Modern American Journal of Medical and Health Sciences
ISSN (E): 3067-803X
Volume 01, Issue 09, December, 2025
Website: usajournals.org

ANTHROPOMETRIC INDICATORS OF CHILDREN LIVING IN AREAS WITH DIFFERENT LEVELS OF AIR POLLUTION

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Abstract

Relevance of the study. Currently, in the context of a pronounced demographic decline, maintaining and improving the health of children is an important task for society and the state. Furthermore, studying indicators of physical development, the level of functioning of the body's main systems, and the body's adaptive capacity, reflecting its degree of resilience to environmental factors, is among the most important areas of hygiene research.

It is known that the majority of the country's population, including children, live in cities, which are hubs of industry and transportation. In these cities, assessing the impact of man-made chemical factors on children's physical and mental development is crucial. However, most studies examine the impact of environmental factors on the morphofunctional and psychophysiological state of schoolchildren and adolescents. Insufficient attention has been paid to preschool-age children in the scientific literature. There are isolated studies in certain regions devoted to studying the incidence of diseases and the physical and neuropsychological development of preschoolers living in ecologically polluted areas.

At the same time, some researchers emphasize the importance of studying the impact of chemical pollution on preschoolers, since, on the one hand, during this age period, the child actively grows, the functional systems of the body develop and improve, higher nervous activity is formed, an increase and mobility of nervous processes is noted, which ensures high sensitivity of preschoolers to chemical exposure, and on the other hand, due to the absence of bad habits and occupational hazards, they are one of the best models, objectively reflecting the influence of unfavorable environmental factors.

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It is known that, when external and internal environmental factors change, children's bodies strive to ensure optimal conditions for their existence by maintaining vital constants within certain limits through complex regulatory mechanisms. However, there is currently insufficient data on the nature of the functioning of preschoolers' physiological systems depending on the quality and quantity of environmental factors. The impact of industrial chemicals on the adaptive capacity of preschoolers remains virtually unexplored. There are no comprehensive, reliable information criteria for identifying preschoolers at risk for declining health based on their level of adaptation. An algorithm for methodological and organizational approaches to shaping preschoolers' health has not been developed. Essentially, the widespread occurrence of latent damage to the body due to increased environmental pollution is becoming a pressing hygiene issue, and the diagnosis of human functional states remains among the most important hygiene problems.

The aim of the study was to assess the impact of chemical air pollution on the morphofunctional and psychophysiological state, the level of adaptive capacity of the body of preschool children, and, on this basis, to develop recommendations for the medical and environmental rehabilitation of children.

Research objectives:

1. Conduct a qualitative and quantitative hygienic characterization of chemical pollution of the atmospheric air in the studied areas of Magnitogorsk and assess the magnitude of the non-carcinogenic risk to the health of preschool children.
2. To assess the anthropometric, physiometric, psychophysiological parameters and the level of adaptive capacity of the body of children living in areas with different levels of air pollution.
3. To establish cause-and-effect relationships and dependencies between the level of air pollution and indicators of physical and mental development and adaptive capabilities of children.

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Study Results. For the first time, priority regional chemical factors of atmospheric air pollution in the studied urbanized areas of residence have been identified, which have an adverse effect on the physical development, functional state of organs and systems, and the adaptive capacity of the body of preschoolers. The risk of developing pathologies in individual organs and systems critical to the effects of xenobiotics present in the atmospheric air has been calculated. Correlation and regression analyses have demonstrated a relationship between the level of atmospheric air pollution and changes in physical development indicators, the level of functioning of the central nervous system, and the adaptive capacity of the body. Children's health centers should conduct in-depth medical studies to assess the functional state of the respiratory, cardiovascular, and central nervous systems in order to identify initial adverse changes in the body of children living in areas with a high level of anthropogenic load.

Include an assessment of children's adaptive capacity in the regional social and hygienic monitoring system, which will enable the timely identification of risk groups and the implementation of therapeutic and health-improving measures.

To enhance the body's resistance, it is recommended that medical institutions implement medicinal (a course of vitamins with microelements, a course of adaptogens - eleutherococcus, ginseng) and non-medicinal (herbal medicine, massage, exercise therapy, manual therapy) interventions for preschoolers living in ecologically unfavorable areas. To quantitatively assess the actual levels of exposure of children to chemical compounds in the atmospheric air and identify priority factors of environmental pollution, it is necessary to improve the monitoring system, taking into account the regional list of chemical pollutants contained in the atmosphere.

The aero-anthropogenic load on the population of the industrial city is formed due to the high level of air pollution with suspended matter, nitrogen dioxide, phenol, which are the priority pollutants of the studied zones of the city; their average daily concentrations in zone 1 exceed those in zone 4 by 2.06, 1.34 and 1.56 times, respectively. The highest coefficient of total air pollution was identified in zone 1, where it amounted to 4.60-0.44, which is 1.27 times higher

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than in zone 2 and 1.52 and 1.66 times higher than in zones 3 and 4: 3.62+0.47, 3.02+0.39, 2.78+0.45.

It was established that the most unfavorable in terms of the risk of developing non-carcinogenic effects is zone 1 and is characterized by an unacceptable risk (10.47), it is 1.33, 1.54, 1.76 times higher compared to zones 2, 3 and 4, where the risk is assessed as high. When assessing the index of impact of air pollutants on various organs and systems, it was calculated that the 1st rank place is occupied by the risk for the respiratory organs: H1 from 5.21 to 9.28; the 2nd rank place is occupied by the impact on the hematopoietic system: from 2.10 to 3.00; the 3rd rank place is occupied by the risk for the central nervous system: from 0.96 to 1.35.

Under conditions of higher levels of aero-anthropogenic load and intake of chemical pollutants into the children's body, there is an increase in the percentage of children with disharmonious physical development: in the 1st group - 17.12%, which is 5.67% and 7.98% more compared to the 3rd and 4th groups; deterioration of the adaptive capabilities of the body is noted due to the increase in the number of children with adaptation stress: in the 1st group there were 35.19%, which is 1.63 and 1.72 times more than children from the 3rd and 4th groups; in the 2nd group of children with adaptation stress there were 31.85%, which is 1.48 and 1.56 times more than in the 3rd and 4th groups.

The priority pollutants determining adverse effects on primary school-age children in the study areas are sulfur dioxide, nitrogen dioxide, manganese, nickel, lead, zinc, chromium, and copper. It was shown that the area with the highest risk of non-carcinogenic effects, based on the calculated hazard indices, is the one with a total hazard index of 22.84, compared to the corresponding values of 12.67.

Peculiarities of the development of imbalances in biotic concentrations of essential elements and the accumulation of toxic microelements in the bodies of children in the compared groups were established. Thus, in the hair of children in Group 3, compared with the hair of children, the level of accumulation of cadmium was 1.55 times higher, lead 3.45 times higher, strontium 1.37 times higher, and nickel 3.66 times higher. In the hair of children, compared with the

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same indicators for children, the accumulation of cadmium was 4.5 times higher, lead 2.18 times higher, manganese 2.92 times higher, and nickel 5.25 times higher.

Anthropogenic pollution of the environment leads to the strain of the heart rhythm regulation systems due to the mismatch of the influences of both parts of the autonomic nervous system, accompanied by excessive vegetative support, which together leads to varying degrees of decrease in the adaptive reserves of the body, which in children of the 1st group is 77.4%; 2nd group 85.2%; 3rd group 90.6%, respectively. Comparative analysis of the functional state of the body of children under the influence of chemical pollutants indicates that high levels of anthropogenic load on the body lead to an increase in the number of children with disharmonious physical development, deterioration of adaptive capabilities due to a decrease in the number of children with satisfactory adaptation by 1.4 times in the 2nd group and by 1.5 times in the 3rd group, a decrease in the level of functioning of the central nervous system in 45.6% of children of the 2nd group and in 52.1% of children of the 3rd group; and the level of nervous reaction decreases by 1.4-1.67 times.

Based on correlation analysis, a relationship was established between the level of anthropogenic load and the level of the body's functional reserves, as well as indicators of the functional state of the central nervous and cardiovascular systems, which made it possible to scientifically substantiate markers of biological impact and biological response.

There is growing concern worldwide about the steadily deteriorating quality of development and health of children. The need to overcome the current alarming trend in the interests of ensuring the life of the younger generation in anthropogenically changed environmental conditions is increasingly recognized as an urgent task for the state. In addition, of no small importance is the understanding that the health of today's generation of children is not only the health of tomorrow's healthy people, but also the health of the future generation of people. A qualitative and quantitative analysis of multicomponent air pollution revealed that the MAC was exceeded by 1.63 times for nitrogen dioxide, 1.57 times for sulfur dioxide, 1.86 times for 3,4benz(a) pyrene, 2.3 times for nickel,

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and 1.4 times for cadmium. The MAC in the atmospheric air was exceeded by 2.05 times; 3,4-benzo(a) pyrene increased by 2.14 times, nitrogen dioxide by 1.19 times, lead by 2.1 times, and suspended solids levels were at 0.98 MAC. In Buguruslan, none of the detected pollutants exceeded the MAC in average daily concentrations.

An assessment of the magnitude of the anthropogenic load on the body of children in the studied areas indicates that the total impact of the complex of pollutants on the child population in the area is 5 times higher.

Conclusions

Based on the correlation analysis, the following relationships were established between the indicators of physical development, psychophysiological state of children and air pollutants: a strong direct correlation between the level of personal anxiety and the content of phenol and suspended solids in the air; a strong inverse correlation between attention productivity and the presence of suspended solids, phenol, and nitrogen dioxide in the atmosphere; a strong direct correlation between the level of adaptive potential and air pollution with suspended solids and phenol; a strong inverse correlation between the vital capacity of boys and the content of suspended solids, phenol, and nitrogen dioxide in the air.

Using the method of single-factor regression and variance analysis, it was established that a high level of total air pollution leads to a decrease in the vital capacity of the lungs, the level of attention productivity, adaptive capabilities, and to an increase in the level of personal anxiety in preschoolers.

Based on the study of the relationship between the adaptive capabilities of the body and the morphofunctional and psychophysiological indicators of children, it was found that a decrease in chest circumference, vital capacity, the level of productivity and attention span, and an increase in the level of personal anxiety make it possible to classify a child into a group of children with reduced adaptive capabilities or with unsatisfactory adaptation and, on this basis, to form risk groups for the timely implementation of therapeutic and health-improving measures aimed at strengthening the health of preschoolers.

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