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The Effects of Aluminum on the Body and Brain, and its Negative Consequences

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Abstract: Aluminum is one of the most abundant elements on Earth, ranking third after oxygen and silicon. In nature, aluminum compounds are diverse and occur in various forms. These compounds are found in more than 280 minerals and are widely used in various human activities. Despite their widespread use, the negative consequences of aluminum remain a significant and unresolved issue in modern medicine. Notably, its complications related to the brain have sparked considerable debate. Numerous discussions continue about how aluminum and its compounds might contribute to profound brain changes such as Alzheimer's disease, autism, Parkinsonism, and progressive sclerosis. Even though large amounts of aluminum can enter the body through drinking water, respiration, and food products, only a small amount is reabsorbed through mucous membranes.

Keywords: Aluminum compounds, brain, Alzheimer's disease, autism.

Aluminum is not essential in human metabolism and processes. This element exerts a potent toxic effect on the body and brain. The numerous pathways through which aluminum enters the body and its extensive use highlight its toxic properties. Particularly, this toxic effect manifests in conditions like Alzheimer's disease, autism, progressive sclerosis, and other brain dysfunctions. International scientific journals have focused on the connection between aluminum and these neurological diseases.

The primary sources of aluminum in the body include water, food colorants, and components used in food packaging, preparation, and storage. In unprocessed food products, aluminum content is less than 5-7 mg/kg. When aluminum compounds enter the stomach, they dissolve in the highly acidic environment, forming trivalent aluminum. In the intestines, aluminum ions form insoluble hydroxides, most of which are excreted in feces.

Older adults tend to accumulate higher levels of aluminum. Water accounts for 0.3% of aluminum intake, while food accounts for 0.1%. When daily aluminum consumption reaches 15 mg/day, about 0.025 mg is excreted through the kidneys, with 5% accumulating in tissues, half of which is stored in bone tissue. Aluminum is also found in the skin, lower digestive system, adrenal glands, parathyroid glands, and lymph nodes. Experiments on rats have shown that aluminum from food accumulates mainly in the pancreas, liver, bones, and kidneys, with smaller amounts found in the brain, heart, lungs, and muscle tissue.

In blood, 90% of aluminum binds to transferrin, and 10% binds to citrates. Increased aluminum levels in tissues lead to a decrease in iron compounds. Accumulation in the brain and bones reduces calcium and magnesium levels. Numerous studies indicate that aluminum in drinking water can lead to cognitive decline and Alzheimer's disease, potentially due to increased synthesis of inflammatory cytokines in the brain.

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