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Influence of A Complex of Environmental Factors on the Health Indicators of Lyceum Students in Various Regions of the Republic of Karakalpakstan

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ABSTRACT

The article provides information about the impact of a complex of environmental factors on the health indicators of lyceum students in various regions of the Republic of Karakalpakstan. Analysis of the results obtained for various ecological zones will allow us to consider in more detail the dependence of morbidity rates among the adolescent population of Karakalpakstan on the influence of environmental factors. Living in the Shumanai and Chimbay regions of the republic entails a number of stress reactions for the teenager's body, determined by the influence of the studied factors.

Introduction

The problem of the relationship between human society and the environment requires urgent solutions, the success of which directly depends on the complex interrelations of environmental and socio-economic systems and will help determine the development paths of any developed society and state (Россинская and Бугаева, 2010). At the present stage of development of society, environmental factors and human lifestyle have a great influence on the formation of the health of the younger generation (Онищенко, 2003).

Adolescence is one of the critical stages in a person's life. Due to anatomical, physiological and morphofunctional characteristics at this age, the body becomes especially vulnerable and unprotected from the effects of various unfavorable environmental factors and

suffers even from sub-threshold concentrations of harmful substances (Выборова, 2001; Рахманин *et al.*, 2012). The main risk factors for the lifestyle of students studying in academic lyceums of Karakalpakstan are non-compliance with hygienic standards of the regime and organization of the educational process, conditions and organization of nutrition and physical education (Онищенко, 2003; Ramazanov, *et al.*, 2022).

As is known, the health of children and adolescents is determined not only by the presence or absence of diseases, but also by harmonious and age-appropriate development, the normal level of basic functional indicators (Рахманин *et al.*, 2012).

Many studies have noted a decrease in the functional capabilities of the body and the effectiveness of adaptation of the body of children and adolescents to

changing environmental conditions. The educational environment often does not contribute to the preservation of the health of students and creates conditions for the formation of pathology, especially in persons with reduced adaptive capabilities (Капцов and Панкова, 2001).

The ability to eliminate potential health threats associated with exposure to a complex of unfavorable environmental factors depends on taking into account the specific environmental and socio-economic characteristics of the areas of residence (Выборова, 2001; Кульнев and Базарский, 2011; Онищенко, 2003).

Atmospheric air pollution leads to an increase in diseases of both the respiratory system and the cardiovascular system. Almost 20% of all respiratory diseases and 10% of circulatory system diseases are associated with air pollution. Currently, industrial cities, where more than 50% of the population is concentrated, can be classified as environmentally hazardous zones, since the content of pollutants in their atmosphere significantly exceeds the maximum permissible concentrations (Выборова, 2001; Кульнев and Базарский, 2011).

Atmospheric pollution by emissions from vehicles, in particular emissions of lead, which has significant toxicity and the ability to accumulate in the body, also plays a large role in this. (Выборова, 2001; Сорокина *et al.*, 2011). Accumulating in the human body, lead, along with other harmful substances, can cause adverse long-term consequences, as it has mutagenic, carcinogenic, teratogenic and embryogonadotoxic properties. (Выборова, 2001; Сорокина *et al.*, 2011; Zaytseva *et al.*, 2013).

Studying the impact of water quality on public health is necessary to directly, rather than indirectly, substantiate the forecast of the real consequences of pollution of water sources on human health in the short and long term. Slow, chronic exposure to small concentrations of chemical components of water, inhibition of the body's protective function to an appropriate extent reduces the body's overall resistance to other damaging factors and contributes to a proportionate increase in overall morbidity, including the incidence of infectious diseases due to a decrease in immune reactivity (Сорокина *et al.*, 2011; Ширкин *et al.*, 2012). Of the large number of different chemical substances entering the environment from anthropogenic sources, heavy metals occupy a special place (Казакова, 2009). According to experts,

geochemical contamination of soils with heavy metals (cadmium, lead, mercury, zinc, nickel) takes first place in terms of the degree of danger for biological objects. Therefore, one of the components of soil monitoring should be a system of three interrelated activities: monitoring the state of heavy metals in soils, assessing this state and making a forecast for the future (Ермолаева *et al.*, 2013). Morphofunctional parameters of children and adolescents, in turn, can serve not only as criteria for physiological norms, but also as predictors of chronic pathology (Хайруллин and Никитюк, 2013).

Materials and Methods

The object of the study was students studying in academic lyceums of the city of Nukus and Chimbay district of the Republic of Karakalpakstan. The subject of the study was the components of the environment, conditions of education and training in educational organizations and the health of students.

The assessment of the quality of the living environment and the health status of adolescents is based on our own research, medical and statistical indicators, socio-hygienic monitoring data for 2020–2023, statistical materials provided by the Ministry of Economy and Statistics of the Republic of Karakalpakstan, results of laboratory studies of the Karakalpak Research Institute natural sciences. The study involved 250 adolescents aged 15–17 years. The examination was carried out on the basis of their voluntary informed consent.

To identify the relationship between the quality of atmospheric air and the morbidity rate of the adolescent population, correlation analysis was used to determine the Pearson pair correlation coefficient. Indicators of the functional state of the cardiovascular system (CVS) were identified with the determination of systolic (systolic), diastolic (diastolic) blood pressure, heart rate (HR). The adaptive potential of blood circulation (APC), minute blood volume (MBV) were calculated using generally accepted methods. The statistical relationship between environmental factors and the functional state of the cardiorespiratory system was identified using the method of correlation analysis (Spearman). The reliability of the results obtained was assessed using the Student test, the critical level of statistical significance p was taken equal to 0.05. Calculations were carried out in the universal statistical program statgraf for windows using the “multiple regression” module and the stepwise regression method.

Results and Discussion

To assess the quality of the environment, the concept of “depositing environment” is used. This is such a complex complex of technogenically altered surface, underground and process waters and soils that form a single mass transfer system, because the accumulation of pollutants occurs mainly in water and soil, and the atmosphere is a temporary environment for substances (Кульнев and Базарский, 2011).

Since toxicants remain in the atmosphere for only a short time, they can increase their concentration and be transformed as a result of photochemical reactions, the state of atmospheric air has an equally important role in assessing the quality of the environment.

Therefore, for an integral assessment of the state of the environment, from the point of view of the impact on public health and determining the degree of ecological and hygienic well-being of the living environment, it is advisable to consider the state of atmospheric air, drinking water and soil as environmental indicators.

The assessment of the influence of factor loads of environmental parameters of the habitat on the health of lyceum students living in various regions of Karakalpakstan is determined by the following levels of impact on the body: the highest level is the level of atmospheric air pollution (32.4%).

The next factors in terms of influence are transport loads (5.8%). Geoenvironment parameters bear an almost equal load and amount to 2.8%. in one of the last places - the characteristics of chemical pollution and unfavorable

physical factors in populated areas - 2.1%. The health status of lyceum students living in the central zone - the city of Nukus - is associated with a slightly increased influence of the accelerated movement of air masses throughout the year (13.8%) in the presence of a significant level of vegetation cover (14.1%). in this regard, the least impact on the formation of the health of adolescents living in this zone is exerted by the quality of vegetation cover, which in this zone is least susceptible to the influence of the anthropogenic environment due to the current decrease in economic activity of the population

A decrease in external respiration function was revealed in adolescent lyceum students from technogenically polluted areas, which was more pronounced under conditions of chemical pollution of atmospheric air. Indicators of the functional state of the cardiovascular system are presented in Table-1.

As can be seen from the presented data, the group average values of systolic blood pressure in young men from experimental groups II and III are statistically significantly higher than those of their peers from the control group (I experimental group).

When analyzing the group average values of diastolic blood pressure, a statistically significant increase was found in boys and girls from experimental group III and in boys from experimental group II; a significant decrease in boys from experimental group II compared to experimental group I. there is a tendency to increase the number of young men with arterial hypertension in the II, III experimental group compared to the control (1, 21; 3, 28 times, respectively).

Table.1 Indicators of the functional state of the cardiovascular system of the examined adolescents (M ± m)

Environmental group	Gender	Systolic blood pressure, mm Hg	Diastolic blood pressure, mm Hg	Heart rate, beats/minute	Minute volume of blood circulation, liter/minutes	Hardware-software complex, score
Nukus city	M	120,6±2,15	76,8±1,61	76,7±2,14	4,8±0,14	1,62±0,04
	F	116,6±1,94	75,2±1,35	76,5±1,91	4,7±0,12	1,57±0,05
Chimbay district	M	127,3±2,43	79,1±1,74	78,8±2,62	5,4±0,19	1,73±0,06*
	F	117,2±2,41	75,1±2,75	74,7±1,41	4,9±0,15	1,65±0,06

Note: * – differences with control are statistically significant (p < 0.05).

Thus, further analysis of the results obtained for various ecological zones will allow us to consider in more detail the dependence of the morbidity rates of the adolescent population of Karakalpakstan on the influence of environmental factors. Living in the Chimbay region of the republic entails a number of stress reactions for the teenager's body, determined by the influence of the studied factors.

According to the results of regression analysis, air pollution has priority importance - 41.5%. In the areas under consideration, there is a significant increase in motor transport, which cannot but affect the air quality in populated areas. The influence of water factors (12.6%) and weather and climatic factors (14.4%) was noted. The syndrome of environmental maladjustment, of course, is corrected under the influence of physical factors, including drinking water. Thus, the optimal means of helping adolescents and children living in conditions of environmental distress are health institutions that carry out adaptive regulation of biosystems.

The social situation is also of great importance. During the years of reforms, the population's body resistance decreased, the incidence of multifactorial pathology increased, which is especially significant for young people. The observed trends towards a decrease in morbidity and mortality of the population are to a large extent related to the improvement of the environmental and social situation in the Republic of Karakalpakstan. Weakening of attention to environmental factors is fraught with irreparable losses of public health in the near and distant future.

Author Contribution

Ramazanov Medetbay Baxitbaevich: Investigation, formal analysis, writing—original draft.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval: Not applicable.

Consent to Participate: Not applicable.

Consent to Publish: Not applicable.

Conflict of Interest: The authors declare no competing interests.

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