

Hg, Mercury, mercury toxicity, role of curcumin as detoxifying agent

Mercury is a natural element in the earth's crust, is found in air, water and soil, it was often found in its native state (liquid drops on rocks), but more often it is obtained by burning natural cinnabar [1]. Mercury is released into the environment as a result of volcanic activity, weathering of rocks and as a result of human activity. The main cause of mercury release is human activities, especially power generation in coal-fired power plants, coal combustion in homes for heating and cooking, industrial processes, using incinerators, as well as mining of mercury, gold and other metals [2].

Once released into the environment, mercury can be transformed under the influence of bacteria into methylmercury and then methylmercury bioaccumulates in fish and shellfish. It can also be biomagnified by predatory fish as a result of eating many small ones that have succumbed to the influence.

There are several forms of mercury, and they are divided according to the degree of toxicity and their effect on the body.

- elementary (metal)
- inorganic (people may be exposed in the workplace)
- organic (eg. methylmercury, people may be exposed while eating, mainly by eating fish and shellfish)

People can be exposed to any form of mercury, but the main exposure occurs during the consumption of methylmercury in food and through the inhalation of elemental mercury during industrial processes. Heat treatment of food does not destroy mercury. All people, without exception, are exposed to mercury at one level or another, the effects of which depend only on the type of mercury, dose, age or stage of human development, duration and mode of exposure [3] [4] [5] [6].

There are companies in the beauty industry that produce skin lightening creams that contain mercury, which causes intoxication and disruption of the body's functioning [7] [8].

It is known that mercury has a property to accumulate and is deposited in the body, reduces oxidative protection, increases oxidative stress, promotes inflammatory processes and thrombosis, causes mitochondrial dysfunction, and subsequently the reverse transport of cholesterol to the liver decreases. It also causes an overproduction of nitric oxide (and other ROS), which affects membrane lipids and causes lipid peroxidation, necrosis, and cell death [9].

Long-term exposure to mercury causes a range of disorders, such as:

- neurological and behavioral disorders [10] [11] [12] [13]
- diseases of the cardiovascular system (atherosclerosis, myocardial infarction, hypertension, ischemic heart disease, cardiac arrhythmia, obstruction of the carotid artery, cerebrovascular accident, generalized atherosclerosis and others) [14] [15] [16] [17] [18]
- disorders of the immune system [19] [20]
- disorders of the endocrine system [21] [22]
- disorders of the reproductive system [23] [24]

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- lung pathology [25] [26]
- kidney disease (nephropathy, glomerulonephritis, chronic kidney disease, aging) [27] [28] [29] [30]
- liver pathology [31] [32] [33]
- skin diseases (hyperpigmentation, contact dermatitis, skin granuloma) [34]
- eye pathology [35] [36] [37]
- diseases of the joints and connective tissues [38]
- threat to intrauterine development of the fetus and development in the early stages of the child [39] [40] [41]
- can lead to death [42] [43]

According to research data, curcumin is one of the best means for preventing the development of pathological processes in the body caused by toxins [44].

Curcumin is the main curcuminoid [45] found in turmeric root [46].

Curcumin is one of the most widely tested natural compounds. Laboratory studies have shown that curcumin is a therapeutically useful tool for preventing or correcting the negative effects of mercury on the body. Curcumin has been shown ability to cross the blood-brain barrier [47], to provide protective effects against oxidative damage, to reduce ROS [48]. Curcumin chelates [49] the toxicity of metals, helps to normalize the content of GSH [50], SOD [51], CAT [52], protects hemoglobin [53] from oxidation [54], interacts with membrane components and prevents lipid peroxidation [55] inside microsomes [56], erythrocytes and brain homogenates [57] [58] [59] [60] [61].

Furthermore, in laboratory conditions curcumin has demonstrated multiple pharmacological properties, including antioxidant, anti-inflammatory, anticarcinogenic, cardioprotective, hepatoprotective, antidepressant, immune-strengthening, and many others [62]

Unfortunately, these encouraging initial findings were not supported in human clinical trials due to the very low bioavailability of curcumin, which averaged no more than 0.1% [63]. This low bioavailability prevents curcumin from showing its therapeutic potential while taking as powder or extract.

It is worth noting that laboratory studies with curcumin have greatly increased interest in it all over the world, and this was especially evident in the segment of dietary supplements. On almost every supplement site, you can purchase preparations made from powder or turmeric extract and find information on the pharmacological effect of curcumin on dozens of diseases. This method of presenting information is a substitution of concepts, when laboratory findings are issued as clinical results. Neither turmeric extract, nor powder, is able to provide the pharmacological action that curcumin has shown in laboratory studies.

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Increasing the bioavailability of curcumin has been the topic of many research teams for several decades [64]. Several technologies have already been developed to increase the bioavailability of curcumin. The most advanced technology for the delivery of active substances into the blood is liposomal [65].

Liposomal curcumin delivery technology allows to achieve the desired pharmacological effect in humans and animals, which has been demonstrated in thousands of laboratory studies [66] [67] [68].

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Hg, Mercury, mercury toxicity, role of curcumin as detoxifying agent

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