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# Modern Principles of the Effect of Heavy Metal Salt on the Body

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**Abstract:** This article provides a statistical analysis of modern principles of the effects of heavy metal salts on the human body. For this purpose, foreign and domestic scientific articles and scientific research results were analyzed.

**Key words:** heavy metals, body, health, pollution.

**Introduction.** The main threats of heavy metals to human health come from exposure to lead, cadmium, mercury and arsenic. These metals have been thoroughly studied and their impact on human health is regularly analyzed by international organizations such as the WHO. Heavy metals have been used by humans for many thousands of years. Although some of the adverse effects of heavy metals on human health have been known for a long time, exposure to heavy metals continues and is even increasing in some parts of the world, particularly in less developed countries, although emissions have decreased in most developed countries over the past 100 years [2]. The aquatic environment is being seriously polluted by heavy metals as a result of rapid industrialization and urbanization [3]. Moreover, fish, which supply high protein and omega-3 fatty acids, are widely consumed by people around the world. Consumption of fish is considered one of the main routes of human exposure to heavy metals. Cadmium (Cd) and lead 7 (Pb) are classified as toxic elements that have no established role in any biological process. In contrast, Pb causes kidney failure, liver damage, mental retardation, coma and even death [8], Cd damages the kidneys and causes acute hypocalcemia and growth retardation [4]. Although Cu, Fe, Mn and Zn are important metabolic elements, they can pose significant health risks when their concentrations accumulate to certain threshold levels. Relatively high levels of Cu and Zn cause nephritis, anuria and extensive kidney damage [5]. The liver, as an active organ, tends to accumulate large amounts of heavy metals by binding to metallothionein for detoxification [326]. MicroRNAs (miRNAs) are a family of small 21-25 nucleotide sequences of evolutionarily conserved non-coding RNA genes that post-transcriptionally regulate the expression of target genes. The human genome is estimated to contain between 1000 and 2000 different miRNA genes [7]. It is assumed that in mammals, miRNAs control the activity of 30–50% of all protein-coding genes, which makes them responsible for biogenesis, increases their role in deciding the fate of cells, and determines their participation in many critical biological events, including proliferation, differentiation, apoptosis, metabolism, viral infections, as well as many diseases associated with metabolic disorders, diseases of various organ systems and some forms of cancer [6]. Chemical carcinogens, such as air pollutants: tobacco smoke, organic pollutants, and exposure to metals through air, soil, water, and food, increase the risk of cancer. However, the underlying mechanisms of carcinogenesis of these chemicals have not been well understood. A growing body of evidence suggests that miRNA dysregulation plays an important role in chemically induced cancers, yet the role of miRNAs in cancer development remains relatively unexplored. It is especially important to obtain modern knowledge about the effect of various chemical carcinogens on the expression of microRNAs [9]. Metals are a major category of common pollutants associated with health problems, including malignant neoplastic processes [10]. Various studies have demonstrated an association between altered miRNA expression and exposure to metals such as As, Cd, aluminum (Al) and chromium (Cr) [13].

According to research by Zdornov O.V. et al., (2021) studied the features of the structural organization of the liver, kidneys, testes, and lungs when exposed to metals. A morphological study of liver pieces revealed reactive changes: a sharp dilation and congestion of the vessels of the portal tracts, central and sublobular veins, as well as sinusoidal capillaries. Phenomena of hyalinosis of small arteries and stasis of blood elements are noted. In the liver parenchyma, protein, fatty and hydropic degeneration of hepatocytes are observed. Often fatty degeneration had the large-droplet nature of obesity. Around the portal tracts, especially when exposed to high concentrations, intensive proliferation of connective tissue occurs. The process of collagen formation is also observed around the central, sublobular veins and along the sinusoidal capillaries. In these same areas, significant infiltration with lymphocytes, macrophages, neutrophils, single eosinophils and plasma cells is noted, which indicates the development of inflammatory processes especially in the periportal zone. Along with dystrophic changes and isolated areas of necrosis, signs of regenerative activity of hepatocytes are observed in the form of their hypertrophy, an increase in the number of binucleate hepatocytes. They are located mainly along the periphery of the classic hepatic lobules. In the vascular system of the kidneys, pronounced dyscirculatory changes are observed: plethora, marginal standing of leukocytes, hypertrophy of endothelial cells, perivascular edema. The renal corpuscles are hypertrophied in some areas, unchanged in others, and atrophy and die in others. The capsule cavities are most dilated with atrophy of the vascular glomeruli. The loops of Malpighian bodies are full-blooded, hypertrophied nuclei of endothelial cells are visible, and nonspecific edema of the mesangium is observed. A few neutrophils appear in the capsule cavities, erythrocyte diapedesis occurs, and desquamated epithelial cells are visible.

In some renal corpuscles, the lumen of the capsule cavity decreases to a slit-like one. “Fingered” vascular glomeruli are identified. In dying renal corpuscles, the glomeruli are reduced in size and are often sclerotic. At the same time, the capsule cavities are sharply expanded, the nuclei of the endothelial cells of the vascular glomeruli and mesangium are pycnotic. In the proximal and other parts of the nephron tubules, contents, forming and formed hyaline casts are visible. In convoluted and straight tubules, granular degeneration, a decrease in the height of epithelial cells of the proximal sections, and nuclear polymorphism are noted. The nuclei of epithelial cells are often large, hyperchromatic, protruding into the lumen of the tubules. The diameters of the lumen of the tubules often increase. Vacuoles of various sizes, often large, sometimes appear in epithelial cells. Necrotic changes in some tubules are observed, while foci of hyperplasia appear in others. In the interstitial tissue of the cortex and especially the medulla, proliferation of connective tissue cellular elements and fibrous structures lying around the Malpighian bodies is noted. Forming collagen fibers are visible between them. Thus, in the interstitium of the cortex and especially the medulla, there is a tendency to the formation of focal fibrosis. Between the tubules, in the interstitium of the cortex and medulla, diffuse focal polymorphocellular infiltrates are detected, larger in the medulla.

Heavy metals cause cardiovascular diseases, severe allergies, and even have carcinogenic properties. They affect the genetic background, as they accumulate in the body with a subsequent effect, manifested in hereditary diseases, mental disorders, etc. The toxicity of heavy metals is expressed in their binding to the functional groups of proteins and other vital compounds in the human body.

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