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RESEARCH LABS, INC.**

ARL is an Authority on Nutrition and the Science of Balancing Body Chemistry Through Hair Tissue Mineral Analysis!


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Aluminum Toxicity

Introduction

Aluminum was discovered in 1825 by Hans Oversted of Denmark. It is the third most prevalent element and the most abundant metal in the earth's surface. Human beings are naturally exposed to relatively large amounts of aluminum from food, water and air.

Recently, however, aluminum toxicity has increased precipitously. Today, nearly 80% of those tested for metal toxicity reveal excessively high hair aluminum levels.

Sources Of Aluminum

Aluminum Cookware

Aluminum is popular for cookware because it is inexpensive and lightweight.

For years, some have alleged that aluminum cookware could be a cause of headaches, colitis and indigestion. Today we know these claims to be true, especially when acidic foods, such as tomatoes and okra, are cooked in aluminum cookware.

Use of steel utensils on aluminum cookware can cause additional toxicity by scraping aluminum into food.

Aluminum Cans

Beer and soft drink cans are made exclusively from aluminum. Since these beverages are often highly acidic, even one beer or cola drink per day can lead to aluminum toxicity in susceptible individuals over a period of time.

Antacids

Most antacids contain significant amounts of aluminum hydroxide, including Maalox, Mylanta, Gaviscon, Riopan, Alka-Seltzer, Roloids and many others. Buffered aspirin compounds, such as Ascriptin, also contain aluminum.

Aluminum functions in these preparations as an anticholinesterase agent to counteract the laxative properties of the magnesium hydroxide which the antacids also contain.

Antacids are available which do not contain aluminum, such as Tums and one type of Riopan.

Anti-Perspirants

Aluminum chlorhydrate or other aluminum compounds are used in anti-perspirants to inhibit sweating. Deodorants, in contrast to anti-perspirants, simply emit a pleasant odor but don't inhibit sweating.

Significant amounts of aluminum can be absorbed through the skin when anti-perspirants are used daily.

Hemodialysis

"In a recent study we found that levels of bone aluminum were elevated in nearly all patients undergoing hemodialysis, especially those with osteomalacia." (Hodsman 1982)

The kidneys appear to be the main excretory organs for aluminum and any impairment of renal function can result in aluminum retention.

The degree of aluminum toxicity in renal failure depends upon the duration of aluminum exposure.

Drying Agents

Sodium silico-aluminate is a fine powder that is used to keep cocoa, salt and other products, dry. Baking powders also frequently contain aluminum.

Cosmetics

Aluminum is also used as a base for various paints and cosmetics.

Water supplies

Most municipal water supplies add aluminum to the drinking water as a flocculating agent (removes dirt). In addition, some water supplies may contain high amounts of naturally occurring aluminum compounds.

Other

Sodium aluminum phosphate is used as an emulsifier in processed cheese and potassium alum is used to bleach flour.

Detection Of Aluminum

Blood

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A debate currently exists concerning the value of blood aluminum levels to determine aluminum status. It is clear, however, that blood aluminum determinations fail to accurately reflect total body burden of aluminum. This is because brain, lung and often bone measurements reveal much higher levels of aluminum than are found in the blood.

Hair

Hair levels of aluminum have been shown to correlate well with bone levels of aluminum.

Hewitt and Day found no correlation between hair and serum aluminum levels. However, in their experiment the hair was washed five times in both acetone and water, for ten minutes each time followed by 10 minutes of ultra-sound agitation. We feel that hair should not be washed at the laboratory and that the procedure used probably invalidates their study.

We also find that hair levels do not necessarily reflect serum aluminum levels because certain minerals are excreted more readily into the hair. Commonly, aluminum levels will rise on a hair retest during nutritional therapy as aluminum is mobilized from storage depots and eliminated.

Metabolism Of Aluminum

Absorption

Aluminum is present in significant amounts in air, water and food, but a large amount of aluminum is not absorbed. Absorption depends on factors such as the levels of competing minerals and parathyroid hormone levels.

Some aluminum is absorbed orally and accumulation definitely occurs in the brain and other organs as a result of oral ingestion. Aluminum phosphate is the only form of aluminum which is not absorbed.

Aluminum competes for absorption with fluoride. Other competing metals are not presently known.

Mayor and coworkers reported that increased parathyroid hormone activity can increase intestinal and brain absorption of aluminum.

Administration of calciferol (vitamin D) does not increase aluminum absorption.

Aluminum may also be absorbed directly from the respiratory epithelium to the brain by axoplasmic transport. This theory is supported by the finding that the olfactory bulb contains a much higher concentration of aluminum than other parts of the brain.

Aluminum can form compounds with alkalis, including saliva, which may enhance its absorption.

Retention

Aluminum is stored mainly in the lungs, liver, thyroid, bone and brain. Levels in most tissues don't increase with age, but levels of aluminum in the lungs and brain show significant accumulation with age.

Excretion

The majority of aluminum in the blood is bound to plasma proteins. Extensive evidence indicates that aluminum penetrates the blood-brain barrier and is excreted in breast milk.

Excretion of plasma aluminum occurs principally through the urine.

Much higher amounts of aluminum are excreted in the feces, but not from the bile, suggesting that most aluminum passes through the digestive tract unabsorbed.

Kidney failure is known to drastically increase aluminum toxicity, presumably because the small amount of aluminum that is absorbed from the gut cannot be eliminated.

The only known drug to increase elimination of aluminum is deferoxamine.

Metabolic Effects Of Aluminum

Membrane Effects of Aluminum

When aluminum replaced calcium in as low a concentration as 0.03 mEq/L in invitro neuron studies, the action potential was blocked. It is thought that aluminum decreases spontaneous nervous discharge, thereby reducing nervous activity.

Changes in Brain Anatomy

Aluminum appears to accumulate in most brain cells. About 80% binds to the chromatin in all cells, but induces change only in certain vulnerable neurons, particularly those with dendritic trees.

Increased aluminum accumulation is known to be associated with neuro-fibrillary tangles in some species. The term *neuro-fibrillary tangles* refers to threadlike tangles of slender fibers within a nerve cell. Not all species develop these tangles when exposed to aluminum. Humans with Alzheimer's disease develop a different kind of tangle (twisted helix) that is not identical to the tangles induced by aluminum in other species.

Neurochemical Effects

Research studies are not conclusive, but suggest that aluminum inhibits cholinergic functioning and may inhibit synaptic uptake of dopamine, norepinephrine and 5-hydroxytryptamine. Aluminum has also been shown to inhibit Na-K-ATPase and hexokinase. Aluminum also can alter the reassociation of DNA.

Behavioral Effects

Rabbits showed difficulty in memory retention and difficulty in learning under the influence of aluminum. Cats also suffered from loss of coordination. Other species, such as rats, are highly resistant to aluminum toxicity.

In humans, dementia resulting from kidney dialysis, is related to aluminum and

results in memory loss, loss of coordination, confusion and disorientation.

Anti-Cholinesterase Activity

Aluminum is used in antacids and anti-perspirants because it reduces peristalsis and sweating. Excessive aluminum is associated with intestinal colic.

Dysfunctions Associated With Aluminum

Early symptoms of aluminum toxicity include flatulence, headaches, colic, dryness of the skin and mucous membranes, tendencies for colds, burning pain in the head relieved by food, heartburn and an aversion to meat. Later symptoms include paralytic muscular conditions, loss of memory and mental confusion.

Metabolic Dysfunctions Related To Aluminum Toxicity

Alzheimer's Disease

Some authorities feel that aluminum is not the primary agent responsible for Alzheimer's disease. However, significantly increased levels of aluminum were noted at autopsies in patients suffering from Alzheimer's disease. A difficulty with this research is that the aluminum is not evenly distributed in the brain.

Amyotrophic Lateral Sclerosis

A study on the island of Guam indicated a relationship between high aluminum in the soil and a high incidence of amyotrophic lateral sclerosis.

Anemia

Anemia may result, due to the interference of aluminum with iron metabolism.

Blood Disorders

Possible blood disorders include hemolysis, leukocytosis, and porphyria.

Colic

Aluminum affects bowel activity, and can cause digestive disturbances.

Dental Caries

There are two distinct mechanisms responsible for an increase in the incidence of dental caries:

- Aluminum impairs bone calcification.
- Aluminum competes with fluoride. High tissue aluminum levels may inhibit fluoride uptake, resulting in dental problems.

Dementia Dialactica

Aluminum is considered to be the primary agent in dementia in dialysis patients with renal failure. Use of deionized water and avoidance of other sources of aluminum can avoid this problem.

Hypoparathyroidism

Aluminum may trigger a feedback mechanism affecting the parathyroid glands.

Kidney Dysfunction

Fatty degeneration of the kidney can result from aluminum toxicity.

Liver Dysfunction

Fatty degeneration of the liver can result from aluminum toxicity.

Neuromuscular Disorders

There is a possible link between aluminum and Parkinson's disease.

Osteomalacia

Dialysis patients, in particular, display increased fractures when their drinking water is high in aluminum and low in calcium. The exact mechanism for the mineralization problem is unknown. It appears that aluminum affects the activity of alkaline and acid phosphatase, and modifies the response of these enzymes to parathyroid hormone and vitamin D.

Parkinson's Disease

The effect of aluminum on the nervous system may contribute to symptoms of Parkinson's disease.

Effect Of Aluminum On Other Nutrients

Iron

High hair aluminum levels are often associated with high hair iron levels; however, the exact connection is presently unknown.

Phosphorus

Aluminum hydroxide gel can greatly reduce blood phosphate levels, which can lead to osteoporosis, muscle aches, and weakness. However, this effect is due to the binding action of hydroxide on phosphorus, not the aluminum per se.

Effects Of Other Nutrients On Aluminum

Iron Binding Agents

The iron chelating agent deferoxamine appears to chelate aluminum.

Fluoride

Fluoride competes with aluminum for absorption in the gut.

Vitamin C.

High-dosages of ascorbic acid can be used as a chelating agent in cases of aluminum toxicity.

Detoxification Of Aluminum

Medical Therapy

The only medical treatment for aluminum toxicity is the chelating agent deferoxamine. Interestingly, deferoxamine was originally used as a chelating agent for iron, not aluminum. We have noted a significant correlation between iron and aluminum levels on hair analyses.

Deferoxamine causes an acute rise in serum aluminum levels, presumably by chelating aluminum from the tissues. The uses of deferoxamine include symptomatic relief of both aluminum encephalopathy and osteomalacia.

However, deferoxamine therapy is still being evaluated. Administration of deferoxamine is not without risk since it is not specific for aluminum and will reduce iron and copper levels along with aluminum.

Complete Nutritional Therapy

Aluminum is handled nutritionally much like other toxic metals. Programs include;

- removal of sources of aluminum from food, air, water and other sources,
- enhancing cellular energy production,
- enhancing activity of the eliminative organs, and
- chelating aluminum with nutrients such as vitamin C.

Let us examine each of these in more detail:

- Remove sources of exposure. Many individuals are unknowingly exposed to aluminum in their drinking water supply, or from a variety of products and foods. Reverse osmosis, or distillation are considered to be the most effective methods to remove aluminum from water. Deionization is another method for water purification.
Labels must be read on deodorants and baking powders to avoid aluminum. Sea salt should be used in place of commercial table salt.
Antacids without aluminum should be used if required. These include Tums and several other products now available.
- Enhance cellular energy production. Cellular energy production is increased by supplying nutrients required for the energy pathway, and by balancing the oxidation rate as revealed by a hair mineral analysis.
- Enhance activity of the eliminative organs. Aluminum is excreted principally through the urine. Adequate kidney function is therefore essential for detoxification.
Aluminum can be eliminated to some extent by the skin. Hot baths with epsom salts may be beneficial. Any therapies which improve the activity of the liver, kidneys, bowel and skin can be helpful.
- Non-toxic chelating agents. Vitamin C can help chelate aluminum.

All aspects of this program must be continued for a year or more, depending on the severity of the aluminum toxicity problem. Hair mineral retests should be performed every three months. This is necessary to monitor progress and to fine-tune the nutrition program so that biochemical energy production is maintained at a high level.

Prognosis of the nutritional approach

Nutritional therapy using hair mineral analysis for monitoring aluminum and guiding the design of corrective nutrition programs is highly successful in early cases of aluminum toxicity. Often symptoms including memory loss, colic, headache, and flatulence disappear within six months of initiating a nutritional balancing program.

Later-stage aluminum encephalopathy is more difficult to reverse, perhaps because permanent brain damage has occurred. However, even in advanced cases, progress of the disease may be halted and some improvement in symptoms may occur.

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