

Section 2. Medical science

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THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE NONSPECIFIC IMMUNITY OF CHILDREN LIVING IN THE ARAL SEA REGION

Abstract

Objectives. A man in the Aral Sea region found himself under the influence of a complex of habitat factors, in close dependence on the quantity and quality of the available water resources of which, acting through nonspecific and specific immunity factors, can cause profound changes in the human body.

Aims. Assessment of the state of the immune system and the elemental status of children, taking into account the water factor in the ecologically unfavorable region of the Aral Sea region.

Materials and Methods: A comprehensive study of the quality of various categories of drinking water (tap, well, open water bodies) by the most important physical and chemical components was carried out: water salinity (dry residue), hardness (Ca + Mg), chloride and sulfate content, pH, the presence of organic matter (according to BOD5 and permanganate oxidizability), biogenic elements, macro- and microelements, and assessment of the state of the immune system and elemental status in 150 healthy children born and permanently residing in the Aral Sea region.

Results: A correlation was established between the quality of drinking water and the morbidity of children with the concentration of sulfates in water $r = 0.83$, chlorides in water $r = 0.52$, hardness ($r = 0.40$), and salinity ($r = 0.53$) drinking water. Assessment of adaptive reactions according to the leukocyte formula of a general blood test revealed an increased activation of the body's adaptive system. The relationship between the influence of environmental factors and the incidence of children in the Aral Sea region was revealed.

Conclusions. The water factor in the Aral Sea region is one of the dominant factors in the occurrence of various pathological conditions in children. In the Aral Sea region, children develop violations of the macro- and microelement status, the immune system, which under normal conditions are mobile, have a pronounced margin of safety and the information content of which is especially high.

A decrease in the quality of drinking water affects the hemogram, increasing the content of leukocytes, as well as the relative and absolute content of lymphocytes, reducing the relative and absolute content of monocytes. These changes, depending on the place of residence, are explained by the reaction of the immune system to the influence of environmental pollution.

Keywords: environmental factors, macro- and microelements, the Aral Sea region, adaptive response, morbidity in children.

Introduction

The human body in the process of life is exposed to a complex of environmental factors of polytropic action, which contribute to the formation of altered reactivity of the body, increasing the risk of developing various diseases [9]. The quality of the environment largely determines the level of the human body's defenses [1]. A man in the Aral Sea region was under the influence of a complex of habitat factors, many of which, acting through nonspecific and specific immunity factors, can cause profound changes in the human body [2].

Adaptation of the body to constantly changing environmental conditions (external and internal) is a continuously occurring process designed to maintain homeostatic balance in the body. The adaptive capabilities of the organism are increasingly considered as one of the important criteria of health since the modern understanding of the disease includes the idea of defense mechanisms, first of all, the mechanisms of adaptation and compensation [3].

Physiological mechanisms of adaptive restructuring of the child's body in ecologically unfavorable conditions naturally lead to shifts in elemental ho-

meostasis [2]. The human habitat and the state of his health in the Aral Sea region turned out to be closely dependent on the quantity and quality of available water resources. With water, a person receives 1–25% of the daily requirement for physiologically necessary chemicals [4]. Mineral substances that enter the human body with water have a more significant physiological value than those that come with food since the latter lose some of their amount in the process of cooking [5]. It is necessary to study the direction of changes in the nonspecific immunity of children, depending on the area of residence, to find and justify ways to correct changes in the immune status in order to improve the quality of life of the population in ecologically unfavorable regions [6].

Aims. Assessment of the type of nonspecific adaptive reactions of the body and the elemental status of children, taking into account the water factor in the ecologically unfavorable region of the Aral Sea region.

Materials and Methods

In the city of Nukus, the Republic of Karakalpakstan, using atomic absorption spectrophotometry, a comprehensive assessment of tap drinking water was carried out for the most important physicochemical

components: water salinity (dry residue), hardness (Ca + Mg), chloride and sulfate content, pH, the presence of organic matter (BOD5 and permanganate oxidizability), biogenic elements, macro- and microelements. A comparative assessment of indicators of macro- and microelements in drinking water and blood serum of children was carried out, as well as an assessment of the type of nonspecific adaptive reactions according to the leukocyte formula of a general blood test (the number of leukocytes, the relative and absolute content of lymphocytes and monocytes) in 150 healthy children born and permanently residing in the region Aral Sea.

Results

In the selected samples of drinking water there are suspended solids or coarse impurities. According to the requirements for the composition and properties of water, the content of suspended solids as a result of the discharge of wastewater should not increase by more than 0.25 and 0.75 mg/l. In accordance with the hygienic requirements for the quality of drinking water, the turbidity should not exceed 1.5 mg/l [4]. In the investigated drinking water of the regions, the turbidity is 5–29 mg/l.

The salinity of drinking water is subject to drastic changes. In all the water samples we have taken, the mineralization exceeds the MPC by 0.36–0.83 times.

Substances in drinking water in low concentrations, but playing an important role in many physiological processes, are of great importance [5]. A study of the composition of macro- and microelements in water samples revealed their mosaic distribution.

The concentration of Co in the well water of the Muynak region is 2 times higher than the MPC, 1.6 times in the Kungrad region, and 4 times in the Kanlykul region. It is known that excess Co in drinking water causes chronic intoxication, characterized by diseases of the upper respiratory tract, allergic symptoms, bronchial asthma, and allergic dermatoses, as well as the so-called “cobalt cardiomyopathy” [8]. The Fe content in all the samples taken was below the MPC level. Fe deficiency in

children can lead to increased absorption of Co in the digestive tract.

The content of Zn in the drinking water of the study areas was almost 500 times lower than the MPC. Zn deficiency conditions are usually characterized by the presence of symptoms such as decreased appetite, anemia, allergic diseases, dermatitis. T-cell immunity is specifically reduced, so children with Zn deficiency usually often and for a long time suffer from colds and infectious diseases. Upon contact with various chemical factors, the homeostasis of the body is provided by the immune system in conjunction with the neurohumoral regulation system. As a result of anthropogenic hyperchimization of the environment during the transient, and especially with prolonged exposure to the body of agents with immunotoxic and immunomodulatory properties, the risk of developing immunopathological conditions, allergic diseases increases [9].

When examining children, it was revealed that Ca deficiency in blood serum is present in 44%, and Fe in 39%, while in the clinical picture hypochromic anemia, inflammatory changes in mucous membranes, and chronic gastroduodenitis, as well as immunodeficiency states, were more often detected.

The incidence of children is closely correlated with environmental pollution with pesticides ($r = 0.66$), the quality of drinking water (with the concentration of sulfates in water $r = 0.83$ and chlorides in water $r = 0.52$). A correlation was established between the incidence of children and the hardness ($r = 0.40$) and mineralization ($r = 0.53$) of drinking water.

L. H. Garkavi et al. made it possible to identify 4 types of nonspecific adaptive reactions arising from the effects of endogenous and exogenous stimuli of any kind with different strengths and reflecting mainly the combined participation of the immune and endocrine links of adaptation. All reactions that are a nonspecific basis of a pre-illness or illness are classified as stressful reactions. As signal indicators of the body's adaptive response in clinical practice, the authors proposed criteria based on the

indicators of the leukocyte formula of the general blood test [3].

The results of the conducted studies showed that the content of leukocytes in children was in the range from 6.75 ± 0.49 to 7.08 ± 0.14 , averaging 6.915 ± 0.31 . By the type of nonspecific adaptive reactions, the deviations of the indicators were within the value for the degree of tension II.

The absolute lymphocyte count in children ranged from 2.79 ± 0.21 to 3.13 ± 0.17 , averaging 2.96 ± 0.19 . The relative content of blood lymphocytes in children was from 36.52 ± 2.68 to 45.12 ± 1.7 , averaging 40.82 ± 2.19 . The indicators were within the values for the degree of tension IV. This indicates an increased activation of the body's adaptive system, which, according to L. Kh. Garkawi increases the secretion of ACTH and glucocorticoids and determines the different effects of these reactions on inflammation, including a certain ratio of the activity of the blood coagulation and anticoagulant systems, which indicates an increase in the activity of the defense systems the organism of children in response to environmental changes in the Aral Sea region. The health level gradually decreases with increased activation [11].

The absolute content of monocytes was from 0.29 ± 0.03 to 0.31 ± 0.05 , averaging 0.3 ± 0.04 . The relative content of monocytes in the blood of children was from 3.98 ± 0.43 to 4.28 ± 0.43 , averaging 4.13 ± 0.43 . The indicators were below the minimum deviation range. Probably, the decrease in the absolute and relative content of monocytes in children permanently residing in the Aral Sea region is due to a large number of pesticides with environmental

pollution ($r = 0.66$), the quality of drinking water (with a concentration of sulfates in water $r = 0.83$ and chlorides in water $r = 0.52$) [12].

Assessment of adaptive reactions according to the leukocyte formula of a general blood test revealed an increased activation of the adaptive system of the body of children. The relationship between the influence of environmental factors and the incidence of children in the Aral Sea region was revealed.

Conclusion

Thus, our studies show that the water factor in the Aral Sea region is one of the dominant factors in the occurrence of various pathological conditions in children. Good-quality drinking water supply should be highlighted in the system of measures aimed at improving the living conditions and health status of children in the Aral Sea region. The quality of drinking water determines the increase in the direct and indirect influence of the water factor on the health of children.

In the Aral Sea region, children develop violations of the macro- and microelement status, the immune system, which under normal conditions are mobile, have a pronounced margin of safety and the information content of which is especially high.

A decrease in the quality of drinking water in the region affects the hemogram of children by increasing the content of leukocytes, as well as the relative and absolute content of lymphocytes, and reducing the relative and absolute content of monocytes. These changes, depending on the place of residence, are explained by the reaction of the immune system to environmental pollution in the region.

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