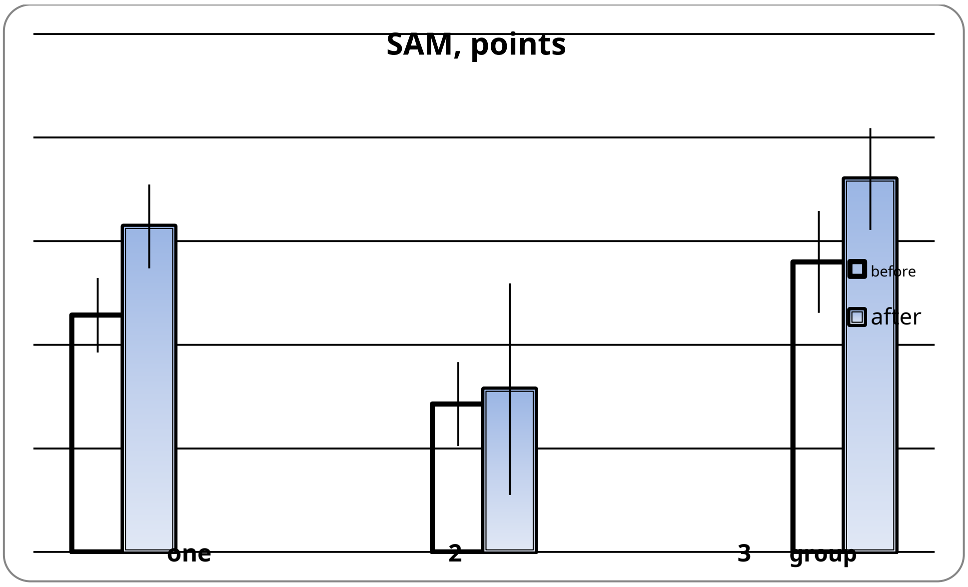

Fig. 1.2.13 Average values of subjective well-being (sam, points) for the surveyed groups 1, 2, 3 before (light bars) and after (filled bars) course water intake.

It can be seen that the subjects of all groups perceived the course intake of any type of water positively, which is evidenced by the increase in the level of their subjective well-being.

Thus, unlimited (according to individual need) course reception "Easy water" promotes restoration of the cardiac conduction system (increases the initially low conductivity in the AV node), maintaining the initial level of sympathetic influences on the heart of the subjects and an increase in the stroke volume of blood, and hence the preservation of their physical performance. Dosed intake of "light water", on the contrary, helps to reduce the initial level of sympathetic influences on the heart and enhance parasympathetic influences, which makes one think about a decrease in the initial level of physical performance in these individuals. The intake of ordinary water in unlimited quantities (in accordance with the individual need) increases the activation of the vasomotor center in these subjects, which causes an increase in vasomotor activity.

Summarizing what has been said based on the results of a comparative analysis of blood circulation indicators in individuals of the observed groups, it should be noted:

Group1: Reception of "light water" in unlimited volumes in in accordance with the individual need caused an increase in sympathetic influences in the individuals of this group. As a result, after the end of the course intake of "light water", they had a weak tendency to a decrease in heart rate (Fig. 1.2.7), a weak tendency to an increase in blood pressure (Fig. 1.2.8), a tendency to a decrease in blood pressure (Fig. 1.2.9) , as a result of which their pulse pressure increased. All this led to a tendency towards an increase in SV (Figure 1.2.10) and a decrease in TPVR (Figure 1.2.12), raising the IOC (Figure 1.2.11). *All this can be interpreted as a positive effect of "light water" on physical performance and subjective well-being of this group of subjects (Fig. 1.2.13). It is in the faces of this* *group, you can expect an increase in physical performance with an increase in the volume and intensity of training loads.*

Group 2: Dosed intake of "light water" (200 ml each before and after training) caused an increase in parasympathetic influences in this group. As a result, after the end of the course intake of "light water", they showed a tendency to a decrease in heart rate (Figure 1.2.7), a weak tendency to an increase in blood pressure (Figure 1.2.8), a weak tendency to an increase in BP (Figure 1.2.9) ..All this led to a tendency towards a slight increase in RBM. (Figure 1.2.10) and an increase in TPVR (Figure 1.2.12), and the IOC tended to decrease (Figure 1.2.11). The subjective well-being of people in this group is not improved (Figure 1.2.13). *It can be assumed that this kind of dynamics will contribute to a decrease in their physical performance.*

Group3: The intake of ordinary drinking water in unlimited volumes in accordance with the individual need caused the activation of the vasomotor center in the subjects of this group. As a result, after the end of the course water intake, their heart rate practically did not change (Fig. 1.2.7), but a pronounced tendency appeared. to increase blood pressure (Figure 1.2.8), BPP significantly increased from 73.8 ± 2.0 to 76.4 ± 1.6 mm Hg. ($p < 0.05$) (Fig. 1.2.9), as a result of which their pulse pressure decreased. All this led to a tendency towards a decrease in SV (Fig. 1.2.10) and an increase in TPRV (Fig. 1.2.12), and, ultimately, to a decrease in MVV (Fig. 1.2.11). The subjective well-being of the people of this group has improved (Figure 1.2.13). *Probably, a decrease in physical performance can also be expected in this group.*

1.3. Changes in lung volumes in subjects before and after taking "light water"

The respiratory system performs an important function in the human body - the function of gas exchange. Breathing is a chain of continuous physiological processes of absorption of oxygen from the environment and the release of carbon dioxide and water. This function is based on the oxidation of organic substances - proteins, fats and carbohydrates, as a result of which energy is released, which ensures the vital activity of the body.

External respiration consists of two phases - inhalation and exhalation, due to which the air of the external environment enters the lungs and exits in the opposite direction. As a result of these processes, it becomes possible to exchange gas between the alveolar air and blood in the alveoli. Measuring the volumes of air inhaled and exhaled is called spirometry.

The volume of air entering the lungs during inspiration is called the tidal volume (TI). The volume of air exhaled at maximum expiration after a normal inhalation is called the expiratory reserve volume (Rovd), and the volume of air that can be inhaled at maximum inspiration after a normal inhalation is called the inspiratory reserve volume (Rovd). The sum of all these volumes is called the vital capacity of the lungs (VC). In athletes, VC can reach 6-7 liters (Kotov A.V., Loseva T.N. (ed), 2011). The ventilation characteristic of the lungs is the respiratory minute volume (MOP).

A feature of the function of external respiration is a combination of automatism and its arbitrary regulation. The respiratory center (DC) is "responsible" for the automatism of breathing. DC is represented by many nerve elements from the spinal cord to the cortex, which provide regulation external respiration, gas exchange, gas transport. Bulbar the respiratory center (a set of neurons of the medulla oblongata) is part of the DC and provides only the frequency of breathing. The bulbar center is distinguished by the highest heterogeneity of the neurons organizing it. Its structures are subject to nervous and humoral regulation under the influence of metabolic changes in itself and excitement coming from mechano - and chemoreceptors, which carry information about the degree of stretching of the alveoli, about the work of the respiratory muscles and the gas composition of the blood.

Table 1.3.1 shows the spirometry parameters in the surveyed observed groups before and after taking "light" and ordinary water.

Table 1.3.1

Average values of lung volumes (M m) in the examined groups 1,2,3 before and after a course of water intake

(p <0.05 - significant differences according to Wilcoxon are indicated)

groups of	**VC, l**		**Rovd, l**		**Rovyd, l**		**TO, l**		**BH, 1 / min**		**MOD, l / min**	
	M	m	M	m	M	m	M	m	M	m	M	m
one **before**	7.43	0.40	3.85	0.32	2.57	0.21	1.00	0.10	17.1	2.04	16.5	1.83
after	7.75	0.24	4.18	0.23	2.48	0.19	1.09	0.1	17.1	2.04	18.3	2.48
2 **before**	6.90	0.47	3.47	0.47	2.83	0.38	0.61	0.14	19.7	2.16	12.1	2.77
after	7.22	0.57	3.7	0.42	2.58	0.17	0.94	0.14	20.6	1.78	18.6	2.45
								p <0.05				**p <0.05**
3 **before**	6.73	0.49	3.70	0.66	2.72	0.36	0.98	0.21	18.0	3.29	15.6	1.93
after	7.01	0,4	3.68	0.3	2.38	0.31	0.95	0.15	eighteen	1.9	16.3	1.94

It can be seen that both "light water" and ordinary drinking water, taken in different volumes, had a different effect on the value of lung volumes in the studied groups. For more clarity, the main parameters are presented in Figures 1.3.1-1.3.4.

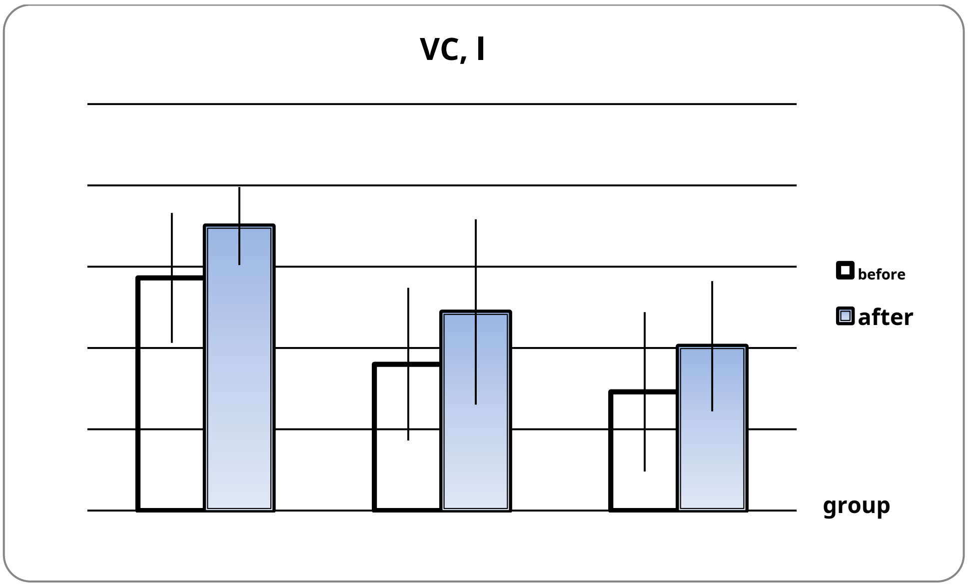

Fig. 1.3.1 Average values of vital capacity of the lungs (VC) in the surveyed groups 1,2 3 before and after drinking water.

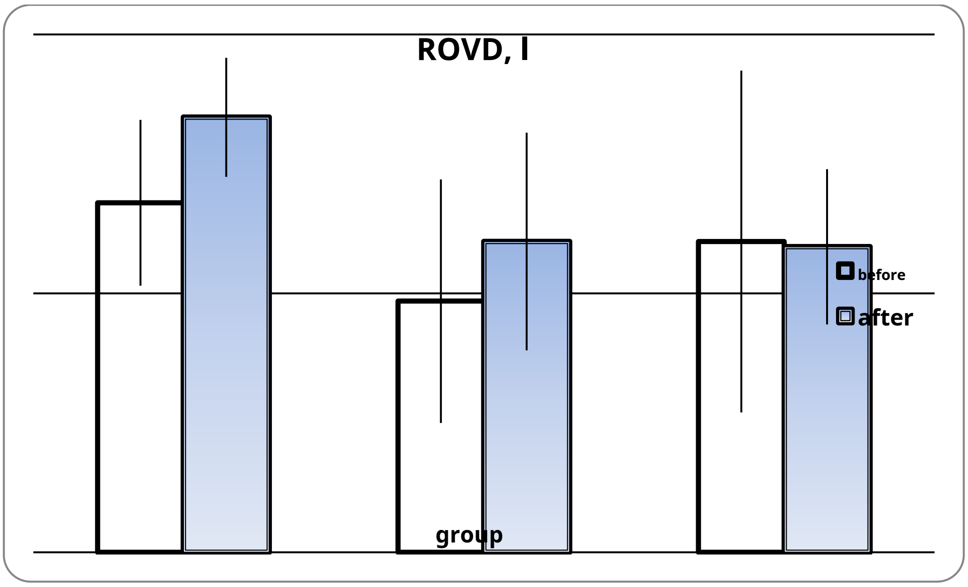

Fig. 1.3.2 Average values of the reserve volume of inspiration (Rovd) in the examined groups 1,2 3 before and after drinking water.

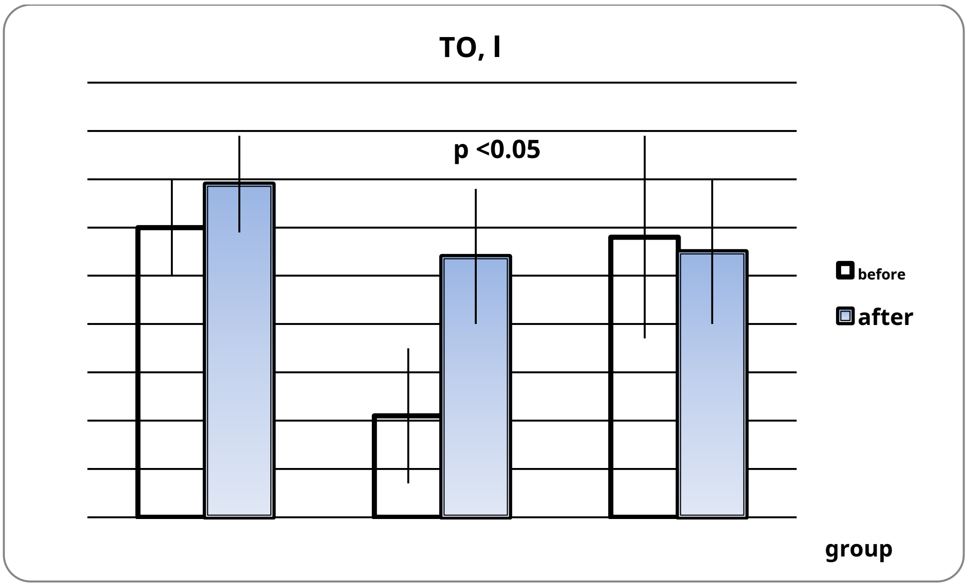

Fig. 1.3.3 Average values of tidal volume (TO) in the examined groups 1, 2, 3 before and after drinking water

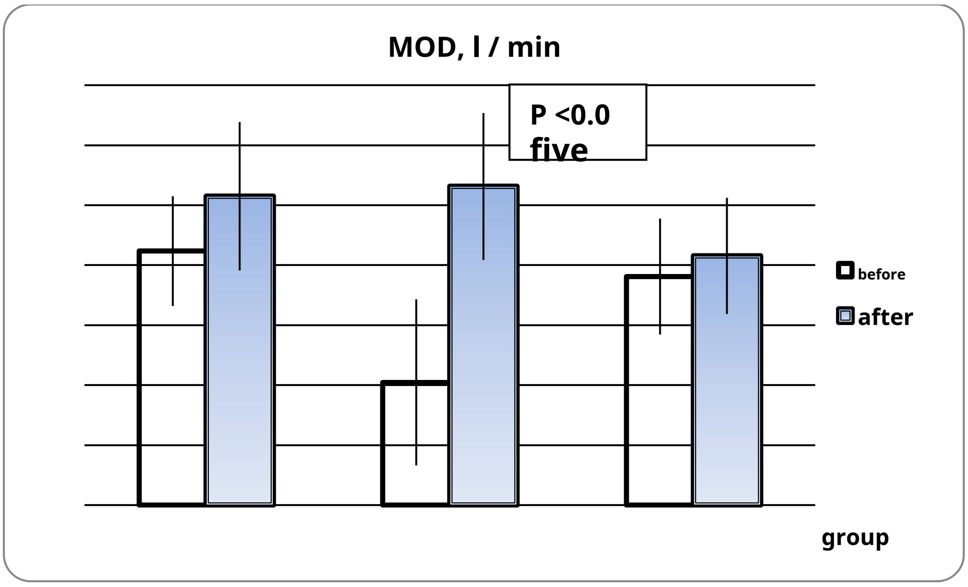

Fig. 1.3.4 Average values of the minute volume of respiration (MOV) in the examined groups 1, 2, 3 before and after drinking water

From Figures 1.3.1-1.3.4 it can be seen that by the end of the course intake of water, VC had a tendency to increase in all groups, ROVD and DO increased only in groups 1 and 2, who took "light water", and MO increased in all groups, but the MOU was greatest only in the groups taking

"Light water". All this testifies in favor of "light water" as a means of improving the parameters of external respiration in athletes.

Group analysis revealed:

- In group 1 (took "light water" unrestrictedly in accordance with individual needs), by the end of the course intake, there was a tendency to increase VC, a tendency to an increase in ROV and a weak tendency to a decrease in ROS, a tendency to an increase in DO and MO. It was in this group that by the end of the course intake of "light water" there was an increase in sympathetic influences on the heart, while the persons of this group had a very high level of IOC, which allows us to speak of their high physical performance. The latter was accompanied by a high level of VC, ROVD, DO and MOD.

- In group 2 (took "light water" dosed - 200 ml each before and after training) - by the end of the course intake of "light water" there was a tendency towards increased parasympathetic effects on the heart, a decrease in IOC, and, consequently, and weak decrease physical the performance of these persons. At the same time, the respiratory function showed its compensatory capabilities, and therefore, in order to maintain the proper level of oxygen in the peripheral blood, these persons showed a tendency to an increase in VC, RVD, a significant increase in DO and MO. We believe that against the background of a decrease in IOC, the balance of the partial pressures of oxygen and carbon dioxide in the blood changed, which led to an increase in the background impulsation of afferents innervating chemorecepto and an increase in ventilation lungs, reflected in credible an increase in tidal volume (DO) and respiratory minute volume (RV).

- In group 3 (took regular drinking water without restriction in conformity from individual needs) by the end of the course water intake, there was a tendency to an increase in VC, as a result of the Department of Internal Affairs and Department of Internal Affairs had a tendency to decrease, and the MOU showed a weak tendency to increase.

In this way, *upon completion of the course intake of "light water" in the surveyed groups 1 and 2, there was an improvement in the ventilation function of the lungs and the utilization of consumed oxygen by the tissues of the body.*

Chapter 2. Indicators parameters blood at highly qualified athletes before and after taking "light water"

Blood is the internal environment of the body, which connects all organs and tissues of a person. From a morphological point of view, blood is a special type of connective tissue, a feature of which is the presence of a large extracellular space, called blood plasma, and the absence of contacts between blood cells, which are called blood cells. Forms of blood elements constantly change their location due to blood flow, which is caused by the release of blood from the heart and the creation by the heart of systolic and diastolic pressure in the arterial part of the circulatory system.

At the same time, blood is the liquid component of the body, in which the constancy of the internal environment of the body, called homeostasis, is maintained. Numerous blood parameters (the number of corpuscles, the concentration of electrolytes, proteins and carbohydrates in the blood plasma, the amount of hormones and enzymes in the blood) determine the constancy of the rate of biochemical reactions in the tissues of the body and the stability of the functional processes of organs. Blood homeostasis determines tissue homeostasis, that is, a certain level of metabolic processes in organs and tissues of the body

Blood counts are important criteria for assessing human health, and their changes indicate certain pathological processes in sick people. Laboratory diagnostics of the level of health or the presence of diseases begins in clinical and polyclinic medicine with a blood test. Initially, a general blood test is performed.

If necessary, a complete or partial biochemical blood test is prescribed.

In order to obtain a more complete picture of the health status of the examined highly qualified athletes and possible deviations of their homeostatic parameters, a study of clinical and biochemical parameters of blood, immune and antioxidant parameters of blood, hormonal parameters of blood and parameters of erythropoiesis factors was carried out.

results analyzes blood were received at highly qualified athletes, conducting regular intense workouts. Three groups were examined: 1) who regularly took "light water", 2) who took "light water" in limited quantities, and 3) who took ordinary drinking water. The results of analyzes of the third group of athletes were considered control. Highly qualified athletes in all three groups were instructed to take "light water" to improve the athlete's reserve capabilities. Therefore, the observed persons of all three groups had the same psychological attitude, which did not affect possible objective changes in blood tests.

Clinical blood test. In the clinical analysis of blood, the concentration hemoglobin, quantity erythrocytes, hematocrit (the ratio of formed elements and plasma), the average volume of one erythrocyte, the average content of hemoglobin in the erythrocyte, the average concentration of hemoglobin in the erythrocyte, the number of leukocytes, percentage content stab neutrophils, percentage the content of segmented neutrophils, the percentage of eosinophils, the percentage of basophils, the percentage of lymphocytes, the percentage of monocytes, the erythrocyte sedimentation rate, the number of platelets.

All parameters of the clinical analysis of blood were within the normal range before and after drinking water in all three groups of the examined athletes. Differences between the average values of clinical blood parameters between highly qualified athletes who took "light water" or ordinary drinking water were not observed (Tables 1A, 1B, 1C).

Hence, Light water" not influenced on the the main homeostatic parameters of blood, which testified to its harmlessness to human health.

Table 1A

Average statistical indicators of the clinical blood test of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	Hemoglobin, g / l		Erythrocytes, 10E12 / l		Hematocrit, %		Wed volume erythrocyte, fl		Wed sod. hemoglob. in er., pg		Wed conc. hemoglob. in er., g / l	
Norm	130-160		4-5.6		40-48		80-94		26-32		310-360	
Group Sports exchange	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
one	150.8 ± 3.24	155.1 ± 33	5.36 ± 0.07	5.46 ± 0.08	44.37 ± 0.9	45.16 ± 0.98	82.26 ± 1.21	82.61 ± 1.34	28.13 ± 0.58	28.39 ± 0.5	340 ± 4.37	342.1 ± 2.87
2	146 ± 6.25	151.3 ± 5.5	5.22 ± 0.19	5.5 ± 0.14	43.34 ± 1.78	45.81 ± 1.8	82.96 ± 1.26	82.77 ± 1.29	27.91 ± 0.4	27.39 ± 0.6	336.7 ± 1.7	331.4 ± 9.47
3	138.8 ± 5.48	146 ± 3.68	5.1 ± 0.16	4.27 ± 0.12	41.06 ± 1.38	42.04 ± 1.08	80.48 ± 0.96	79.78 ± 0.79	27.2 ± 0.66	27.74 ± 0.31	337.8 ± 4.39	347.8 ± 0.97

Table 1B

Average statistical indicators of the clinical blood test of athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and regular drinking water (3)

	Leukocytes, 10E9 / l		PY neutrophils, %		Sya neutrophils, %		Eosinophils, %		Basophils, %	
Norm	4-9		1-6		47-72		0-5		0-1	
Group sports exchange	Before	After	Before	Aftere	Before	Aftere	Before	Aftere	Before	Aftere

one	7.19 ± 0.63	7.11 ± 0.62	1.57 ± 0.37	2.14 ± 0.74	47.71 ± 2.22	50.86 ± 3.86	2.29 ± 0.52	1.43 ± 0.3	0	0
2	7.67 ± 0.99	6.69 ± 0.55	2.14 ± 0.59	3.14 ± 0.63	54.14 ± 3.65	52.71 ± 2.93	1.86 ± 0.59	2.57 ± 0.9	0	0
3	6.5 ± 0.57	6.54 ± 0.52	2.2 ± 0.73	2.6 ± 1.03	52.2 ± 3.06	55 ± 2.88	2.8 ± 0.8	1.4 ± 0.4	0	0

Table 1B

Average statistical indicators of the clinical blood test of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	Lymphocytes, %		Monocytes, %		ESR, mm / hour		Platelets, 10E9 / l	
Norm	19-37		2-10		2-10		140-440	
Group but sports exchange	Before	After	Before	After	Before	After	Before	After
one	38.29 ± 2.59	35.6 ± 3.6	10.14 ± 0.67	10 ± 0.72	3.57 ± 0.37	3.71 ± 0.36	270.6 ± 22.7	232.1 ± 19.7
2	34 ± 2.94	34.14 ± 2.8	7.86 ± 1.14	7.43 ± 0.92	5.57 ± 1.36	4.29 ± 0.71	285.4 ± 33.3	293.1 ± 28.4
3	35.2 ± 1.83	32.4 ± 1.72	7.6 ± 1.5	8.6 ± 1.25	3.6 ± 0.4	5.2 ± 0.8	229.4 ± 6.58	239.8 ± 12.4

Blood chemistry. In a biochemical blood test, the concentration of glucose, total bilirubin, cholesterol, protein, albumin, globulins, uric acid, and urea was determined. The amount of ions in blood plasma was measured: potassium, sodium, chloride, calcium, magnesium. The concentration of pancreatic enzymes was determined: alpha-amylase, pancreatic amylase and lipase. The concentration of rheumatoid factor was recorded.

Most of the parameters of the biochemical blood test were within the normal range before and after drinking water in all three groups of the examined athletes. Differences between average values no biochemical blood parameters were observed between athletes who took "light water" or ordinary drinking water (Table 2A, 2B, 2C).

A significant decrease in blood plasma protein and albumin was recorded in all three groups of the examined athletes. There are no differences between the average values of protein and blood plasma albumin between persons who have taken "light water" or ordinary drinking water.

observed (Table 2A). The observed decrease in the amount of protein and albumin in blood plasma is associated with intense training of highly qualified athletes.

Consequently, "light water" did not affect the biochemical parameters of blood, which indicated its harmlessness to human health.

Table 2A

Average statistical indicators of biochemical blood analysis of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	Glucose (serum rotary), mmol / l		Bilirubin general, µmol / l		Cholesterol, mmol / l		Total protein, g / l		Albumen, g / l		Globulin, g / l	
Norm	3.5-6		0-20.5		3.9-6.5		63-85		35-53		20-40	
Group sports exchange	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
one	4.26 ± 0.16	4.24 ± 0.33	14.56 ± 2.5	18.19 ± 5.77	4.04 ± 0.17	4.13 ± 0.15	76.14 ± 1.37	68.57 ± 1.39 **	50.71 ± 0.89	43.57 ± 0.69 ***	25.43 ± 0.61	25.0 ± 0.85
2	4.31 ± 0.23	4.69 ± 0.21	13.4 ± 1.28	13.87 ± 1.64	3.7 ± 0.12	3.63 ± 0.21	77 ± 1.4	70 ± 1.23 **	49.71 ± 0.29	43.0 ± 0.38 ***	28.29 ± 1.11	27.0 ± 1.11
3	4.1 ± 0.17	5.02 ± 0.25	15.92 ± 1.65	15.48 ± 2.36	3.86 ± 0.31	3.72 ± 0.24	76.2 ± 1.07	70.0 ± 1.0 **	51.4 ± 0.87	44.2 ± 0.92 ***	24.8 ± 0.58	25.8 ± 0.73

* * - the level of significance of the difference between the values before and after drinking water $p < 0.005$,

* * * - the level of significance of the difference between the values before and after drinking water $p < 0.001$.

Table 2B

Average statistical indicators of biochemical blood analysis of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	Urinary acid, µmol / l		Urea, mmol / l		Potassium, mmol / l		Sodium, mmol / l		Chlorides, mmol / l		Calcium general, mmol / l	
Norm	200-416		2.5-8.2		3.8-5.3		135-152		98-107		2.1-2.6	
Group sports exchange	Before	After	Before	After	before	After	before	After	before	After	Before	After
one	384.57 ± 39.4	282.86 ± 28.39	5.5 ± 0.36	4.96 ± 0.47	4.11 ± 0.11	3.81 ± 0.07	139.73 ± 0.8	140.07 ± 0.14	100.14 ± 0.26	103.01 ± 0.98	2.47 ± 0.04	2.5 ± 0.03
2	369.57 ± 29.9	315.71 ± 17.52	6.87 ± 0.33	5.53 ± 0.59	3.93 ± 0.05	3.89 ± 0.08	139.79 ± 0.51	140.46 ± 1.01	100.29 ± 0.18	102.04 ± 0.4	2.47 ± 0.03	2.52 ± 0.05

3	421.8 ± 45.98	294.6 ± 30.62	5.58 ± 0.25	5.36 ± 0.37	4.14 ± 0.18	3.92 ± 0.07	140.28 ± 0.87	139.1 ± 0.33	100.6 ± 0.24	102.3 ± 0.31	2.43 ± 0.03	2.57 ± 0.04

Table 2B

Average statistical indicators of biochemical blood analysis of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	Alpha amylase, honey / l		Amylase pancreatic, U / L		Lipase, U / L		Magnesium, mmol / l		Rheumatoid factor, honey / l	
Norm	0-200		17-115		0-160		0.7-1.15		0-20	
Group sports exchange	Before	After	Before	After	Before	After	Before	After	Before	After
one	145.3 ± 13	133.8 ± 12.8	87.14 ± 7.75	80.14 ± 7.63	35.4 ± 4.15	35.0 ± 4	0.93 ± 0.02	0.8 ± 0.03	11.66 ± 0.41	12.76 ± 0.42
2	178 ± 34.7	147.8 ± 32.14	106.71 ± 20.9	88.71 ± 13.82	34.43 ± 5.03	26.71 ± 3.08	0.91 ± 0.02	0.81 ± 0.02	12.01 ± 0.43	13.46 ± 0.65
3	178.2 ± 27.8	157.6 ± 26.35	107 ± 16.6	94.4 ± 15.92	30.2 ± 6.4	29.0 ± 6.43	0.94 ± 0.02	0.81 ± 0.02	13.32 ± 0.57	14.0 ± 0.66

Analysis of immune and antioxidant blood parameters. IN Immunoassay of blood determined the concentration of immunoglobulin Ig-G, the activity of superoxide dismutase and the total antioxidant activity.

The first two immune blood parameters were within the normal range before and after drinking water in all three groups of the examined athletes. There were no differences between the average values of biochemical blood parameters between the observed persons who took "light water" or ordinary drinking water (Table 3).

A tendency was found to increase the total antioxidant activity of blood plasma in all three groups of the examined athletes. There were no differences between the average values of the total antioxidant activity of blood plasma between persons who took "light water" or ordinary drinking water (Table 3). The observed increase in the total antioxidant activity of blood plasma is associated with intense training of the observed individuals.

Consequently, "light water" did not affect the immune and antioxidant parameters of the blood, which indicated that it was harmless to human health.

Table 3

Average statistical indicators of the immune blood test of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	Ig-G, g / l		Superoxide dismutase in the ER, E / gmol		Common Antioxidant Act., %	
Norm	8-17		1100-1800		40-75	
Group sports exchange	Before	After	Before	After	Before	After
one	9.29 ± 0.96	8.32 ± 1.01	1446.6 ± 40.8	1508.6 ± 108.8	37.3 ± 4.84	48.43 ± 6.19
2	9.62 ± 0.79	8.84 ± 0.89	1405 ± 54.13	1457.43 ± 63.87	32.6 ± 5.62	51.6 ± 5.09 *
3	9.02 ± 0.69	9.14 ± 0.75	1501.2 ± 95.1	1416 ± 85.83	39.8 ± 8.04	55 ± 7.06

* - the level of significance of the difference between the values before and after drinking water $p < 0.05$.

Hormonal blood test. In a hormonal blood test, the concentration of the thyroid hormone triiodothyronine, a precursor hormones thyroid glands thyroglobulin, pituitary hormone prolactin, male sexual hormone testosterone, the adrenal glucocorticoid cortisol, and the pancreatic hormone insulin.

Most of the studied hormones were within normal limits before and after drinking water in all three groups of subjects. Differences between the average values of the concentration of these hormones between persons taking "light water" or ordinary drinking water were not observed (Table 4).

A significant decrease in thyroglobulin, the precursor of thyroid hormones, was recorded in the first and second groups of subjects who took "light water" (Table 4). According to the clinical literature, an increase in the concentration of thyroglobulin in the blood is one of the symptoms of a cancerous process in the thyroid gland. However, the literature does not provide examples of a decrease in the concentration of thyroglobulin in the blood. It can be assumed that the use of "light water" can be recommended for patients with thyroid dysfunction. However, to confirm this assumption, more studies are needed in patients with thyroid lesions.

Consequently, "light water" did not generally affect the hormonal composition of the blood plasma, which indicated its harmlessness to human health. A decrease in thyroglobulin under the influence of "light water" intake may be beneficial for persons with thyroid dysfunctions.

Table 4

Average statistical indicators of hormonal blood analysis of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake ordinary drinking water (3)

	T3 general, ng / ml		Thyroglobulin, pg / ml		Prolactin a piece of chalk		Testosterone general, nmol / l		Cortisol nMol / L		Insulin, mlU / ml	
Norm	0.8-2		10-55		53-360		9-57.6		138-690		6-27	
Group sports exchange	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
one	1.15 ± 0.02	1.14 ± 0.03	15.2 ± 1.17 ***	6.3 ± 0.97 ***	195.3 ± 34.17	203.6 ± 36.43	17.19 ± 1.48	16.25 ± 1.83	445.9 ± 63.03	513.3 ± 41.82	13.94 ± 1.94	12.01 ± 3.63
2	1.18 ± 0.05	1.17 ± 0.07	13.11 ± 1.95 *	5.54 ± 1.44 *	145.7 ± 13.77	129.3 ± 16.5	17.4 ± 2.15	17.6 ± 2.73	352.7 ± 43.7	407.86 ± 43.33	22.5 ± 6.73	15.64 ± 4.26

3	1.08 ± 0.05	1.11 ± 0.06	11.28 ± 1.7	7.0 ± 1.17	255.0 ± 114.46	223 ± 112.01	21.5 ± 1.5	19.22 ± 0.95	308.4 ± 55.74	338.6 ± 47.63	9.6 ± 2.19	19.34 ± 9.13

* - the level of significance of the difference between the values before and after drinking water $p < 0.05$,

* * * - the level of significance of the difference between the values before and after drinking water $p < 0.001$.

Analysis of erythropoiesis factors. In the analysis of factors determining the formation of red blood cells, which is called erythropoiesis, measured the concentration of the vitamin "folic acid" and the tissue hormone erythropoietin. Both of these factors affect the red bone marrow, accelerating the formation of red blood cells, one of whose functions is to carry oxygen and carbon dioxide. In the clinic, these factors are considered as a diagnostic tool for possible anemia (a decrease in the number of red blood cells) in the blood of sick people.

Erythropoiesis factors were within normal limits before and after drinking water in all three groups of the examined athletes. Differences between the average values factors erythropoiesis between athletes who took "light water" or ordinary drinking water were not observed (Table 5).

Hence, Light water" not influenced on the the change erythropoietic factors of blood, which testified to its harmlessness to human health.

Table 5

Average statistical indicators of erythropoietic blood factors of highly qualified athletes before and after regular intake of "light water" (1), limited intake of "light water" (2) and intake of ordinary drinking water (3)

	Folic acid, ng / ml		Erythropoietin, mlU / ml	
Norm	3-17		2.6-34	
Group sports exchange	Before	After	Before	After
one	7.9 ± 0.88	7.66 ± 0.6	6.3 ± 1.06	7.59 ± 0.94

2	8.19 ± 1.16	8.2 ± 1.19	5.76 ± 0.58	8.5 ± 1.17
3	7.3 ± 1.41	9.94 ± 0.69	5.6 ± 0.96	6.24 ± 0.72

Thus, we can conclude that:

1. "Light water" did not affect the main homeostatic blood parameters.

2. "Light water" did not affect the biochemical parameters of the blood.

3. "Light water" did not affect the immune and antioxidant blood counts.

4. "Light water" did not generally affect the hormonal composition of the plaza blood. A decrease in thyroglobulin under the influence of "light water" intake may be beneficial for persons with thyroid dysfunctions.

5. "Light water" did not affect the change in erythropoietic blood factors.

6. The data obtained testified to the harmlessness of “light water "for human health.

Chapter 3. Influence of "light water" on the physical performance of people involved in sports

3.1. Hypoxic sustainability at highly qualified athletes when performing speed-strength work and maximum breath holding on inhalation and exhalation before and after taking "light water"

The most valuable information about the functional state of the cardiorespiratory system of highly qualified athletes can be obtained when taking into account the physiological changes of the main vegetative parameters during physical work. The most accessible indicators of the oxygen supply system of the human body are systolic and diastolic blood pressure, heart rate assessed before and after exercise tests, the time for performing speed-strength physical work, the time of maximum breath holding during inhalation and exhalation before and after physical work.

Arterial pressure - the pressure of blood on the walls of the arteries varies depending on the phase of the cycle of the heart. It depends on the strength of contraction of the heart, blood flow into the arterial system, the state of the walls of blood vessels, blood viscosity and many other factors. Distinguish between systolic blood pressure (maximum), diastolic (minimum) and pulse (VB Voinov, 2002). Pulse pressure is the difference between systolic and diastolic pressure. Pulse pressure is required to open the semilunar valves during ventricular systole. Normal pulse pressure is 35-55 mm Hg. Art. If the systolic pressure becomes equal to the diastolic pressure, the movement of blood will be impossible (V.L. Karpman, 1982, S.A. Georgieva, 1981).

Arterial pulse (pulse, heart rate) is a rhythmic oscillation of the walls of the arteries, caused by the tremors of blood that occur during the contraction of the heart. A pulse wave, otherwise a wave of pressure increase, occurs in the aorta at the time of expulsion of blood from the ventricles. As a result of the elasticity of the walls of the aorta and arteries, the systolic increase in pressure does not push the entire column of blood, but causes the walls of the arteries to stretch. Thanks to this stretching, the aorta and arterial trunks contain the systolic blood volume ejected by the heart. The walls of the vessels, which received additional tension during systole, tend, due to elasticity, to reduce their capacity and during diastole move forward the systolic blood volume. The expansion of the wall and the increase in pressure occur in this case in the adjacent area. Pressure fluctuations Repeating in waves and gradually weakening, they capture more and more new areas of the arteries until they reach the arterioles and capillaries, where the pulse wave dies out. Corresponding to the pulsating changes in pressure, the flow of blood through the arteries also acquires a pulsating character - there is an acceleration of blood flow during systole and a slowdown during diastole. The speed of propagation of the pulse wave does not depend on the speed of blood movement. The maximum linear velocity of blood flow through the arteries does not exceed 0.3–0.5 m / s. The speed of pulse wave propagation in young and middle-aged people, with normal blood pressure and normal vascular elasticity, is 5.5–8 m / s in the aorta, and 6–9.5 m / s in the peripheral arteries. With age, by until they reach the arterioles and capillaries, where the pulse wave is extinguished. Corresponding to the pulsating changes in pressure, the flow of blood through the arteries also acquires a pulsating character - there is an acceleration of blood flow during systole and a slowdown during diastole. The speed of propagation of the pulse wave does not depend on the speed of blood movement. The maximum linear velocity of blood flow through the arteries does not exceed 0.3–0.5 m / s. The speed of pulse wave propagation in young and middle-aged people, with normal blood pressure and normal vascular elasticity, is 5.5–8 m / s in the aorta, and 6–9.5 m / s in the peripheral arteries. With age, by until they reach the arterioles and capillaries, where the pulse wave is extinguished. Corresponding to the pulsating changes in pressure, the flow of blood through the arteries also acquires a pulsating character - there is an acceleration of blood flow during systole and a slowdown during diastole. The speed of propagation of the pulse wave does not depend on the speed of blood movement. The maximum

decreasing elasticity vessels, speed

pulse wave propagation increases. Distinguish between arterial, venous and cardiac impulse. Usually, the pulse is determined by the fingertips of the hand (palpation) on the person's wrist (radial artery). Frequency, rhythm, content, tension, height are evaluated. Rhythm and pulse rate are broadly analogous to rhythm and heart rate. Pulsation of the arteries can be easily detected by touching any palpable artery: radial (a. Radialis), ulnar (a.ulnaris), temporal (a. Temporalis), femoral (a. Femoralis), subclavian (a. Subclavia), brachial (a . brachialis), popliteal (a. poplitea), etc. (EB Babsky, 1984, EV Bykov, 1998, VB Voinov, 2002.).

There are four main types of reaction of the cardiovascular system to dosed physical activity.

The normotonic type of reaction of the cardiovascular system is characterized by an increase in heart rate, an increase in systolic and a decrease in diastolic pressure. Pulse pressure increases. Such a reaction is considered physiological, because with a normal increase in heart rate, adaptation to the load occurs due to an increase in pulse pressure, which indirectly characterizes an increase in the stroke volume of the heart. An increase in systolic blood pressure reflects the effort of left ventricular systole, and a decrease in diastolic blood pressure reflects a decrease in the tone of arterioles, which provides better blood access to the periphery. The recovery period with such a reaction of the cardiovascular system is 3-5 minutes. This type of response is typical of trained athletes.

The hypotonic (asthenic) type of reaction of the cardiovascular system is characterized by a significant increase in heart rate (tachycardia) and, to a lesser extent, an increase in the stroke volume of the heart, a slight rise in systolic and a constant (or slight increase) in diastolic pressure. Pulse pressure decreases. This means that increased blood circulation during exercise is achieved more due to increased heart rate, and not an increase in stroke volume, which is irrational for the heart. The recovery period is dragging on.

Hypertensive a type reactions on the physical load characterized by a sharp increase in systolic blood pressure - up to 180-190 mm Hg. Art. with a simultaneous rise in diastolic pressure up to 90 mm Hg. Art. and higher and a significant increase in heart rate. The recovery period is dragging on. Hypertensive a type reactions estimated as unsatisfactory.

Dystonic type of reaction of the cardiovascular system to the physical load characterized by significant raising systolic pressure - above 180 mm Hg. Art. and diastolic, which after the termination of the load can sharply decrease, sometimes to "0" - the phenomenon of an endless tone. The heart rate increases significantly. Such a reaction to physical activity is regarded as unfavorable. The recovery period is dragging on.

The stepwise type of reaction is characterized by a stepwise rise in systolic pressure at the 2nd and 3rd minutes of the recovery period, when the systolic pressure is higher than at the 1st minute. Such a reaction of the cardiovascular system reflects the functional inferiority of the regulatory circulatory system, therefore it is assessed as unfavorable (V.S.Farfel, 1960, V.M. Pokrovsky, 2007).

Hypoxia is a typical pathological process that develops as a result of insufficient biological oxidation, leading to a violation of the energy supply of functions and plastic processes in the body (PF Litvitsky, 2002).

The term "hypoxia" in its etymological and meaningful meaning can be interpreted in two ways.

In some cases, the term “oxy” is taken as a basis as referring to oxygen. In this interpretation, the term "hypoxia" defined as follows: hypoxia - a condition resulting from insufficient supply of body tissues with oxygen and / or a violation of its assimilation during biological oxidation. Synonyms for the concept of "hypoxia" in this interpretation are "oxygen starvation" and "oxygen failure", what characteristically at fulfillment training or competitive work of large volume and intensity.

In other cases, the term "oxy" is interpreted as referring to oxidation. In this embodiment, the term "hypoxia" is used in a broader sense. This interpretation of the term "hypoxia" means absolute or relative insufficiency of the level of real energy supply in comparison with the level of functional activity and intensity of plastic processes in an organ, tissue, organism. This condition leads to disruption of the vital functions of the body as a whole, disorders of the functions of organs and tissues. Morphological changes in them have a different scale and degree, up to the death of cells and non-cellular structures (ED Goldberg. AM, Goldberg, 2006, AZ Kolochinskaya, 1983).

Hypoxia characterized by metabolic violations, mainly on the part of energy (deficiency of high-energy compounds) and carbohydrate (increased glycolysis, increased concentration of lactic and pyruvic acids in blood serum) metabolism, the development of metabolic acidosis. Resistance of the body to a lack of oxygen

- one of the factors of adaptation - is determined by genetic and phenotypic properties (hereditary and acquired in the process of life) (NK Khitrov, 1991).

Hypoxia in any variant is often combined with hypoxemia (PF Litvitsky, 2002).

The most common type of hypoxia - physical exercise hypoxia (A.Z. Kolchinskaya, 1983) is often accompanied by hypocapnia (N.A. Agadzhanyan, 1974, 1986).

According to E.D. Goldberg (2006), A.Z. Kolochinskaya (1983), F.Z. Meerson (1989), ventilatory and motor hypoxic conditions are classified according to various criteria: etiology, severity of disorders, rate of development and duration of hypoxia.

According to etiology, several types of hypoxia are distinguished, conditionally combined into two groups:

- exogenous: normobaric and hypobaric
- endogenous: tissue, respiratory, substrate, cardiovascular (circulatory), overload, blood (hemic).

According to the criterion of severity of disorders of the body's vital functions, the following types of hypoxia are distinguished: mild, moderate (moderate), severe, critical (life-threatening, lethal).

The following are used as the main signs of one or another severity (severity) of hypoxia:

- the degree of impairment of neuropsychic activity,
- severity of cardiovascular and respiratory system dysfunctions,
- the value of deviations of indicators of gas composition and blood acid baseline ratio, as well as some other indicators.

According to the criteria for the rate of occurrence and duration of a hypoxic state, several of its varieties are distinguished.

Lightning (acute) hypoxia develops within a few seconds. As a rule, after a few tens of seconds (within the first minute) after the action of the cause of hypoxia, a serious condition of the patient is revealed, often serving as the cause of his death (for example, when aircraft are depressurized at a high (more than 9-11 thousand m) altitude or as a result of a rapid loss of large amounts of blood (for example, with injuries of large arterial vessels or rupture of an aneurysm of their wall).

Acute hypoxia develops within a few minutes (usually within the first hour) after exposure to the cause of hypoxia (for example, as a result of acute blood loss or acute respiratory failure).

Subacute hypoxia forms within a few hours (but within the first day). Examples of such a variety can be hypoxic conditions that develop as a result of the ingestion of methemoglobin-forming agents (nitrates, nitrogen oxides, benzene), venous blood loss, slowly increasing respiratory or heart failure.

Chronic - develops and / or, for lasts more than a few days, example, with chronic anemia, cardiac or respiratory insufficiency.

Exogenous types of hypoxia include normo- and hypobaric hypoxia. The reason for their development: a decrease in the partial pressure of oxygen (pO2) in the air entering the body.

- When normal barometric pressure say about normobaric exogenous hypoxia.
- With a decrease in barometric pressure, exogenous hypoxia is called hypobaric.

Causes of normobaric exogenous hypoxia: restriction of oxygen intake with air at normal barometric pressure. Such conditions develop when:

- finding people in a small and / or poorly ventilated space (room, shaft, well, elevator);
- violations of air regeneration and / or the supply of oxygen mixture for breathing in flying and deep-seated vehicles, autonomous suits (astronauts, pilots, divers, rescuers, firefighters);
- non-observance of the method of ventilation.

The reasons hypobaric exogenous hypoxia: decline barometric pressure when ascending to an altitude (more than 3-3.5 thousand m, where the pO2 of air is reduced to about 100 mm Hg) or in a pressure chamber. Under these conditions, the development of either mountain, altitude, or decompression sickness is possible.

Mountain sickness is observed when climbing mountains, where the body is exposed not only to a low oxygen content in the air and low barometric pressure, but also to more or less pronounced physical activity, cooling, increased insolation and other factors of medium and high mountains.

Altitude sickness develops in people raised to great heights in open aircraft, on elevator chairs, as well as when the pressure in the pressure chamber decreases. In these cases, the organism is mainly affected by the reduced pO_ in the inhaled air and barometric pressure.

Decompression sickness is observed with a sharp decrease in barometric pressure (for example, as a result of depressurization of aircraft at an altitude of more than 10-11 thousand meters). In this case, a life-threatening condition is formed, which differs from mountain and altitude sickness by an acute or even lightning-fast current.

The main links in the pathogenesis of exogenous hypoxia (regardless of its cause) include arterial hypoxemia, hypocapnia, gas alkalosis, followed by acidosis; arterial hypotension, combined with hypoperfusion of organs and tissues.

- Decrease in oxygen tension in arterial blood plasma (arterial hypoxemia) - the initial and main link of exogenous hypoxia. Hypoxemia leads to a decrease in the oxygen saturation Hb of the total oxygen content in the blood and, as a consequence, to disturbances in gas exchange and metabolism in tissues.

- Decreased blood pressure of carbon dioxide (hypocapnia). It occurs as a result of compensatory hyperventilation of the lungs (due to hypoxemia).

- Gas alkalosis is the result of hypocapnia.

At the same time, it should be remembered that in the presence of a high content of carbon dioxide in the inhaled air (for example, when breathing in a confined space or in an industrial environment), exogenous hypoxemia can be combined with hypercapnia and acidosis. Moderate hypercapnia (unlike hypocapnia) does not aggravate the effects of exogenous hypoxia, but, on the contrary, promotes an increase in blood circulation in the vessels of the brain and heart. However, a significant increase in pCO2 in the blood leads to acidosis, an imbalance of ions in cells and biological fluids, hypoxemia, a decrease in the affinity of Hb for oxygen, and a number of other pathogenic effects.

A decrease in systemic blood pressure (arterial hypotension), combined with tissue hypoperfusion, is largely a consequence of hypocapnia. CO2 is one of the main factors in the regulation of cerebral vascular tone. A significant decrease in pCO2 is a signal for a narrowing of the lumen of the arterioles of the brain and heart and a decrease in their blood supply. These changes cause significant disorders of the body's vital functions, including the development of fainting and coronary insufficiency (manifested by angina pectoris, and sometimes myocardial infarction).

In parallel with these deviations, violations of the ionic balance are detected, both in cells and in biological fluids: intercellular, plasma blood (hypernatremia, hypokalemia and hypocalcemia), lymph, cerebrospinal fluid. The above-described deviations can be reduced or eliminated by adding the required (calculated) amount of carbon dioxide to the inhaled air (E.D. Goldberg, 2006).

Hypoxic hypoxia occurs due to a decrease in the partial pressure of oxygen in the inhaled air or the difficulty of oxygen penetration into the blood through the respiratory tract.

Hemic hypoxia is a consequence of a decrease in the number of erythrocytes in the peripheral blood or a sharp decrease in the hemoglobin content in erythrocytes.

Circulatory hypoxia is caused by dysfunction of the cardiovascular system (weakening of the heart, vasospasm) and the resulting deterioration of oxygen supply to the tissues.

Tissue hypoxia occurs due to the deterioration of oxygen utilization in violation of biological oxidation processes and is associated with damage to oxidative, enzyme systems, cell membrane structures, etc.

Hypercapnia is a state of the body caused by an increase in the partial pressure of carbon dioxide in arterial blood due to physical exertion (VB Voinov, 2002). A healthy body can be in a state of hypoxia if the demand for oxygen (oxygen demand) is higher than the ability to satisfy it.

With light to moderate physical work, a sufficient amount of oxygen is delivered to the muscle cells. The resulting NAD · H_2 (nicotinamide dinucleotide) is completely oxidized by an oxygen acceptor. Pyruvic acid (PVA) is also completely oxidized. With increasing load, the breakdown of glycogen increases, as well as the rate of recovery of NAD. The moment comes when the oxygen transport system can no longer cope with the lack of the required amount of oxygen. PVC starts to play the role of a hydrogen acceptor and, as a result of the oxidation of NAD · H_2, lactic acid is formed (V.I. Dubrovsky, 2005). Lack of oxygen stimulates the body to use additional anaerobic energy sources - the breakdown of glycogen to lactic acid. However, the energy yield of ATP is small in this case.

Acidification of the internal environment of the body with lactic acid and other under-oxidized metabolites occurs. At the same time, the human body responds with an adaptive response in response to a harmful destructive effect (R. Mohan, 2001, N.G. Ozolin, 2002). In response to hypoxia, adaptation, conditioning opportunity normal vital functions of the body in conditions of chronic oxygen starvation. With the depletion of compensatory processes developing during hypoxia, adaptation breaks down, accompanied by a violation of a number of physiological functions and metabolic reactions. Thus, sports activities stimulate the launch of both urgent and long-term adaptive processes in systems oxygen supply to the human body. According to V.F.Bashkirov (1990), E.N. Tkachuk (1997), adaptation to intensive (usually short-term) work in muscles develops a different spectrum of adaptations than to prolonged moderate work. The capacity of the anaerobic glycolysis system increases due to the increased synthesis of glycolytic enzymes, rise stocks glycogen and creatine phosphate - energy sources for the synthesis of ATP. The power of the endoplasmic reticulum in muscle fibers and the amount of Ca2 + stored in it, which plays one of the main roles in muscle contraction, increases. When long-term adaptations is happening stimulation biosynthetic processes in transport, regulation and energy supply systems, which increases their structural potential and reserve capacity. In transport systems, this is the proliferation of the vasculature (angiogenesis) in the lungs, heart, brain, the growth of lung tissue, and an increase in the number of red blood cells in the blood. In regulatory systems, this is, on the one hand, an increase in the activity of enzymes responsible for the synthesis of mediators and hormones, and on the other, an increase in the number of receptors to them in tissues. In energy supply systems - an increase in the number of mitochondria and enzymes of oxidation and phosphorylation, synthesis glycolytic enzymes. Physical activity has a double training effect: it increases the body's resistance to a lack of oxygen and, by increasing the power of the respiratory and cardiovascular systems, contributes to its better assimilation (N.A. Agadzhanyan, 2001).

The function of the external respiration apparatus is aimed at providing the body with the necessary amount of oxygen and freeing it from excess carbon dioxide. Gas exchange in the lungs and blood oxygen saturation are carried out through the coordinated interaction of several processes, the main of which are pulmonary ventilation, alveolar-capillary diffusion, pulmonary blood flow (A.I. Zhuravleva,
1993, M. Smirnova, 2001).

A functional test is a way to assess the fitness of certain body systems using a control test; it is a fairly quick and qualitative way to assess the adaptive properties of an athlete's body under the influence of a load (V.A.Zaporozhanov, 1988).

The test with maximum voluntary breath retention (MPRD) is used to judge the oxygen supply of the body. It also characterizes the general level of fitness of a person. With functional weakness of the myocardium, oxygen starvation of tissues due to a decrease in systolic and minute blood volume, as well as a slowdown in blood circulation, occurs faster. An increase in the amount of carbonic acid leads to an earlier excitation of the respiratory center. With fixed adaptive shifts in the oxygen supply system, the time of maximum voluntary breath holding increases. MPZD causes a decrease in the content of oxyhemoglobin and tissue oxygen tension in subjects to levels characteristic of short-term physiological hypoxia (VB Voinov, 2002, VI Dubrovsky, 1991, VA Zaporozhanov, 1988). An increase in the MPZD time indicates the adaptation of the body to hypoxia. Such mechanisms are carried out, according to E.N. Tkachuk (1997), hyperfunction of oxygen transport and utilization systems.

In our study of hypoxic resistance, we evaluated fitness highly qualified athletes (observed persons) before and after taking "light water" according to the following indicators and tests:

1) measurement of heart rate and blood pressure in highly qualified athletes before loads (before physical work and MPAP on inspiration and expiration);

2) maximum voluntary breath holding on inspiration;

3) maximum voluntary breath holding on exhalation;

4) the maximum number of squats in three minutes (physical Work);

5) maximum voluntary breath holding on inspiration after performing physical work;

6) maximum voluntary breath holding on exhalation after performing physical work;

7) measurement of heart rate and blood pressure after exercise (after MPZD on inspiration and on exhalation after physical work).

The tests were carried out on three groups of highly qualified basketball athletes with sports categories of CMS and MS before taking "light water" and after taking "light water":

1st group (7 people) - took "light water" unlimited for 28 days in accordance with the individual needs of the body;

Group 2 (7 people) - took "light water" dosed: 200 ml before the start of training and 200 ml after it for 28 days;

Group 3 (5 people) - control - took ordinary water (placebo) unlimited for 28 days in accordance with the individual needs of the organism.

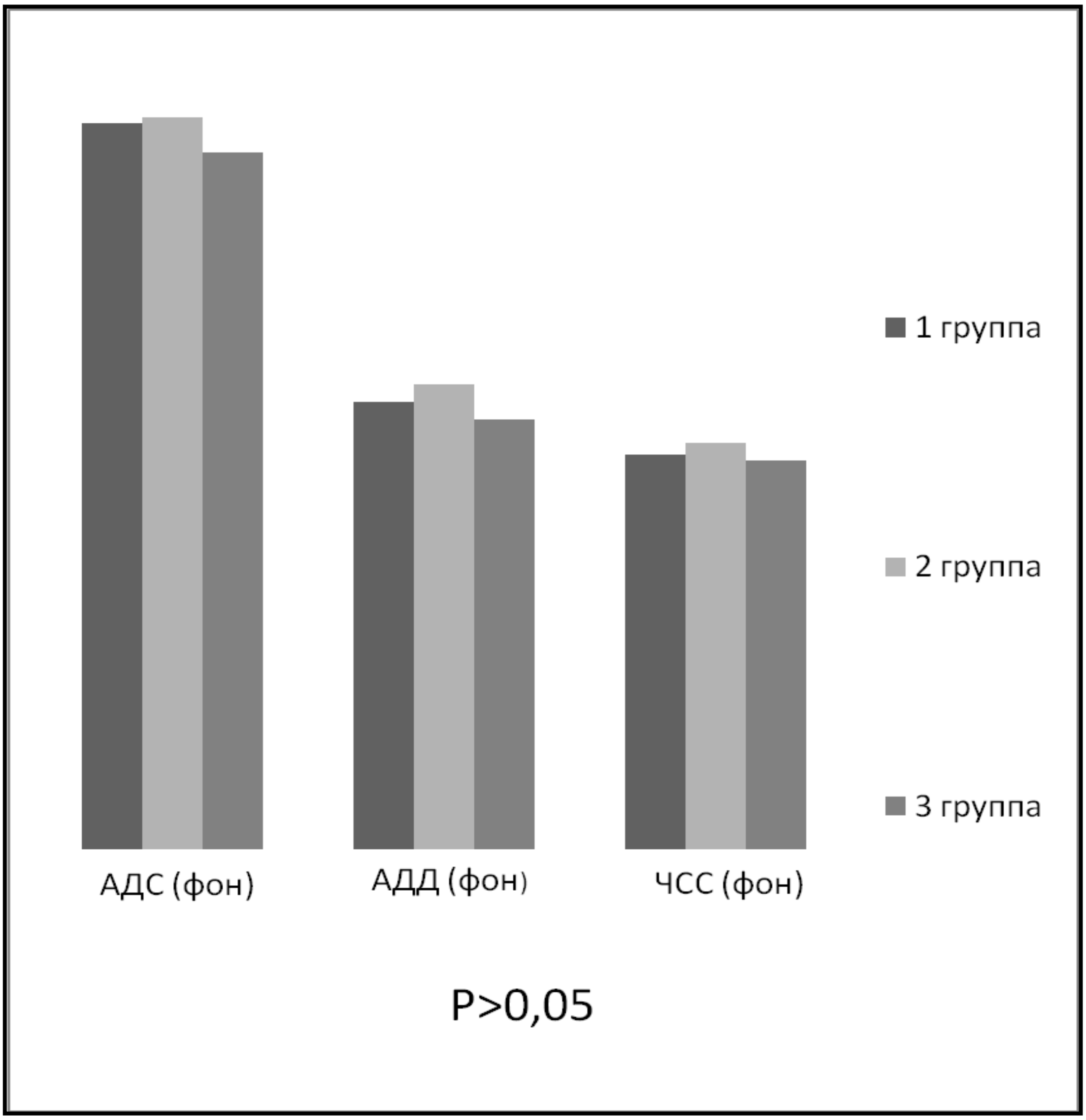

Fig. 3.1.1. Baseline (before exercise: physical work and MPAP) mean values of intergroup differences in systolic blood pressure (ADS, mmHg.), arterial pressure diastolic (BPP, mm Hg), heart rate (HR, beats / min.) in three groups of observed persons before taking "light water".

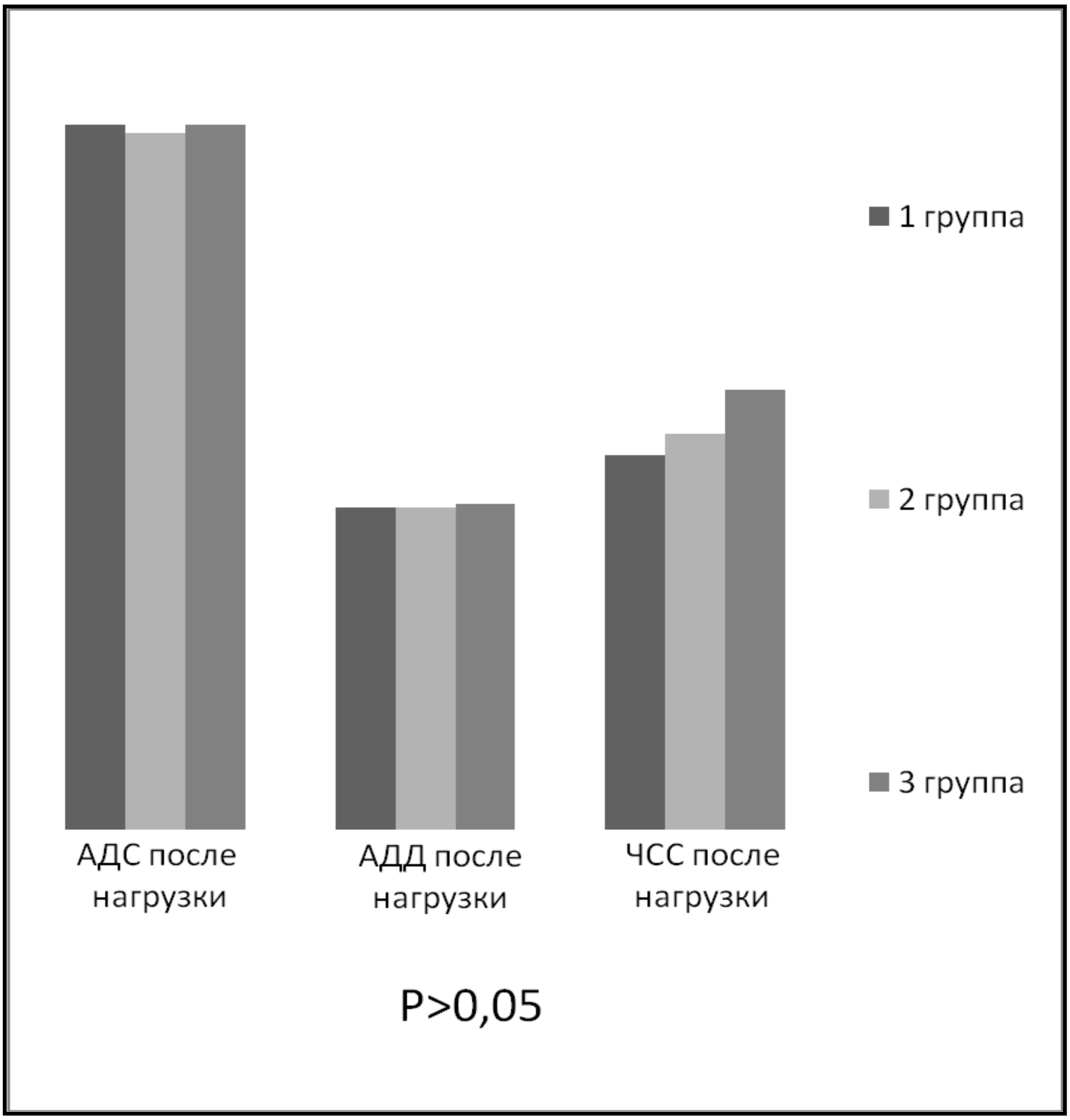

Fig. 3.1.2. Average indicators intergroup differences arterial pressure systolic (ADS, mmHg.), diastolic blood pressure (BPP, mm Hg), heart rate (HR, beats / min.) after exercise (physical work and MPAP) in three groups of observed persons before taking "light water".

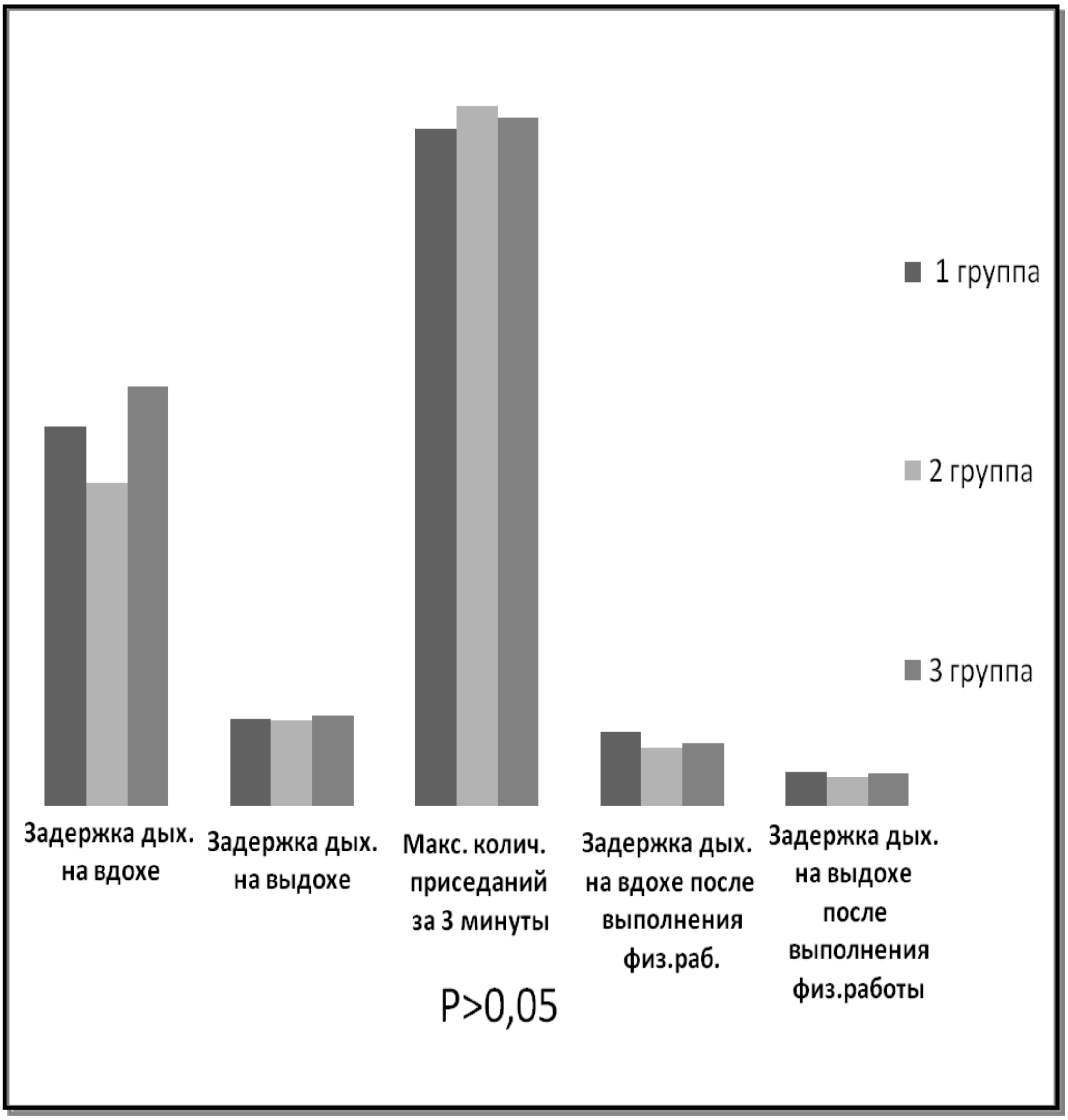

Fig. 3.1.3. Average indicators intergroup differences the maximum number of squats in three minutes (physical work), the time of the maximum voluntary breath holding on inhalation (sec.), the maximum voluntary breath holding on the exhalation (sec.) before and after physical work in three groups of observed persons before taking "light water".

Table 3.1.1

Average indicators for three groups of observed persons before admission "Light water".

Studied indicators	Groups		
	I	II	III (control)
BP systolic before load (mm Hg) BP	125 ± 4.88	126 ± 5.63	120 ± 2.87
diastolic before load (mm Hg) Heart rate	77 ± 3.22	80 ± 2.02	74 ± 1.98
before load (bpm)	68 ± 6.08	70 ± 2.97	67 ± 2.82
Post-exercise systolic blood pressure (mm Hg)	173 ± 4.69	171 ± 9.01	173 ± 16.44
Post-exercise diastolic blood pressure (mm Hg)	79 ± 0.75	79 ± 4.02	80 ± 9.16
Post-exercise heart rate (bpm)	92 ± 8.14	97 ± 3.73	108 ± 6.50
Maximum voluntary breath holding on inspiration (sec.)	66.70 ± 5.61	56.6 ± 6.41	73.80 ± 9.29
Maximum voluntary breath holding on exhalation (sec.)	15.10 ± 1.62	15 ± 4.15	15.80 ± 2.52
The maximum number of squats in 3 minutes (physical work)	119 ± 11.12	123 ± 10.2	121 ± 7.77
Maximum voluntary breath holding on inspiration after physical work (sec.)	13 ± 1.38	10 ± 1.41	11.00 ± 1.30
Maximum voluntary breath holding on exhalation after physical work (sec.)	5.9 ± 1.12	5 ± 0.93	5.60 ± 1.12

As can be seen from Table 3.1.1 (Fig. 3.1.1, 3.1.2, 3.1.3), the average values of indicators for three groups of observed persons before taking "light water" did not reveal significant differences between them.

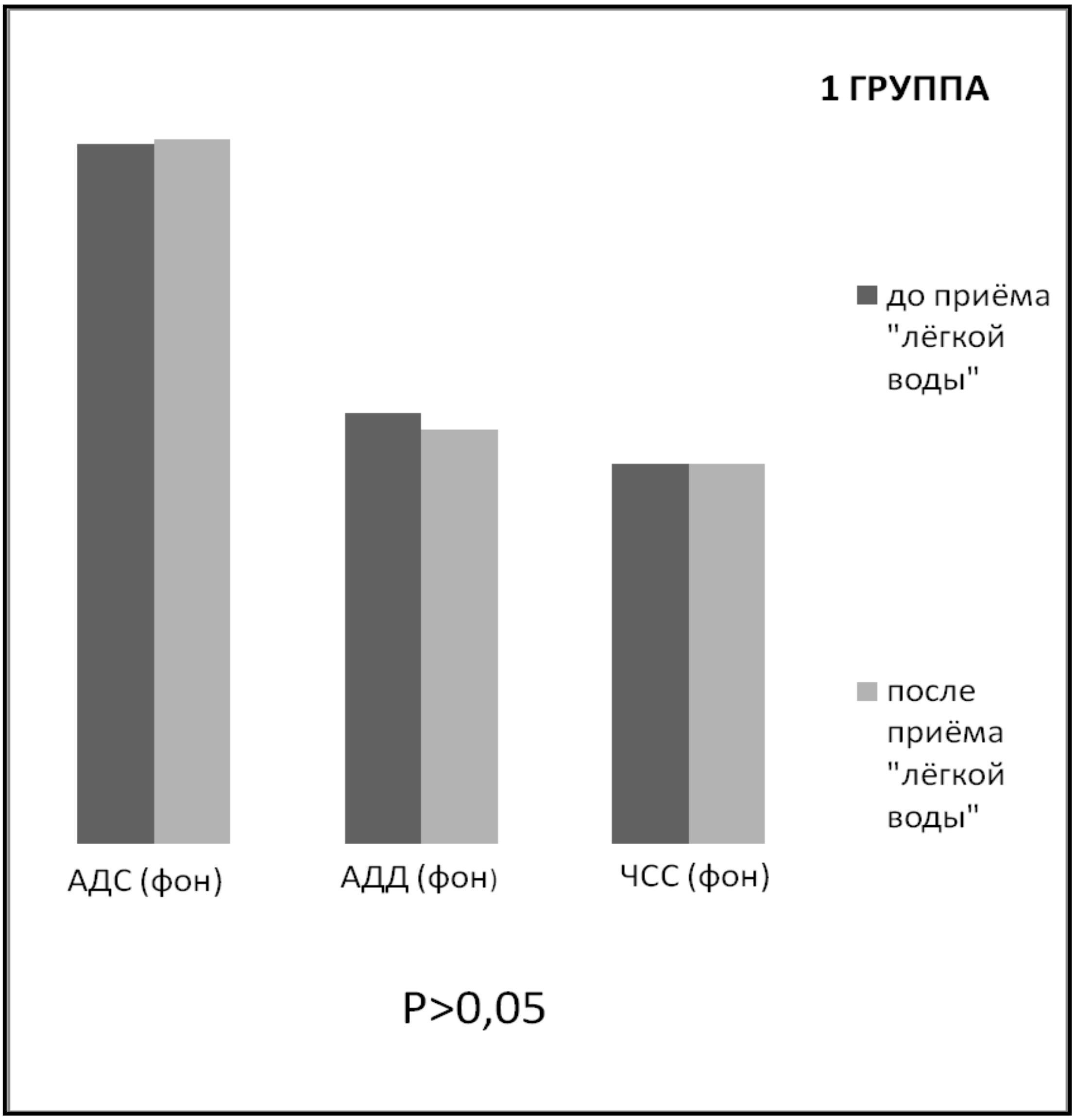

Fig. 3.1.4. Baseline (before exercise: physical work and MPPD) mean values of systolic blood pressure (BPM, mm Hg), diastolic blood pressure (BPP, mm Hg), heart rate (heart rate, beats / min. .) in the first group of observed persons before and after taking "light water"

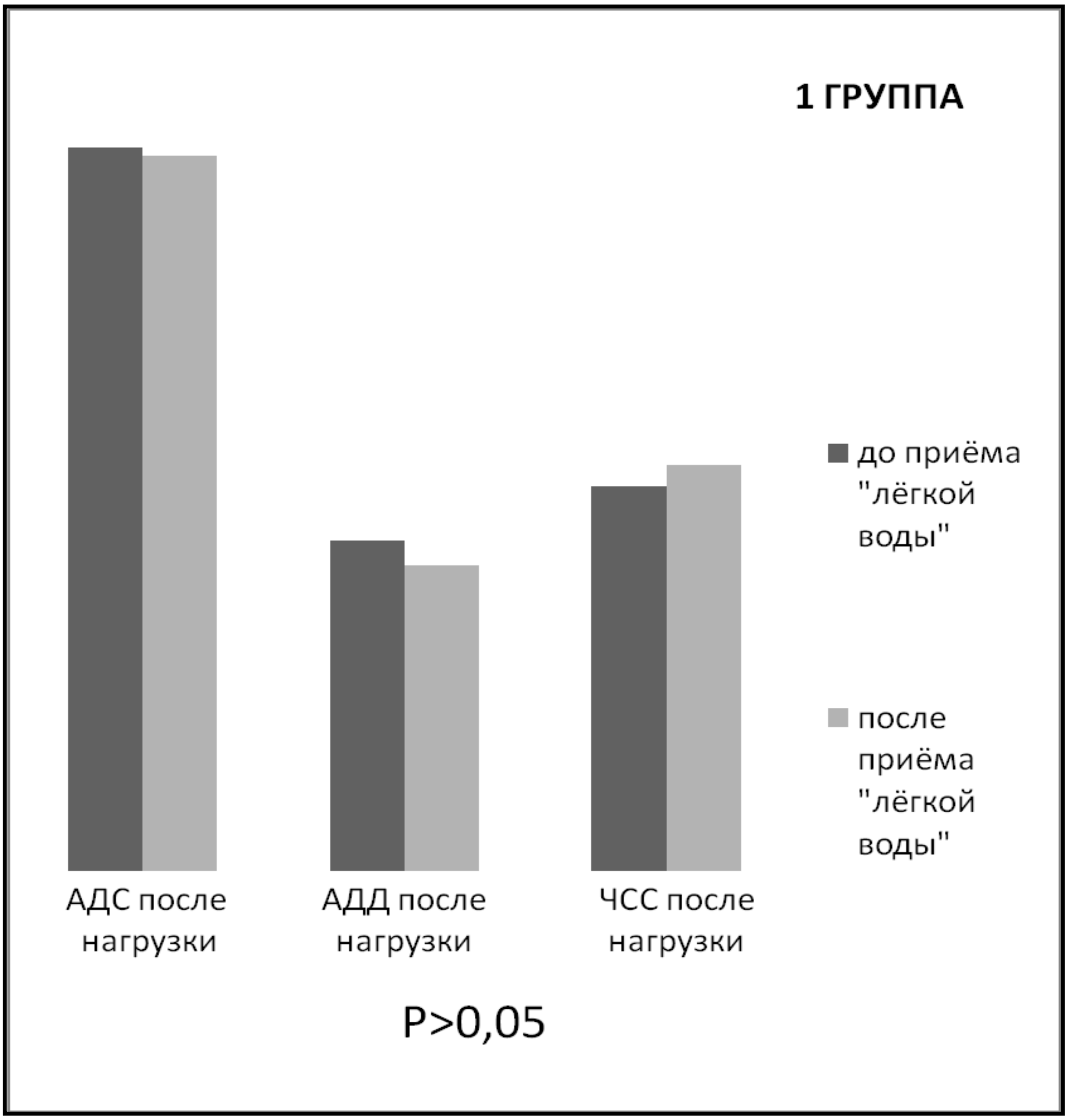

Fig. 3.1.5. Average indicators arterial pressure systolic (ADS, mmHg.), arterial pressure diastolic (BPP, mm Hg), heart rate (heart rate, beats / min.) after exercise (physical work and MPAP) in the first group of observed persons before and after taking "light water"

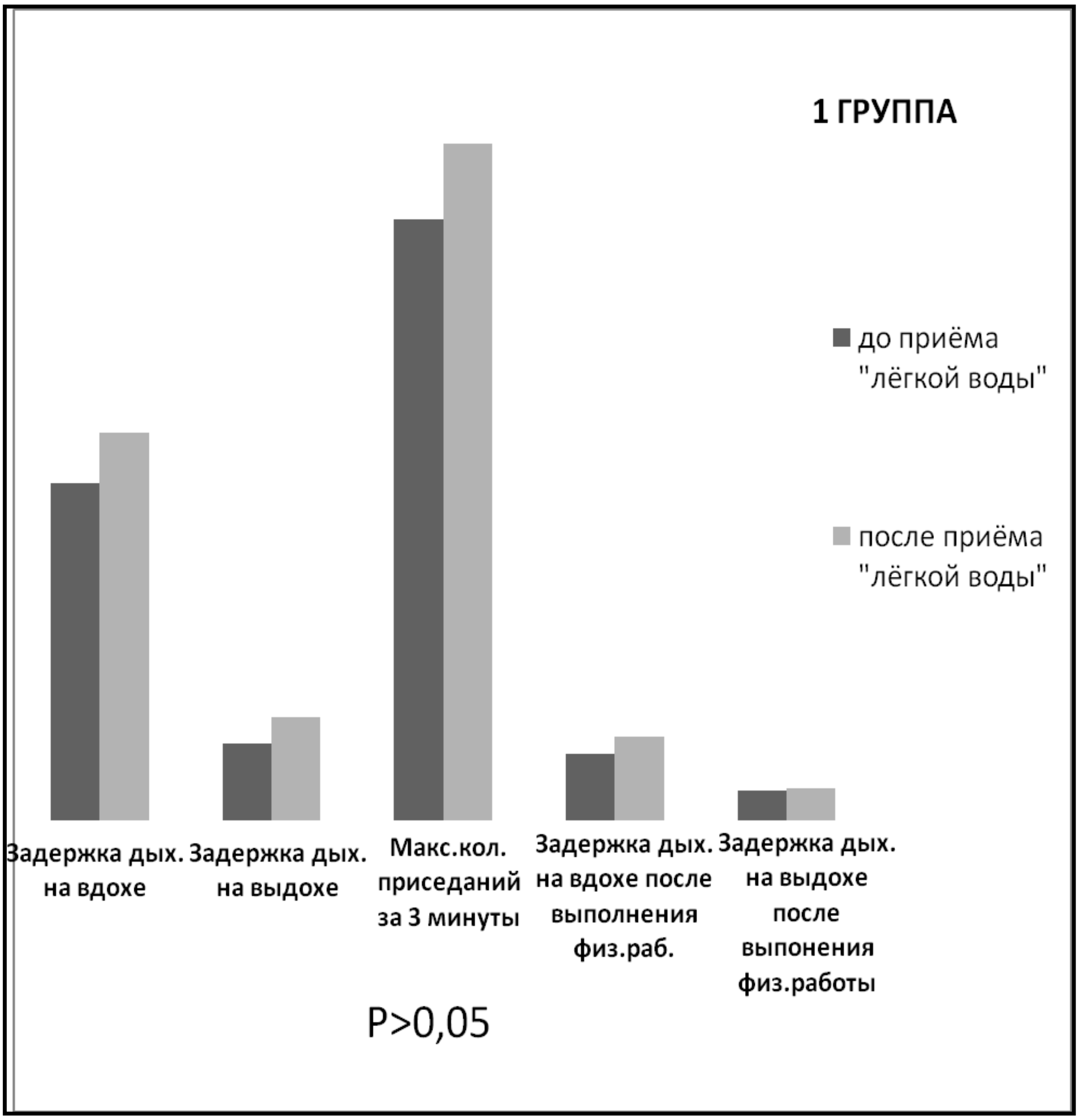

Fig. 3.1.6. Average indicators of the maximum number of squats for three minutes (physical work), the time of the maximum voluntary breath holding on inspiration (sec.), The maximum voluntary breath holding on the exhalation (sec.) Before and after physical work in the first group of observed persons before and after taking " light water "

Table 3.1.2

Average values of indicators in the first group of observed persons before and after taking "light water"

Studied indicators	First group	
	before the appointment "Light water"	after admission "light water" 125
BP systolic before load (mm Hg) BP	± 4.88	126 ± 3.62
diastolic before load (mm Hg) Heart rate	77 ± 3.22	74 ± 4.31
before load (bpm)	68 ± 6.08	68 ± 4.63
Post-exercise systolic blood pressure (mm Hg)	173 ± 4.69	171 ± 4.20
Post-exercise diastolic blood pressure (mm Hg)	79 ± 0.75	73 ± 3.10
Post-exercise heart rate (bpm)	92 ± 8.14	97 ± 4.83
Maximum voluntary breath holding at 66.70 ± 5.61 breaths (sec.)		76.7 ± 6.19
Maximum voluntary breath holding at 15.10 ± 1.62 expiration (sec.)		20.3 ± 2.40
Max Squats in 3 Minutes (physical labor)	119 ± 11.12	134 ± 10.51
Maximum voluntary breath holding at 13 ± 1.38 breaths after performing physical work (sec.)		16.6 ± 2
Maximum voluntary breath holding at 5.9 ± 1.12 exhalation after physical work (sec.)		6.4 ± 0.9

According to the indicators of Table 3.1.2 (Fig. 3.1.4, 3.1.5, 3.1.6), no significant differences were found in the observed individuals of the first group before and after taking "light water". However, there was a pronounced positive dynamics after taking "light water" in terms of pulse blood pressure before and after exercise; in terms of maximum voluntary breath holding on inhalation and exhalation before and after physical work and in terms of the maximum number of squats in three minutes.

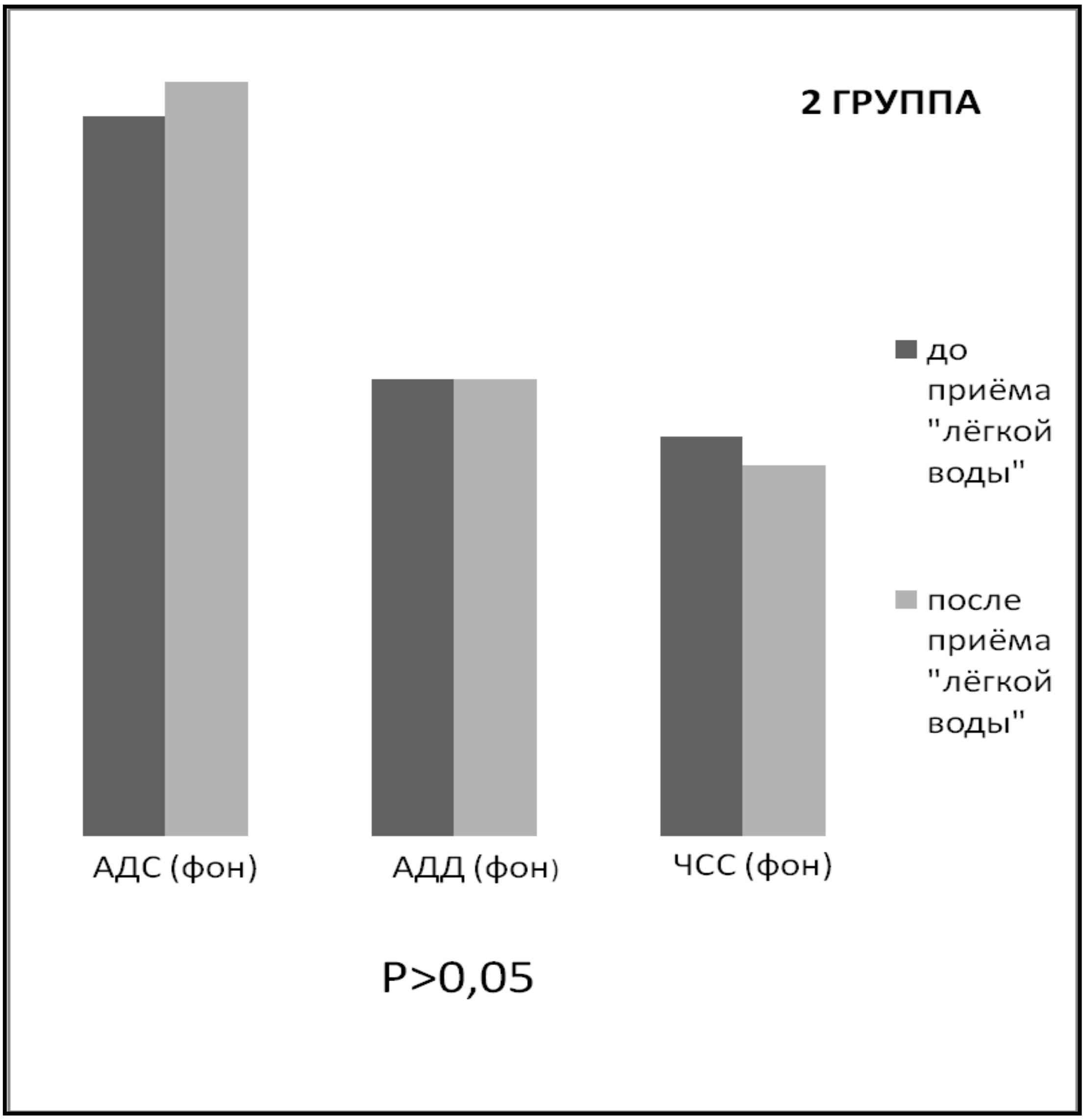

Fig. 3.1.7. Before the load (physical work and MPPD), the average indicators of systolic blood pressure (BPS, mm Hg), diastolic blood pressure (BPP, mm Hg), heart rate (HR, beats / min.)) in the second group of observed persons before and after taking "light water"

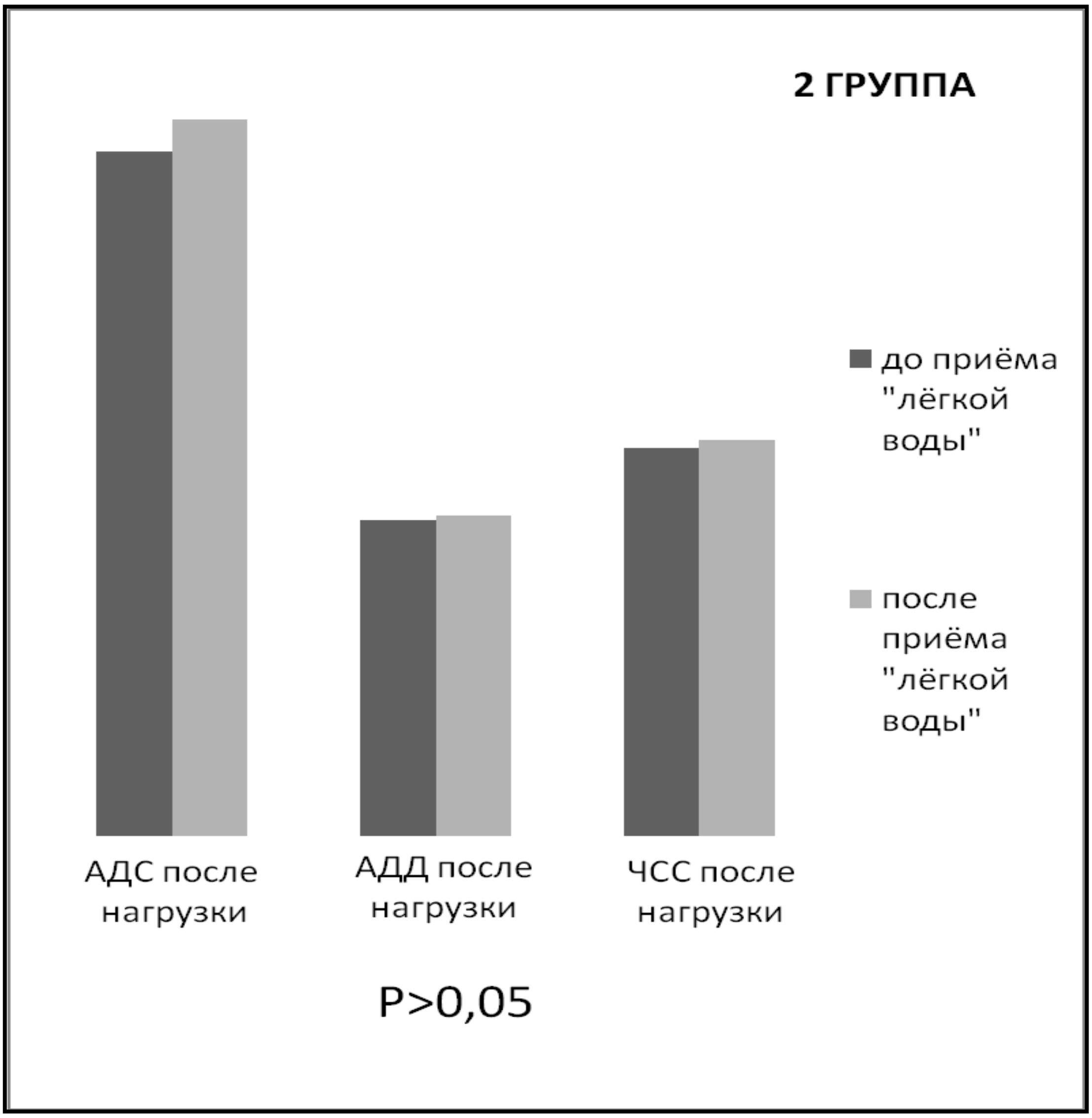

Fig. 3.1.8. Average indicators arterial pressure systolic (ADS, mmHg.), arterial pressure diastolic (BPP, mm Hg), heart rate (HR, beats / min.) after exercise (physical work and MPAP) in the second group of observed persons before and after taking "light water"

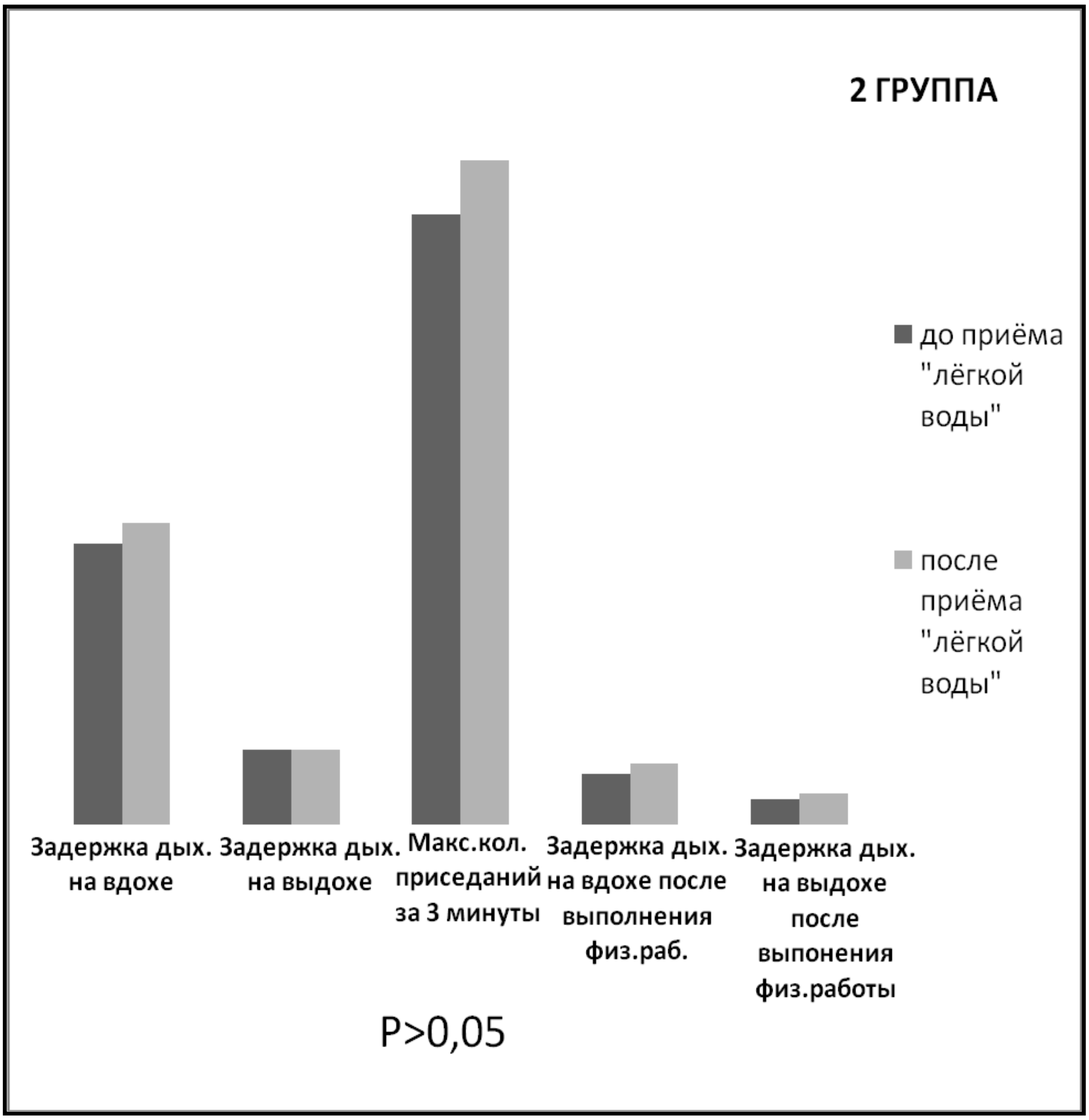

Fig. 3.1.9. Average indicators of the maximum number of squats in three minutes (physical work), the time of the maximum voluntary breath holding on inspiration (sec), the maximum voluntary breath holding on the exhalation (sec) before and after physical work in the second group of observed persons before and after taking "light water "

Table 3.1.3

Average values of indicators in the second group of observed persons before and after taking "light water"

Studied indicators	Second group	
	before the appointment "Light water"	after admission "Light water
BP systolic before load (mm Hg) BP	126 ± 5.63	132 ± 5.10
diastolic before load (mm Hg) Heart rate	80 ± 2.02	80 ± 3.91
before load (bpm)	70 ± 2.97	65 ± 3.39
Post-exercise systolic blood pressure (mm Hg)	171 ± 9.01	179 ± 9.04
Post-exercise diastolic blood pressure (mm Hg)	79 ± 4.02	80 ± 3.21
Post-exercise heart rate (bpm)	97 ± 3.73	99 ± 7.17
Maximum voluntary breath holding at 56.6 ± 6.41 breaths (sec.)		60.7 ± 7.42
Maximum voluntary breath holding for 15 ± 4.15 exhalation (sec.)		14.9 ± 1.87
Max Squats in 3 Minutes (physical labor)	123 ± 10.2	134 ± 12.41
Maximum voluntary breath holding for 10 ± 1.41 breaths after performing physical work (sec.) Maximum voluntary		12.1 ± 1.93
breath holding for 5 ± 0.93 breaths after performing physical work (sec.)		6.1 ± 1.42

According to the indicators of Table 3.1.3 (Fig. 3.1.7, 3.1.8, 3.1.9), the average values in the second group of observed persons before and after taking "light water" did not reveal significant differences, but there were a number of positive trends in the indicators after reception of "light water". There was a tendency towards an increase in the value of arterial systolic pressure before and after exercise. There was a decrease in heart rate before exercise and its increase after exercise, an increase in the time of holding the breath on inspiration before and after performing physical work, and the time holding the breath on exhalation after performing physical work. In comparison with the first group, the tendency towards an increase in the indicated indicators in the second group of observed persons is less pronounced. The maximum number of squats for three minutes in the observed individuals of the first and second groups after taking "light water" did not differ.

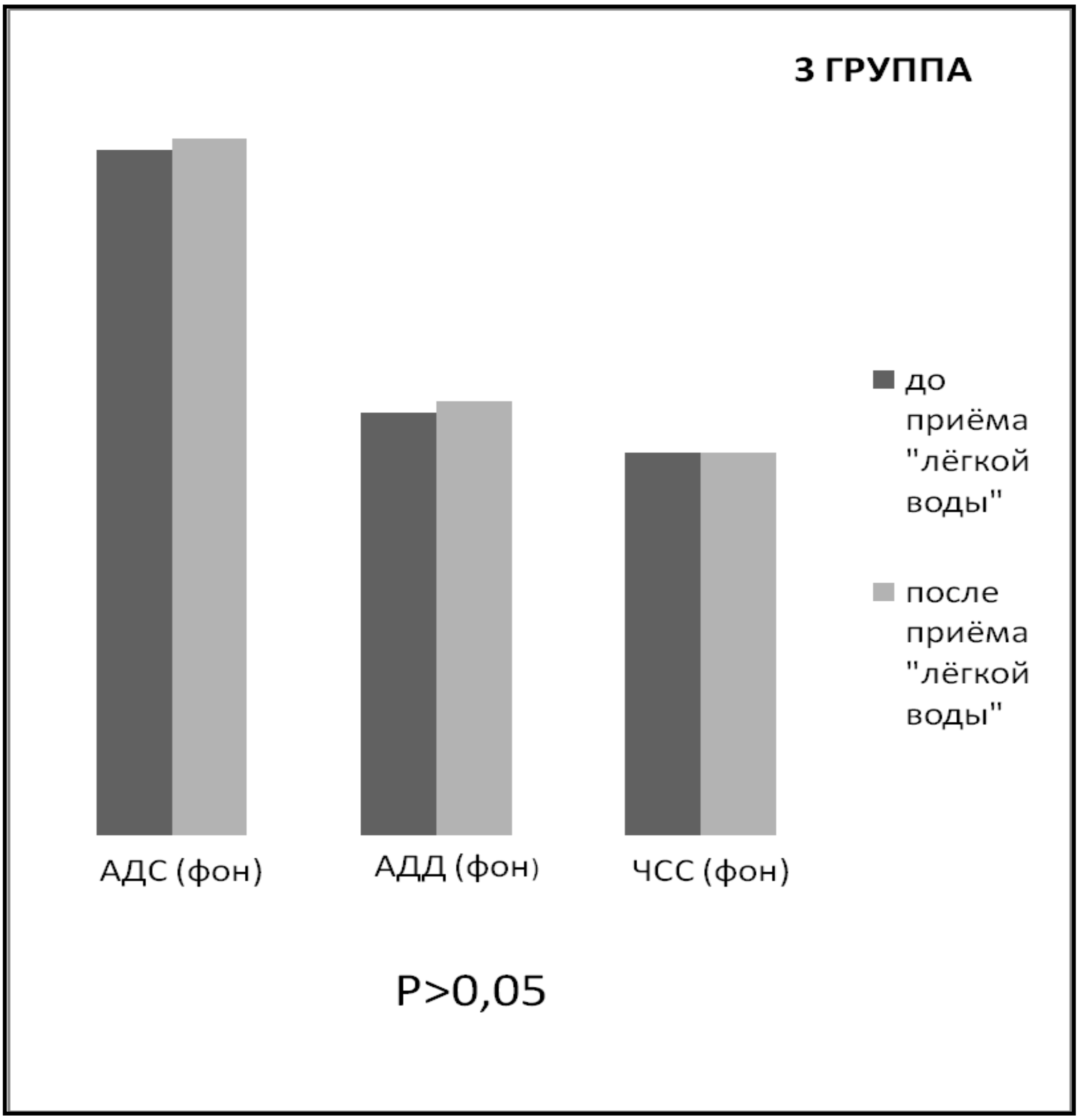

Fig. 3.1.10. Baseline (before exercise: physical work and MPPD) mean values of systolic blood pressure (BPM, mm Hg), diastolic blood pressure (BPP, mm Hg), heart rate (heart rate, beats / min. .) in the third (control) group of observed individuals before and after taking regular water (placebo)

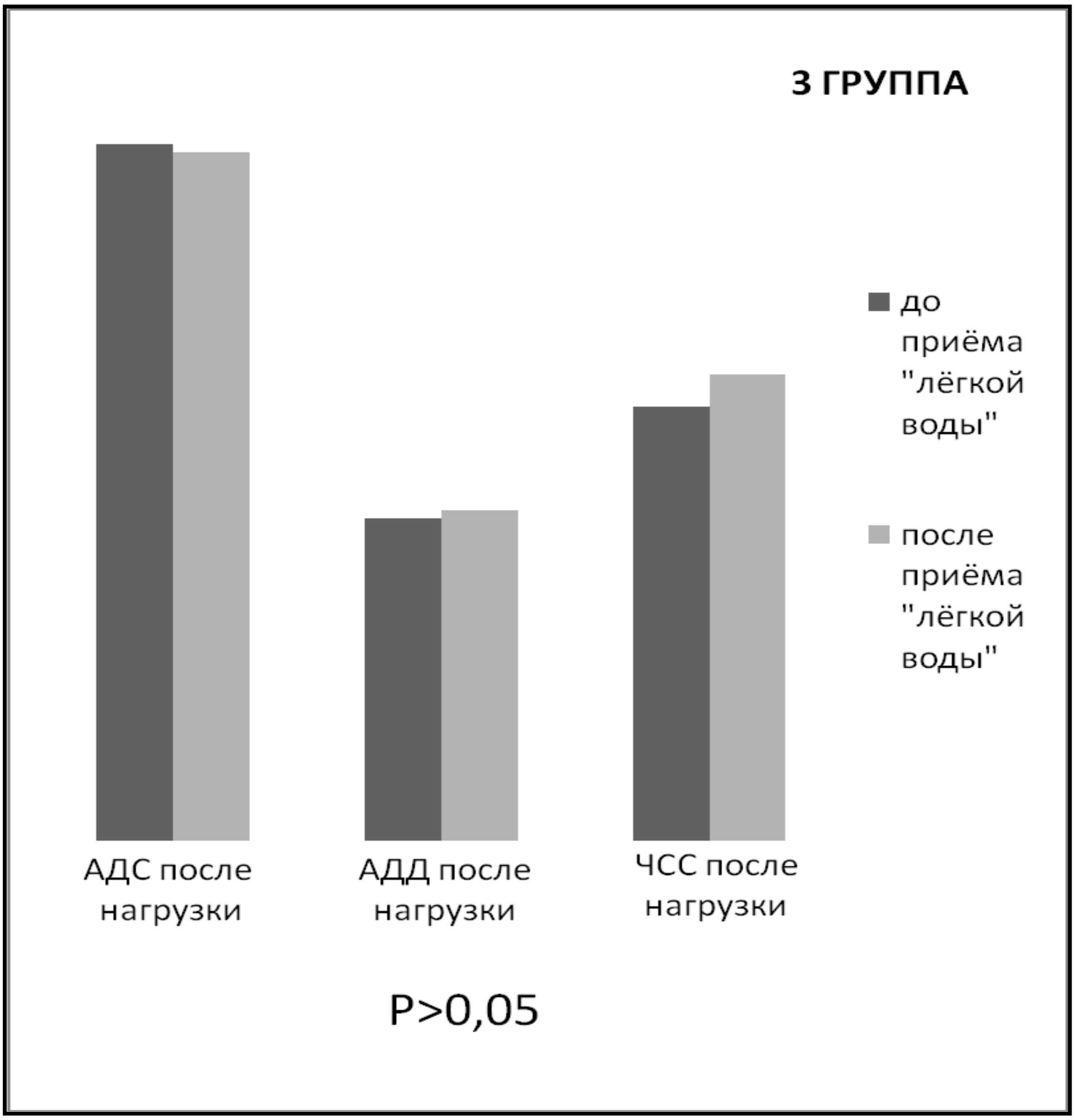

Fig. 3.1.11. Average values of systolic blood pressure (ADS, mmHg.), arterial pressure diastolic (BPP, mm Hg), heart rate (HR, beats / min.) after exercise (physical work and MPAP) in the third (control) group of observed persons before and after taking plain water (placebo)

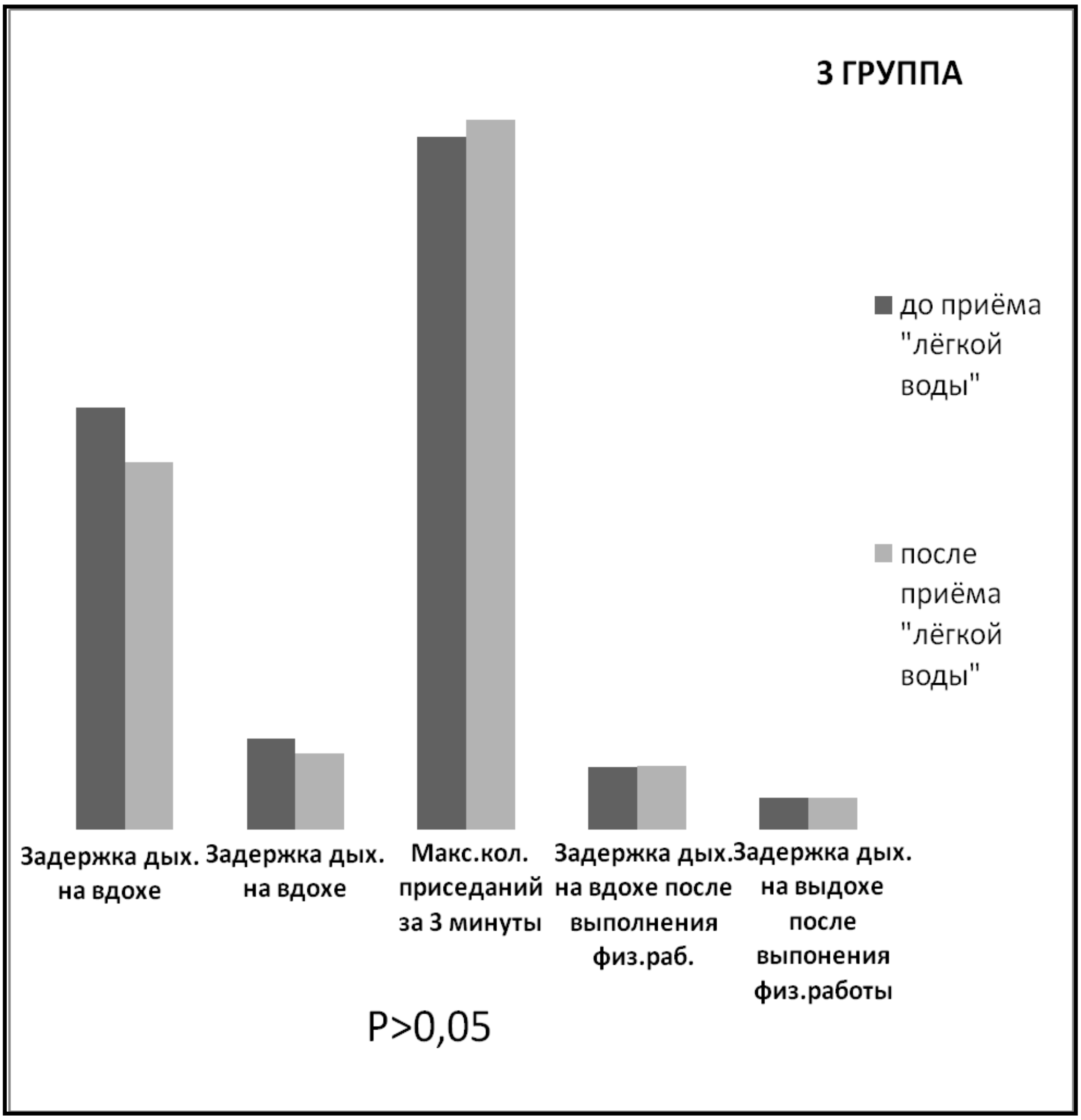

Fig. 3.1.12. Average indicators of the maximum number of squats for three minutes (physical work), the time of the maximum voluntary breath holding on inspiration (sec.), The maximum voluntary breath holding on the exhalation (sec.) Before and after physical work in the third (control) group of observed persons before and after taking plain water (placebo)

Table 3.1.4

Average values of indicators in the third (control) group of observed persons before and after taking plain water (placebo)

Studied indicators	Third group (control)	
	before water intake	after admission water
BP systolic before load (mm Hg) BP	120 ± 2.87	122 ± 3.14
diastolic before load (mm Hg) Heart rate	74 ± 1.98	76 ± 1.57
before load (bpm)	67 ± 2.82	67 ± 3.14
Post-exercise systolic blood pressure (mm Hg)	173 ± 16.44	171 ± 12.2
Post-exercise diastolic blood pressure (mm Hg)	80 ± 9.16	82 ± 6.56
Post-exercise heart rate (bpm)	108 ± 6.50	116 ± 6.52
Maximum voluntary breath holding at 73.80 ± 9.29 inspiration (sec.)		64.2 ± 10.75
Maximum voluntary breath holding at 15.80 ± 2.52 exhalation (sec.)		13.2 ± 2.35
Max Squats in 3 Minutes (physical labor)	121 ± 7.77	124 ± 8.24
Maximum voluntary breath holding at 11.00 ± 1.30 after physical work (sec.)	inhalation	11.2 ± 1.39
Maximum voluntary breath holding at 5.60 ± 1.12 exhalation after physical work (sec.)		5.6 ± 1.57

According to the table. 3.1.4 (Fig. 3.1.10, 3.1.11, 3.1.12), significant differences between the average indicators of the third (control) group before and after taking plain water (placebo), as well as pronounced positive trends after taking plain water (placebo) are absent.

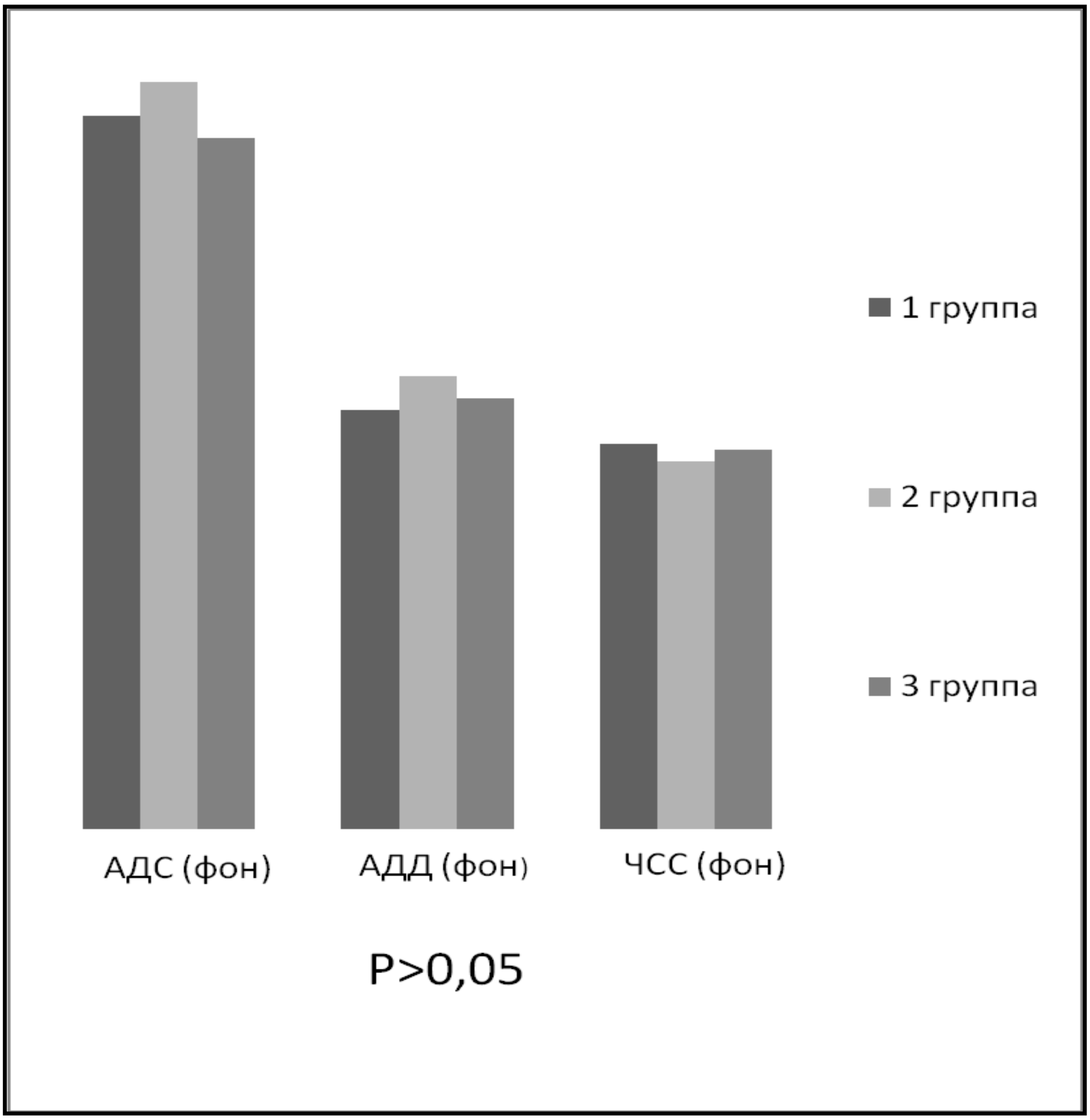

Fig. 3.1.13. Baseline (before exercise: physical work and MPAP) mean values of intergroup differences in systolic blood pressure (ADS, mmHg.), arterial pressure diastolic (BPP, mm Hg), heart rate (HR, beats / min.) in three groups of observed persons after taking "light water".

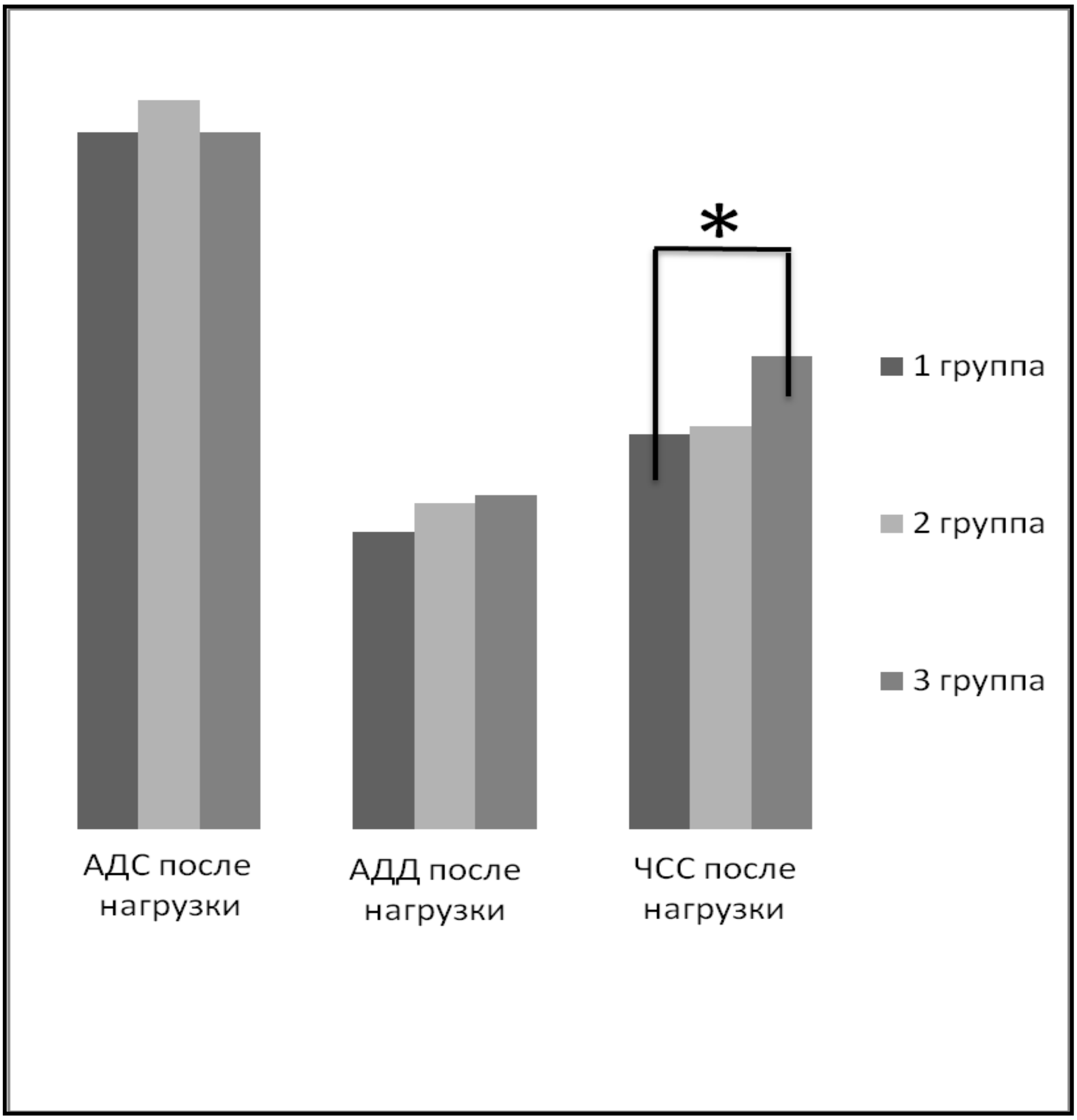

Fig. 3.1.14. Average indices of intergroup differences in arterial pressure systolic (ADS, mmHg.), diastolic blood pressure (BPP, mm Hg), heart rate (HR, beats / min.) after exercise (physical work and MPAP) in three groups of observed persons after taking "light water".

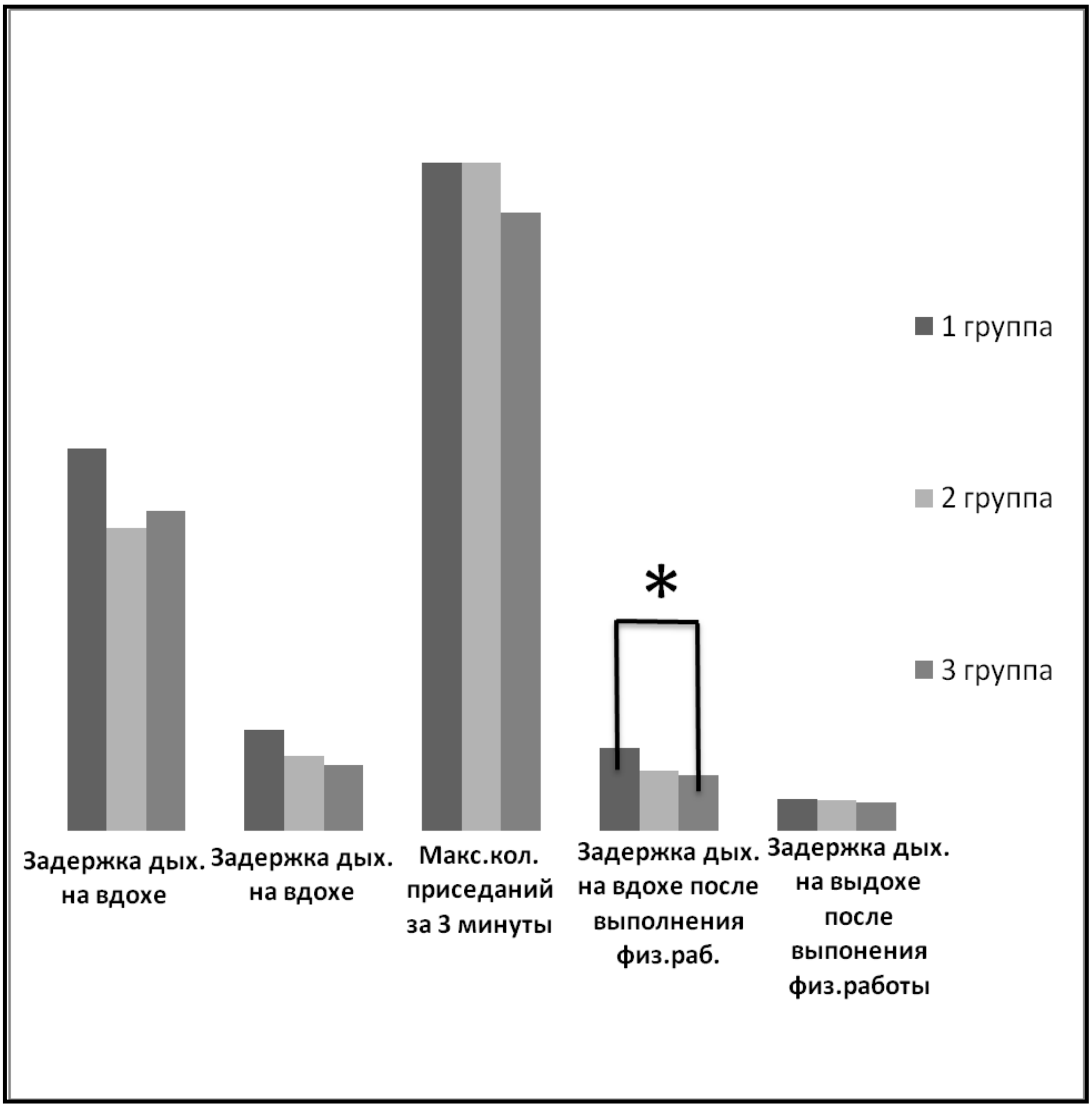

Fig. 3.1.15. Average indices of intergroup differences in the maximum number of squats in three minutes (physical work), the time of the maximum voluntary breath holding on inspiration (sec.), The maximum voluntary breath holding on the exhalation (sec.) Before and after physical work in three groups of observed persons after taking “ light water ".

Table 3.1.5

Average indicators of intergroup differences for the three groups observed persons after taking "light water".

Studied indicators	Indicators after taking "light water"		
	I	II	III (control)
BP systolic before load (mm Hg) BP	126 ± 3.62	132 ± 5.10	122 ± 3.14
diastolic before load (mm Hg) Heart rate	74 ± 4.31	80 ± 3.91	76 ± 1.57
before load (bpm)	68 ± 4.63	65 ± 3.39	67 ± 3.14
BP systolic after exercise (mm Hg)	171 ± 4.20 BP	179 ± 9.04	171 ± 12.2
diastolic after load (mmHg.)	73 ± 3.10	80 ± 3.21	82 ± 6.56
Heart rate after exercise (bpm)	97 ± 4.83 ⋆	99 ± 7.17	116 ± 6.52
Maximum arbitrary delay breathing on inspiration	76.7 ± 6.19	60.7 ± 7.42	64.2 ± 10.75
(sec.) Maximum arbitrary delay breathing on exhalation (sec.)	20.3 ± 2.40	14.9 ± 1.87	13.2 ± 2.35
The maximum number of squats in 3, minutes (physical labor)	134 ± 10.51	134 ± 12.41	124 ± 8.24
Maximum arbitrary delay breathing on inspiration after doing physical work (sec.)	16.6 ± 2 ⋆	12.1 ± 1.93	11.2 ± 1.39
Maximum arbitrary delay exhalation breathing after doing physical work (sec.)	6.4 ± 0.9	6.1 ± 1.42	5.6 ± 1.57

Statistical significance of differences: * - at P <0.05

According to the indicators of table 3.1.5 (Fig. 3.1.14, 3.1.15), significant differences were revealed in the heart rate after exercise and the maximum voluntary breath holding on inspiration after physical work after taking "light water" in the observed persons of the first group in comparison with the observed persons of the third (control) group. In the observed individuals of the first group, the heart rate indicators after exercise were significantly lower, and the indicators of the maximum voluntary breath holding during inspiration were significantly higher. According to the indicators of the maximum voluntary breath holding on inhalation and exhalation before performing physical work, the maximum voluntary breath holding on exhalation after performing physical work, the maximum number of squats in three minutes, their tendency to increase in the observed persons of the first group in comparison with the observed persons of the third (control) group.

In the first and second groups of observed persons, in the characteristics of the differences in average indicators, in contrast to the comparison of the characteristics of indicators of the first and third groups, similar dependencies were observed.

Discussing the results of the studies, it can be noted that the absence of significant differences in the three groups of observed persons before taking "light water" testified to the homogeneity of the samples presented and the purity of the experiment.

The functional tests carried out by us consisted of a two-fold execution of the maximum voluntary breath holding on inhalation and exhalation, burdened by the performance of speed-strength physical work in the form of the maximum number of squats in three minutes. it allowed maximally and in short timing load cardiorespiratory system to obtain accurate and high-quality views of its condition before and after taking "light water".

There was a positive dynamics in the increase in pulse pressure after performing speed-strength physical work and two-fold maximum voluntary breath holding during inhalation and exhalation in the observed persons of the first group after taking "light water". That is, the difference between systolic blood pressure and diastolic blood pressure was 98 mm Hg. (171 mm Hg -73 mm Hg) with an increase in heart rate from 68 bpm. (up to load) up to 97 bpm. (after exercise), while before taking "light water" pulse pressure was equal to 94 mm Hg. (173 mm Hg-79 mm Hg) with a smaller increase in heart rate - from 68 beats / min. (up to load) up to 92 bpm. (after loading). This phenomenon, according to V.S. Farfel (1960), characterizes the type of reaction of the cardiovascular systems on the dosed load as normotonic. With this type of reaction of the cardiovascular system, there is an increase in heart rate, an increase in systolic and a decrease diastolic pressure. Pulse pressure increases. Such a reaction considered physiological and peculiar trained athletes. Consequently, the unrestricted intake of "light water" by the first group observed persons consolidated positive shifts in hemodynamic parameters of the body. In addition, the observed persons have the first group observed increase time maximum voluntary breath holding on inhalation and exhalation before performing physical work and after it has been performed after taking "light water": the time of maximum voluntary breath holding on inhalation before performing physical work increased from 66.7 sec. (before taking "light water") up to 76.7 sec. (after taking "light water"); after doing physical work, the time increased from 13 sec. (before taking "light water") up to 16.6 sec. (after taking "light water"). The time of maximum voluntary breath holding on exhalation before physical work increased from 15.1 sec. (before taking "light water") up to 20.3 seconds and after doing physical work - from 5.9 seconds. (before taking "light water") up to 6.4 sec. (after taking "light water"). This phenomenon is apparently due to with an increase in the resistance of highly qualified athletes of the first group to a lack of oxygen after taking "light water". Since, according to N.A. Aghajanyan (1986), E.N. Tkachuk (1997), the resumption of external respiration in athletes occurs at lower values of the oxygen content in the blood and tissues. The development of deeper hypoxia in the presence of MHCS confirms that the organism of the athletes of the first group after taking "light water" is better adapted to the extreme values of the oxygen content. The maximum number of squats in three minutes in the observed individuals of the first group increased from 119 (before taking "light water") to 134 (after taking "light water"). The maximum number of squats in three minutes can be physiologically evaluated as speed-strength physical work in the zone of increasing hypoxia. Such physical activity, allow you to develop the body's resistance to a lack of oxygen. According to V.F. Bashkirova (1990), F.Z. Meerson (1989), the systematic effect of physical activity of a certain power creates hypoxia in the tissues, which the body eliminates, constantly turning on powerful compensatory physiological and protective mechanisms, training them more and more. As a result, a state of high resistance to oxygen deficiency arises.

The second group of observed persons showed a dynamics similar to the first group in terms of indicators, but expressed to a lesser extent. The time of maximum voluntary breath holding on inspiration before performing physical work increased from 56.6 sec. (before taking "light water") before 60.7 sec. (after taking "light water"); after doing physical work, the time increased from 10 sec. (before taking "light water") up to 12.1 sec. (after taking "light water"). The time of maximum voluntary breath holding on exhalation before performing physical work decreased from 15 sec. (before taking "light water") up to 14.9 sec. (after taking "light water"), and after doing physical work - increased from 5 sec. (before taking "light water") up to 6.1 sec. (after taking "light water"). The maximum number of squats in three minutes in the observed persons of the first and second groups after taking "light water" was 134, however, in the observed persons of the first group, it increased compared to the initial one (from 119 to 134) to a greater extent than in the observed persons of the second group (from 123 to 134). Pronounced positive shifts during speed-strength physical work (the maximum number of squats in three minutes) in the observed individuals of the first and second groups testified in favor of both unlimited and dosed consumption of "light water" in order to urgently adapt the body to short-term intensive work.

Pulse pressure indicators after exercise in the observed persons of the second group did not change in a positive direction after taking

"Light water", however, there was a decrease in heart rate before the load: from 70 beats / min. (before taking "light water") up to 65 beats / min. (after taking "light water"). According to V.I. Dubrovsky (2005), lower heart rate indicators may indicate more a low heart rate, compared with undertrained athletes, an increase in the stroke volume of the heart, greater economization of the work of the cardiovascular system.

In the observed persons of the third (control group), the indicators of the time of the MPZD on inhalation and exhalation, speed-strength physical work (the maximum number of squats in three minutes) did not change significantly. The time of maximum voluntary breath holding on inspiration before performing physical work decreased from 73.8 sec. up to 64.2 sec., and after doing physical work - increased slightly: from 11 sec. up to 11.2 sec. The time of maximum voluntary breath holding on exhalation before performing physical work decreased from 15.8 to 13.2 seconds, and after performing physical work it remained the same - 5.6 seconds. Maximum amount squats in three minutes increased insignificantly - from 121 to 124. Consequently, the intake of ordinary water (placebo) did not have a positive effect on the indicators of hypoxic resistance and adaptation to speed-strength physical work in highly qualified athletes.

Significant differences in HR values after exercise in the observed individuals of the first group (97 beats / min.) After taking light water in comparison with the observed individuals of the third (control) group (116 beats / min.) Indicated that the performance of the same load by well-trained athletes is performed at a lower heart rate, compared to insufficiently trained athletes ... According to V.I. Dubrovsky (2005), with light physical exertion, the heart rate first increases significantly, then gradually decreases to a level that remains during the entire period of stable work. Consequently, this type of load for the first group of highly qualified athletes after taking "light water" was not limiting and allowed the cardiovascular system to work more economically. Significantly higher values of the MPAP on inspiration after performing physical work in the first group of observed persons (16.6 sec.) After taking "light water" in comparison with the indexes of MPAP on inspiration after performing physical work in the third (control) group of observed persons (11 , 2 sec.) Testified to the high efficiency of unlimited intake of "light water" for 28 days in the formation of the body's hypoxic resistance.

In addition, in the second group of observed persons, taking light water dosed, there was a superiority in terms of hypoxic resistance and adaptation to speed-strength physical work in comparison with the indicators of the third (control) group. Consequently, the intake of "light water" in a metered manner increases hypoxic resistance and adaptation to speed-strength physical work in comparison with the intake of ordinary water (placebo), but to a lesser extent than with its unlimited intake.

Summing up the above, we can conclude that according to the indicators of the time of maximum voluntary breath holding on inhalation and exhalation before and after physical work, the maximum number of squats in three minutes, indicators of ABP, BPP, heart rate before and after the load before and after 28 daily course intake of "light water", the most sustainable to hypoxia turned out the first Group highly qualified athletes, taking "light water" unlimitedly, in accordance with the individual needs of the body. The second group of highly qualified athletes, who took "light water" in doses, also had resistance to hypoxia, however, the positive shifts in indicators were less pronounced in comparison with the first group. Indicators of hypoxic resistance in highly qualified athletes of the third (control) group, taking regular water (placebo) for 28 days did not change significantly.

Thus, the most pronounced positive effect on the body's hypoxic resistance, hemodynamic parameters and adaptation to speed-power physical work at highly qualified athletes receive "light water" in unlimited quantity, the corresponding individual the needs of the body. Dosed intake of "light water" is also accompanied by similar positive dynamics, but the shifts in the indicators of hypoxic stability and physical performance are less pronounced.

3.2. Changes in lung volumes and running time to failure on a treadmill

highly qualified athletes before and after drinking "light water"

Physical activity (Work muscles) presents by myself repetitive contraction of individual skeletal muscle groups that provide movement in a joint or multiple joints. Any kind of physical activity (abbreviations skeletal muscles) changes the internal environment at many levels and has a great impact on the functional systems of the body, homeostasis, metabolism, metabolic processes and much more. For example, with physical activity:

- glucose consumption can increase 20 times;
- pH in skeletal muscle is significantly reduced;
- with sweat, 2-3 liters of water are released;
- body temperature can rise up to 41 °. To prevent the cells of the body from dying, these deviations must be compensated for.

Cyclic work of skeletal muscles during physical activity causes a reaction of the whole organism.

In humans, there are about 660 skeletal muscles; more than 400 of them are under the control of consciousness. Skeletal muscle accounts for over 40% of body weight; they have three main functions: they provide movement and breathing, support body position, and generate heat when exposed to cold. The relative mass of skeletal muscle is an indicator of the degree of change in homeostasis that can occur when that muscle is working. The varied needs of skeletal muscle are met by different systems. For example, in response to increased oxygen consumption during exercise, the muscle increases cardiac output and blood flow velocity.

On the part of the respiratory system, pulmonary ventilation and oxygen transfer to erythrocytes should increase. As a result of the work of skeletal muscles, the acidity of the extracellular fluid increases, which significantly affects the acid-base state. Thus, the interaction of all functional systems of the body ensures the normal functioning of skeletal muscles, supporting its physical performance. Essentially, the physiological response of the body to physical activity is aimed at ensuring the work of skeletal muscles and maintaining homeostasis. In this case, the main function of the respiratory system is to ensure gas exchange between the body and the environment. In addition, it plays an important role in maintaining acid-base balance, especially during exercise. Effective exchange of oxygen in the circulatory system requires that pulmonary blood flow is adequate for ventilation.

During submaximal physical activity, the minute volume of respiration increases as the workload and consumption increase oxygen almost linearly up to 50-75% of VO_2 max. When its meaning exceeds 75% of VO_2 max, the minute volume of respiration increases exponentially. At rest, the minute volume of respiration in a man weighing 70 kg is approximately 7.5 l / min. At maximum physical activity, the minute breathing volume can increase to 120-175 l / min.

The minute breathing volume is equal to the product of the volume of inhaled air (VO) by the frequency of respiratory movements (RR). With physical exertion, the respiratory rate can increase to 40-50 breaths per minute (vd / min), compared to 12-15 vd / min at rest. The tidal volume (the volume of air exchanged in one breath) can increase from 0.5 liters at rest to 3 or more liters.

The cardiovascular system and the respiratory system ensure the delivery of oxygen and substrates to the working muscle, supply hormones that stimulate the absorption of substrates, and remove metabolic products (including heat) from the muscle.

The increase in oxygen demand during exercise causes two types of changes in the cardiovascular system.

- Cardiac output should increase. This increase is achieved through an increase in heart rate and stroke volume.

- There must be a redistribution of blood flow from relatively inactive organs to working muscle, and at the same time, sufficient blood flow and blood pressure must be maintained in vital organs such as the brain.

There is a clear relationship between heart rate, stroke volume, mean arterial pressure and cardiac output and oxygen uptake (workload).

Exercise increases cardiac output and heart rate. At rest, cardiac output averages 5 L / min with an average heart rate of 72 beats / min and a stroke volume of approximately 70 ml per beat. In trained men (70 kg), the maximum cardiac output exceeds 34 l / min, and in women (50 kg) - 23 l / min.

The heart rate can reach its maximum value.

Typically, the maximum heart rate is 220 beats / min. If the heart rate exceeds 220 beats / min, then the filling time and stroke volume decrease, and, consequently, cardiac output decreases.

Usually, the age formula or the Karvonen formula is used to determine the maximum heart rate during exercise.

To calculate using the age formula, you need to subtract age from 220. For example, for a 20-year-old man, the maximum heart rate is 220 - 20 = 200 beats / min.

To carry out endurance testing, it was necessary to choose such a level of physical activity, at which the heart rate would not exceed the limit level and would be lower by 15%. The average age of the subjects was 23 years. To calculate according to the age formula, it is necessary to subtract 23 from 220. On average, the set heart rate level will be 220 - 23 = 197 beats / min. Thus, the average heart rate should be 167 beats / min. We took this factor into account when testing athletes who took "light water". According to a number of authors, physical performance is provided by three components.

1. Alactic-anaerobic.
2. Glycolytic anaerobic with increasing delivery of O2.
3. Aerobic - due to the enhancement of aerobic processes in working muscles with a significant increase in the delivery of O2.

The assessment of the physical performance of highly qualified athletes when performing cyclic running work to failure on a treadmill can be considered as an aerobic process that requires a significant increase in the delivery of O2 to the working muscles, where the deficit of intramuscular glycogen stores increases and significant amounts of lactic acid accumulate.

To assess the effect of taking "light water" on physical performance at sublimit physical exertion (work to failure), the following parameters were measured: minute volume, respiratory rate and tidal volume (volume of air exchanged per breath). Respiratory minute volume = tidal volume (L) x respiratory rate (breaths / min). These

parameters determine the change in the value of VO_2 max - the maximum level of oxygen consumption and efficiency that can be manifested in a decrease in the minute volume of respiration at the same level of physical activity. In the case we are considering, the main indicator of the positive effect of taking "light water" on endurance at subliminal physical activity is the volume and time spent on running work to failure by an athlete on a treadmill.

Usually, the age formula or the Karvonen formula is used to determine the maximum heart rate during exercise.

To calculate using the age formula, you need to subtract age from 220. For example, for a 20-year-old man, the maximum heart rate is 220 - 20 = 200 beats / min.

Individual data on the results of tests prior to the 28-day course of "light water" intake and after its completion are presented in summary tables 3.2.1. – 3.2.4. An asterisk * denotes data that is not used in statistical analysis due to a strong discrepancy with the average data.

The analysis of indicators in the initial state revealed that the observed persons of all groups were in approximately the same state, which was determined by the volume of ventilation of the lungs and the heart rate. At the same time, the volume of ventilation of the lungs, measured before the start of the test on a treadmill, in the observed persons of various groups was: 1st group: 12.8 ± 2.27 l / min, 2nd group: 14.3 ± 1.48 l / min, 3rd group: 11.54 ± 1.1 l / min.

The heart rate was as follows: 1st group: 85.4 ± 6.56; 2nd group: 86.4 ± 3.24; 3rd group: 88.6 ± 9.24 beats per minute (table 3.2.1).

Physical activity led to a significant increase in all the observed indicators directly related to the energy costs of the work performed. At the same time, the volume of ventilation of the lungs was: 1st group: 101 ± 5.25 l / min, 2nd group: 121 ± 12.5 l / min, 3rd group: 107.7 ± 20 l / min, and the heart rate at the time of refusal from running work was: 1st group: 173 ± 2.89; 2nd group: 176 ± 3.2; 3rd group: 183.4 ± 3.46 beats per minute. A comparative analysis of the above indicators shows that all three groups of surveyed persons are homogeneous in their composition from the point of view of the physical form of athletes and their current state of health and from the point of view of physiological indicators differ insignificantly.

The distances that the athletes of these groups covered before passing the course of taking "light water" were: 1st group: 1071 ± 129 m; 2nd group: 871 ± 88.7 m; 3rd group: 1130 ± 246 m. Despite the fact that the observed persons of 3 groups covered different distances, their physiological parameters (heart rate, ventilation volume) practically did not differ. This suggests that the subjects of all groups achieved approximately the same level of fatigue.

After a 28-day course of taking "light water" in the observed groups, the initial state at rest before stress testing according to the above indicators in the observed individuals changed somewhat compared to the initial state of the primary examination.

In the initial state, before the start of the tests on the treadmill, the following changes in the physiological parameters of respiration were observed: At the same time, the volumes of ventilation of the lungs before the start of the test on the treadmill were higher (Fig. 3.2.1) and amounted to: 1st group: 15.1 ± 3, 07, 2nd group: 18.4 ± 4.95 3rd group: 15.88 ± 1.59 liters per minute, and the heart rate at rest was: 1st group: 92.6 ± 5.29 ; 2nd group: 91.6 ± 6.88; 3rd group: 94.4 ± 6.49 beats per minute. The respiratory rate in the 1st group was 11% higher, and in the third group it was 26% higher than in the examination before the course of taking "light water". The tidal volume also increased in all groups, which is an indicator of more active work of the muscles of the chest and diaphragm involved in respiratory movements. In the 1st group it was 3% higher, in the second group it was 27%, and in the third group it was 14% higher than in the examination before undergoing a monthly course of taking "light water". An increase in respiratory rate and tidal volume led to an increase in respiratory minute volume (RVM), which is an indirect indicator of effective oxygen consumption and corresponds to the current physical condition. Respiratory minute volume was 18% higher in group 1, 30% higher in group 2, and 38% higher in group 3 (Fig. 3.2.2).

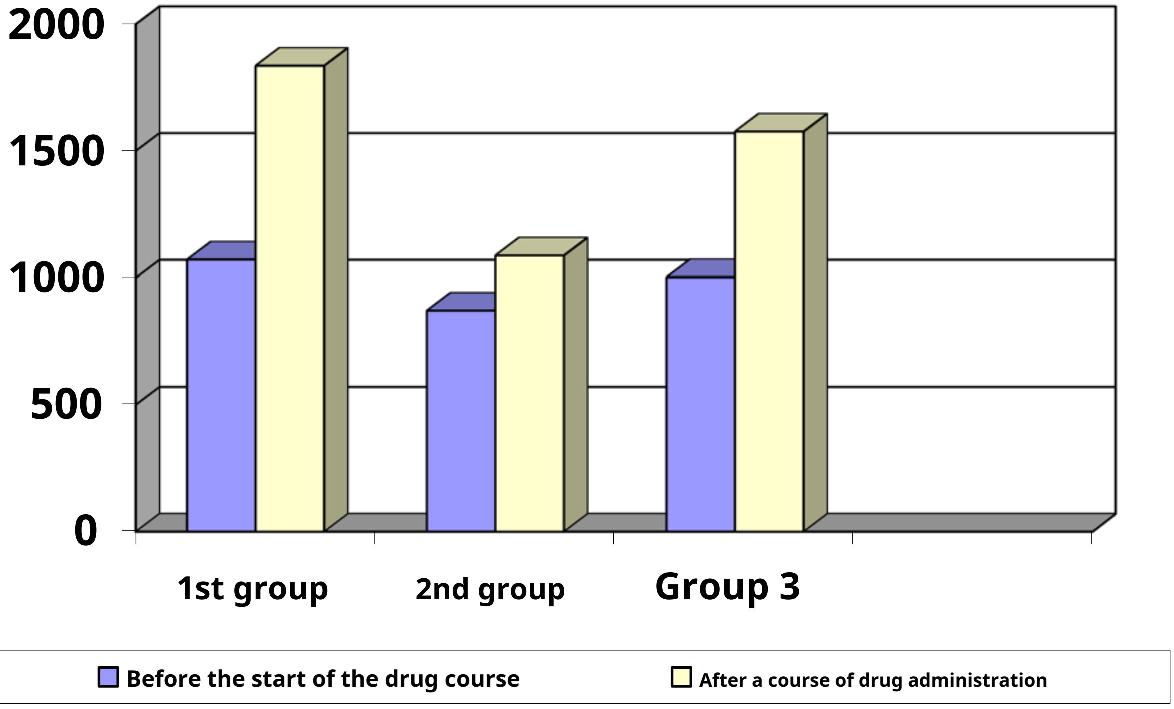

Fig. 3.2.1. The average tidal volume before testing on a treadmill in athletes of various groups (1,2,3) before (light bars) and after (shaded bars) the course of taking "light water".

The heart rate was also higher in all groups. In the 1st group the heart rate was 8% higher, in the second group it was 6%, and in the third group it was 13% higher (Fig. 3.2.3). This is because the treadmill tests were conducted against a background of fatigue caused by previous squat tests, which performed better in all three groups. This naturally affected vegetative performance.

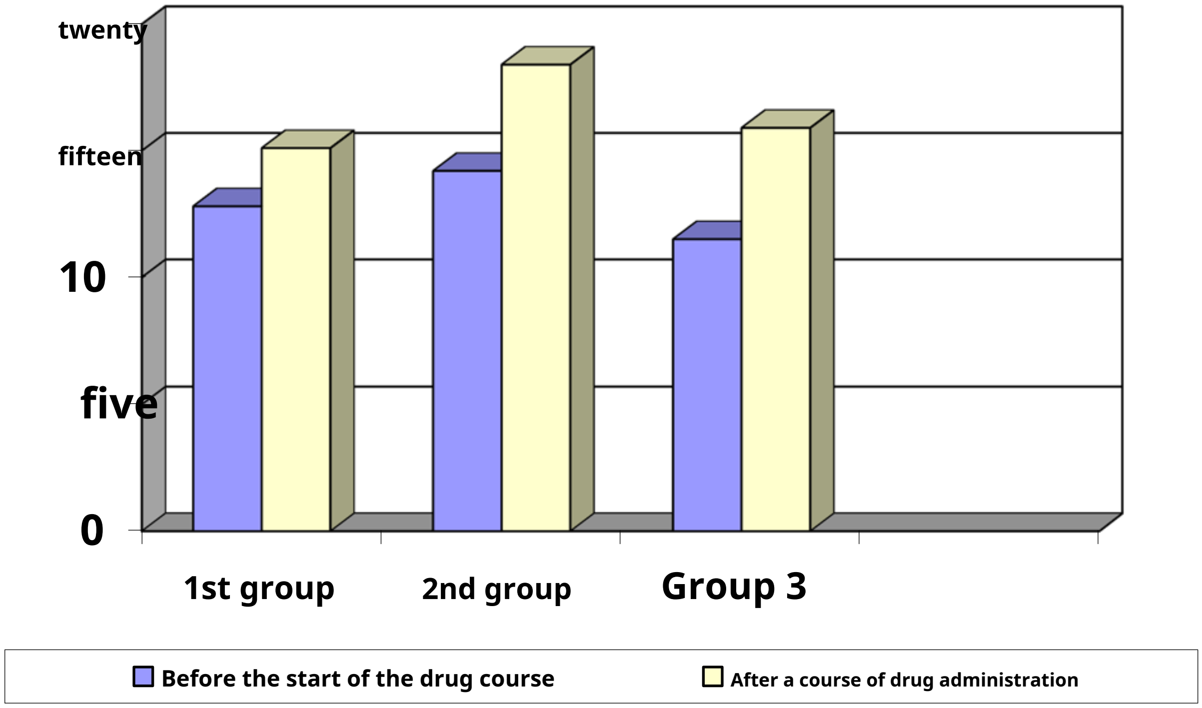

Fig. 3.2.2. The average value of the minute breathing volume after testing on a treadmill in athletes of different groups (1,2,3) before (light bars) and after (shaded bars) taking "light water".

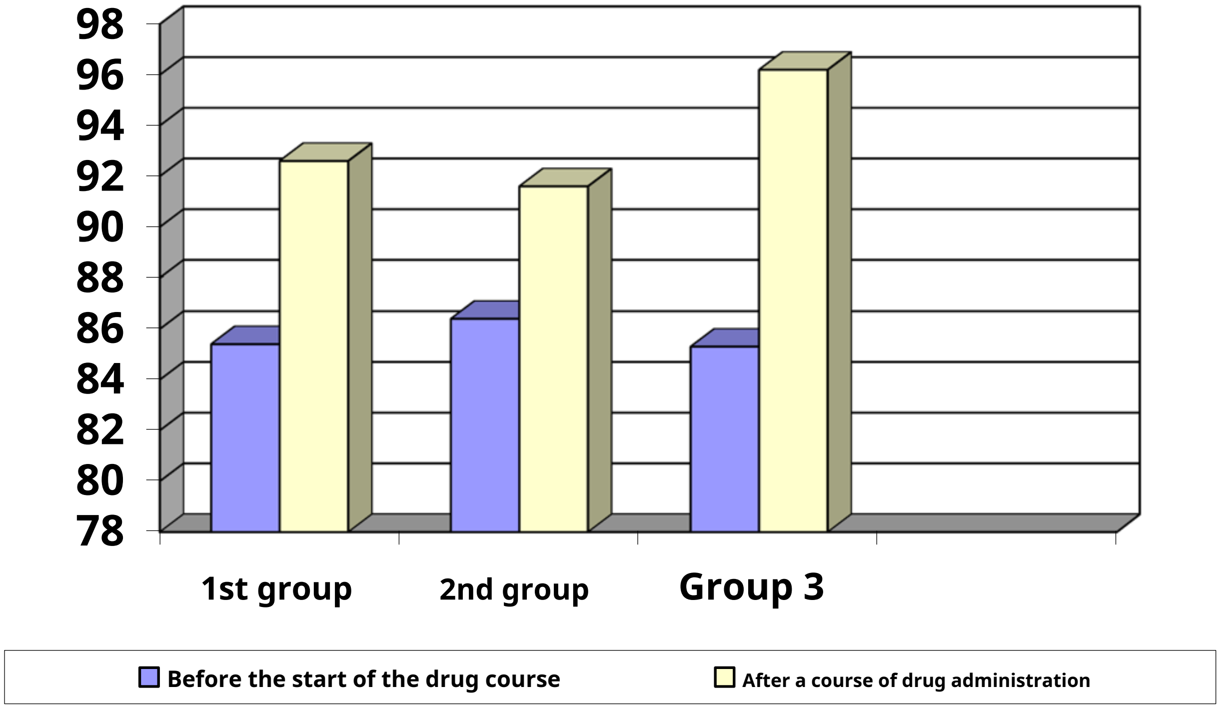

Fig. 3.2.3. Mean heart rate before testing on a treadmill among athletes of different groups (1,2,3) before (light bars) and after (shaded bars) the course of taking "light water".

In domestic and foreign literature there are data on the effectiveness of the minute volume of respiration in highly qualified athletes. The studies carried out convincingly indicate a more efficient consumption and use of O2 at lower rates of MOU. Based on these data, in the observed cases, the most effective and economical ventilation was possessed by the athletes of the first group (Fig. 3.2.2), who took “light water” unlimitedly.

During stress testing (running to failure) after a monthly course of taking "light water" in the observed groups (see Tables 3.2.1-3.2.4), there was an increase in the volume of ventilation of the lungs, which did not differ significantly from the volume of ventilation in the tests preceding conducting a course of taking "light water". At the same time, the volume of ventilation of the lungs was: 1st group: 118.8 ± 8.39 l / min, 2nd group: 127.5 ± 9.92 l / min, 3rd group: 107.8 ± 16.5 l / min (Fig. 3.2.4). The average value for all groups was 118 ± 11.6 l / min versus 110 ± 12.5 in the tests preceding the course of taking "light water".

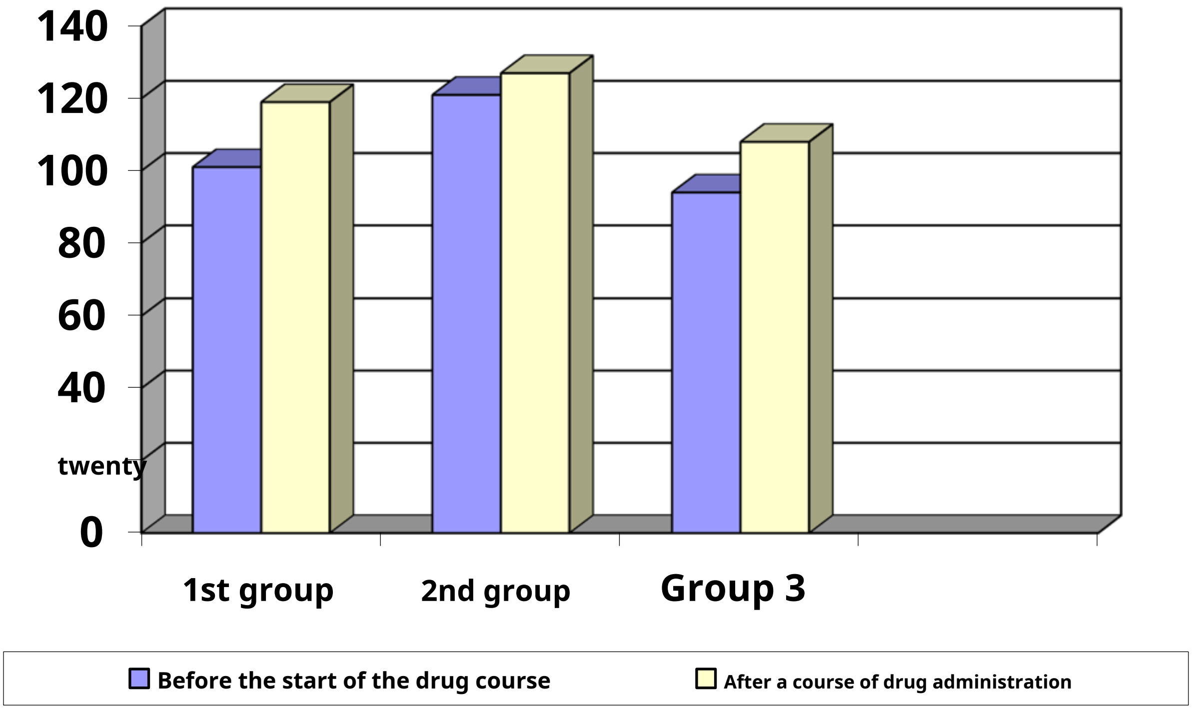

Fig. 3.2.4. The average value of the minute breathing volume after testing on a treadmill in athletes of various groups (1,2,3) before (light bars) and after (shaded bars) taking "light water".

The heart rate at the time of termination of running work to failure after the course of taking "light water" in the observed groups increased insignificantly and amounted to: 1st group: 184 ± 2.29; 2nd group: 177.8 ± 3.84; 3rd group: 184.6 ± 3.89 (Fig. 3.2.5). The average heart rate after the course of taking "light water" was 182.1 ± 3.34 versus 177.3 ± 3.18 beats per minute in the initial state.

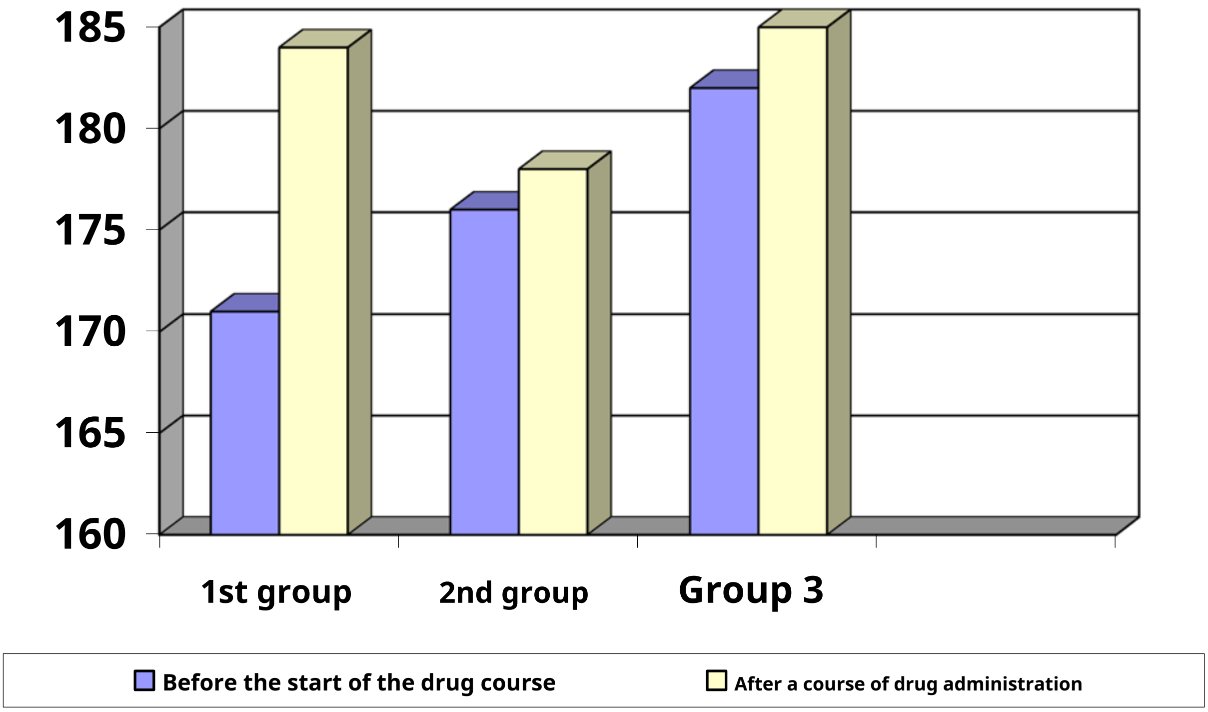

Fig. 3.2.5. Average heart rate at the end of testing on a treadmill in athletes of different groups (1,2,3) before (light bars) and after (shaded bars) the course of taking "light water".

However, it should be noted that the time of work to failure (Fig. 3.2.6) and the distance during running work, covered by athletes on a treadmill, after the course of taking "light water" increased significantly (Table 3.2.4): in the first group with 1071 ± 129 m to 1836 ± 152 m; in the second group from 871 ± 88.7 m to 1087 ± 114 m; in the third group from 1130 ± 246 m to 1561 ± 271 m (Fig. 3.2.7). The relative increase in running distances after the course of taking "light water" in all three groups was: 71%, 25% and 58%, respectively. The increase in the distance in the first group in relation to the second was 46%, and the increase in the distance in the first group in relation to the third was 17%.

It should be noted that the heart rate indicators, despite their identity, gave the subjects of the 1st and 2nd groups the opportunity to perform a greater volume of running work.

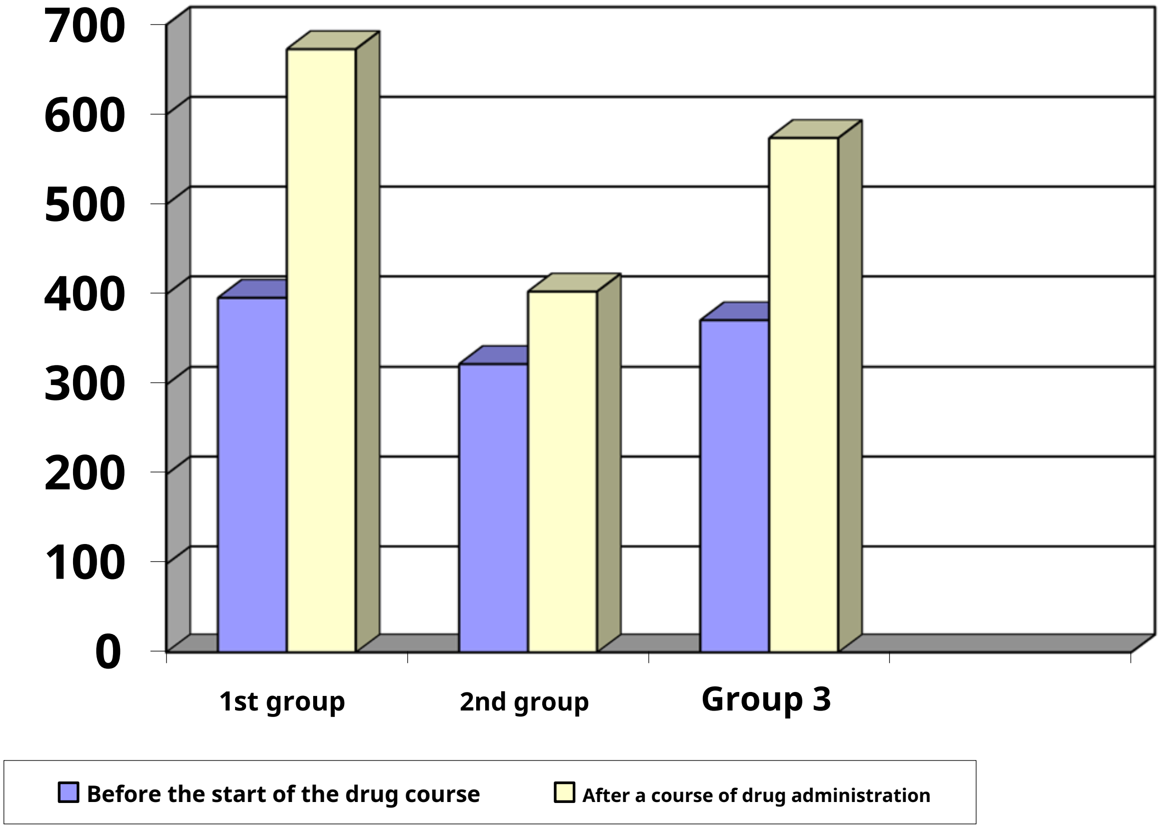

Fig. 3.2.6. The average value of the running time to failure (in seconds) among athletes of various groups (1,2,3) before (light bars) and after (shaded bars) the course of taking "light water".

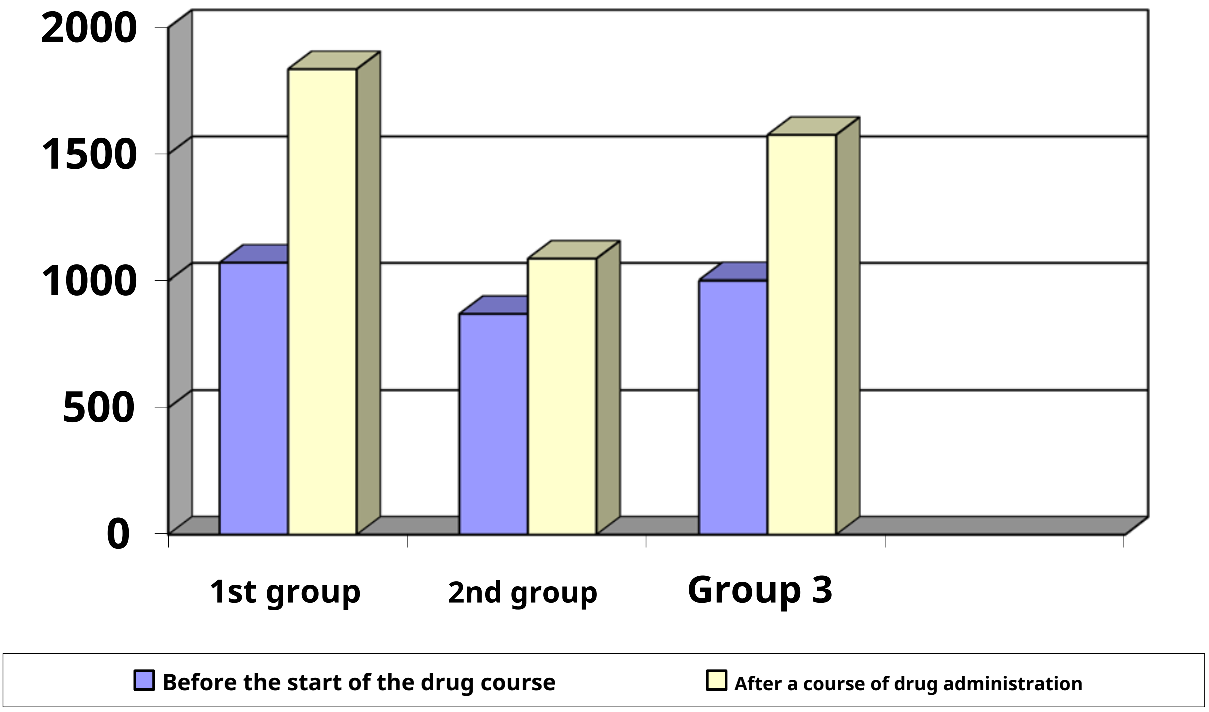

Fig. 3.2.7. The average value of the distance of running work to failure (in meters) among athletes of different groups (1, 2, 3) before (light bars) and after (shaded bars) the course of taking "light water"

Conclusion

As you can see from the above graphs and tables, after 28 days of intake Easy water" highly qualified athletes change in running time from failure and, accordingly, in distance increased in all three groups. At the same time, attention is drawn to itself a significant increase in time and length of the distance in the first group of athletes in relation to the second and third. The observed temporary positive effect of unlimited intake of "light water" in the first group to the third can be explained by more stable metabolic and homeostatic changes, happened in organism highly qualified athletes of this group. At the same time, the athletes of the second group showed an increase in the duration of the running work performance to failure and the length of the distance relative to the first group were less pronounced. Apparently, the dosed intake of "light water" in the second group was insufficient for stable metabolic and homeostatic changes in organism, contributing to the provision of intense physical work to failure on the treadmill.

Dosed (200 ml) intake of "light water" before training by athletes of the third group gave a short-term effect of increasing physical performance. This phenomenon was confirmed in an experiment on performing speed-strength work (the maximum number of squats in 3 minutes), where the results obtained in the first and second groups were similar.

In the third group, there is also an increase in working capacity, but it is associated with the placebo effect.

Conclusion

"Light water" is drinking water with a low deuterium content, and therefore has new unique properties. The main effect of "light water" on the human body is a gradual decrease in the concentration of deuterium in the body fluids due to isotope exchange reactions. The analysis of our results allows us to say that "light water" allows you to improve the work of the most important functional systems of the human body, which, ultimately, has a positive effect on his physical performance.

The examinations involved 19 highly qualified athletes aged 18-27 years, who for 28 days were asked to drink "light water" instead of ordinary drinking water.

During the specified period, the observed persons performed training work in accordance with the individual plan.

The course reception of "light water" was carried out by them in various volumes, depending on which the subjects were divided into 3 groups:

1 group (7 people) - took "light water" daily at within 28 days according to individual needs.

Group 2 (7 people) - took "light water" dosed in within 28 days - 200 ml of "light water" immediately before training and 200 ml of "light water" immediately after training.

Group 3 - control (5 people) - drank ordinary drinking water packaged in the same dishes as "light water". The drinking regimen was the same as in the 1st group, however, the subjects were not informed that this was ordinary drinking water.

It was found that when choosing water, preference was given to "light water". This was supported by the fact that with its unlimited consumption for 28 days, the surveyed groups 1, who drank only

“Light water”, they drank more of it than the surveyed groups 3 who drank ordinary water. We believe that this is due to the fact that "light water", which did not have chlorine and deuterium in its composition, seemed preferable to the examinees in terms of its taste.

It has been shown that the 28-day course of taking "light water" led to a tendency towards an improvement in the psychological sphere and a tendency towards a decrease in the level of anxiety in all surveyed persons.

It was found that "light water" has practically no effect on the electrocardiogram of the subjects. However, in persons of group 1, who took only "light water" without restriction for 28 days, there was a tendency to restore the initially low conductivity in the AV node of the heart, which testifies in favor of the positive effect of "light water".

"Light water" helped to normalize the balance of the autonomic nervous system. It was shown that under the influence of the course intake of light water in the subjects of group 1, the total power of the heart rate spectrum normalized, which cannot be said about the subjects who drank ordinary water. So, after a course of "light water" intake, the vegetative tone in the subjects of group 1, who took "light water" unrestrictedly, tended to normalize, but they still retained a weak predominance of sympathetic influences. On the contrary, among the subjects of group 2, who drank "light water" in small volumes, after a course intake of "light water" there was an increase in parasympathetic influences on the heart. In the examined group 3, who took ordinary water without restriction, after a course intake of ordinary water, there was a significant increase in the spectral power of LF-waves (vascular waves),

Hemodynamic parameters changed in accordance with vegetative tone. So, in the subjects of group 1, against the background of mild sympathicotonia, the course intake of "light water" in unlimited volumes caused a weak tendency towards an increase in blood pressure and a tendency towards a decrease in blood pressure, as a result of which their pulse pressure increased. This led to a tendency towards a decrease in the total peripheral vascular resistance and an increase in stroke and minute blood volumes. All this testifies in favor of an increase in physical performance in these subjects, which can be attributed to the positive influence of "light water".

Dosed intake of "light water" (200 ml each before and after training) caused an increase in parasympathetic influences in persons of group 2. As a result, after the end of the course of taking "light water", they showed a tendency to a decrease in heart rate, a weak tendency to an increase in blood pressure (blood pressure) and blood pressure (BP), and stroke blood volume (SVV). However, the minute blood volume had a weak tendency to decrease. It can be assumed that this kind of dynamics of hemodynamic parameters will contribute to the preservation or insignificant increase in their physical performance.

The intake of ordinary drinking water in unlimited volumes caused the activation of the vasomotor center in the surveyed group 3. As a result, against the background of practically unchanged heart rate, they showed a pronounced tendency to increase in blood pressure and a significant increase in blood pressure ($p < 0.05$), as a result of which pulse pressure decreased ... All this led to a tendency to a decrease in the stroke volume of blood and a tendency to an increase in the total peripheral vascular resistance, and, ultimately, to a decrease in the minute volume of blood. Apparently, in this group, an increase in physical performance is also unlikely, and if it did occur, it was associated with the placebo effect. Thus, we can conclude that "light water" manifests its pronounced positive qualities on the state of the circulatory system and respiratory function when taken in unlimited quantities.

The analysis of clinical and biochemical blood parameters revealed that "light water" had no effect on clinical and biochemical parameters of blood, as well as immune and antioxidant parameters. "Light water" did not affect the overall hormonal composition of the blood plasma. A decrease in thyroglobulin under the influence of "light water" intake may be beneficial for persons with thyroid dysfunctions. It also did not affect the change in blood erythropoietic factors. Thus, the obtained data testified to the harmlessness of "light water" for the parameters of human blood.

Analysis indicators hypoxic sustainability at highly qualified athletes performing speed-strength physical work and maximum breath holding on inhalation and exhalation before and after taking "light water" revealed that after a 28-day course intake of "light water" the first group of highly qualified athletes was the most resistant to hypoxia, accepting "light water" unlimitedly, in accordance with the individual needs of the body. The second group of highly qualified athletes, who took "light water" in doses, also turned out to be resistant to hypoxia, however, the positive shifts in indicators were less pronounced in comparison with the first group. Indicators of hypoxic resistance

at highly qualified athletes third (control) groups, taking regular water (placebo) for 28 days, did not change significantly.

Thus, the most pronounced positive effect on the body's hypoxic resistance, hemodynamic parameters and adaptation to speed-power physical work at highly qualified athletes receive "light water" in unlimited quantity, the corresponding individual the needs of the body. Dosed intake of "light water" is also accompanied by similar positive dynamics, but the shifts in the indicators of hypoxic stability and physical performance are less pronounced.

The analysis of physiological indicators in the observed groups against the background of 28-day intake of regular and "light water" while performing cyclic work on a treadmill to failure and the time of performing the specified work gives grounds to conclude that the athletes of the first group had more pronounced positive dynamics practically for all parameters of the studied indicators. While in the athletes of the second group, the positive dynamics of the same indicators was less pronounced, not significantly different from the control group that took ordinary water. The dynamics of indicators in persons of the third (control) group had a character characteristic of the placebo effect.

conclusions

1. Reception of "light water" is unlimited (1 group) in accordance with needs for 28 days revealed the most pronounced dynamics in work to failure on the treadmill against the background of positive dynamics of physiological indicators.

2. Dosed intake of "light water" (group 2) when performing speed-strength work and hypoxic tests revealed a similar increase in working capacity and hypoxic tests with the first group, while during work to failure these indicators were significantly lower.

3. In the third group, who took ordinary water, positive the dynamics of the studied indicators was revealed at the level of trends and was associated with the placebo effect.

4. Clinical and biochemical blood test during admission "Light" and ordinary water in the observed groups revealed the stability of the studied parameters. There is reason to believe that the intake of "light water" turned out to be harmless for highly qualified athletes, taking "light water" for 28 days against the background of the training process.

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