

**UNFORESEEN RISKS OF ALUMINIUM UTENSILS ON HEALTH****Ancy Thomas,* Aeista Thomas, Shithin Ann Vargeses, Jiju V. and Elessy Abraham**

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Thiruvalla, Kerala.**INTRODUCTION**

Aluminium is a chemical element in the boron group with symbol Al and atomic number 13. It is a silvery-white, soft, nonmagnetic, ductile metal. It is one of the most widely used metals and frequently found compounds in the earth's crust. Due to these facts, aluminium is commonly known as an innocent compound.

Aluminium metals are usually used in cooking vessels, foils, cans etc. But still, when one is exposed to high concentrations, it can cause health problems. The water-soluble form of aluminium causes the harmful effects, these particles are called ions. These are also available in solution with combination of other ions.

The uptake of aluminium can take place through food, through breathing and by skin contact. Long lasting uptakes of significant concentrations of aluminium can lead to serious health effects, such as:

- Damage to the central nervous system
- Dementia
- Loss of memory
- Severe trembling

Aluminium is a risk in certain working environments, such as mines, where it can be found in water. People that work in factories where aluminium is applied during production processes may endure lung problems when they breathe in aluminium dust. Aluminium can cause problems for kidney patients when it enters the body during kidney dialyses. Inhalation of finely divided aluminium and aluminium oxide powder has been reported as a cause of pulmonary fibrosis and lung damage. This effect, known as Shaver's Disease, is

complicated by the presence in the inhaled air of silica and oxides of iron. It may also implicate in Alzheimer's disease. Aluminium foil is aluminium prepared in thin metal leaves with a thickness less than 0.2 mm. The small amount of aluminium are ingested from foil, unless you are cooking highly acidic foods like tomatoes or fruit juices in foil, the acid foods will react with aluminium and bring flunky flavour to the food. These may contribute to Alzheimer's disease.

The amount of aluminium in the human body ranges between 50 and 150 mg. with an average of about 65 mg. Most of this mineral is found in the lungs, brain, kidneys, liver, and thyroid. Our daily intake of aluminium may range from 10-110 mg, but the body will eliminate most of this in the faeces and urine and some in the sweat. With decreased kidney function, more aluminium will be stored, particularly in the bones.

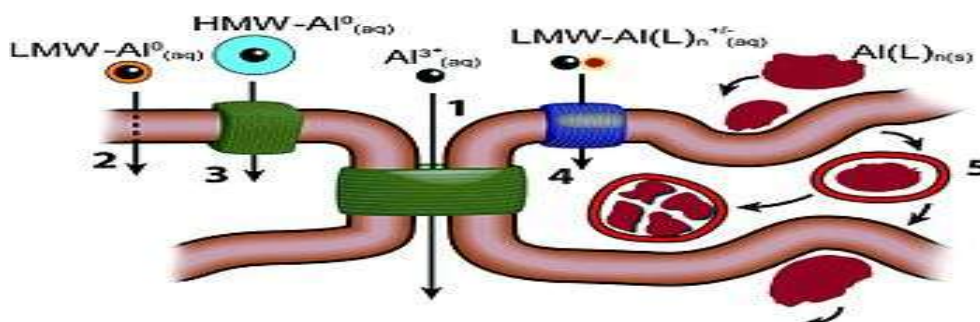
SOURCE OF ALUMINIUM IN EVERYDAY LIVES

Some of the sources of aluminium are

- Aluminium leaving agents and anti-caking agents used in such food as bread and pastries, pancake and waffles, on- diary creams, cake mixes, processed cheese, baking powder, and food starch modifiers.
- Aluminium cookware and containers such as soft drink and beer cans.
- Municipal tap water.
- Antiperspirants, antacids, Buffered aspirin, food wrapped Al foil, Infant formula, vaccines.
- Inhalation sources; talcum powder, cement, tobacco smoke.

SCHEMATIC REPRESENTATION OF AL ABSORTION

There are five major Al forms absorbed by human body: the free solvated trivalent cation ($Al^{3+}(aq)$); low-molecular-weight, neutral, soluble complexes ($LMW-AlO(aq)$); high-molecular-weight, neutral, soluble complexes ($HMW-AlO(aq)$); low-molecular-weight, charged, soluble particulates complexes ($LMW-Al(L)_n^{+/-}(aq)$); nano and micro- ($Al(L)_n(s)$).

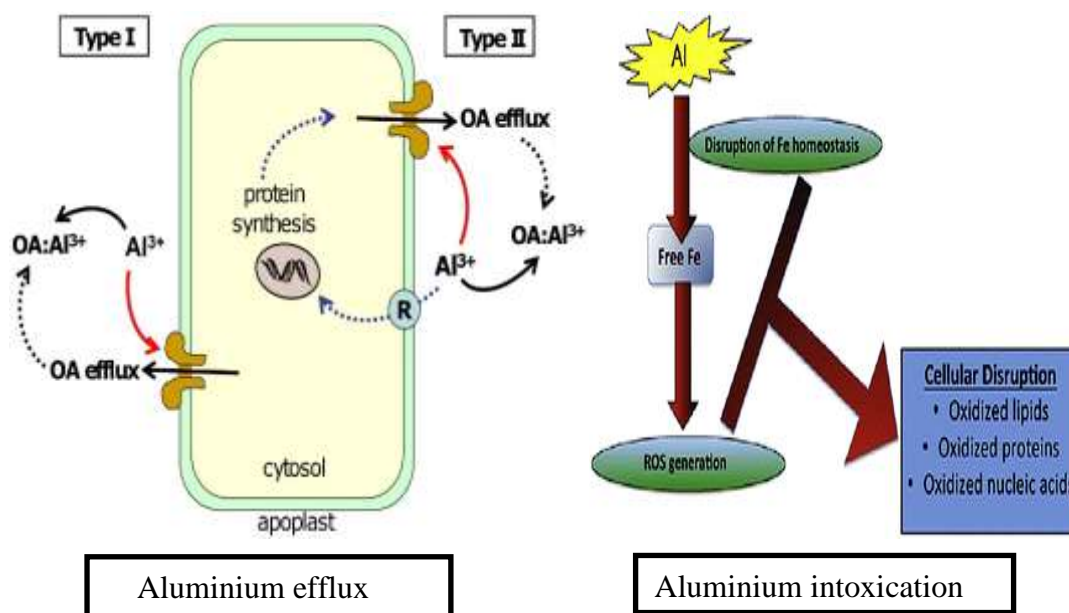


PATHOPHYSIOLOGY OF ALUMINIUM TOXIFICATION

Toxic effects of aluminium depend on the amount of metal ingested, entry rate, tissue distribution, concentration achieved, and excretion rate. Fatty acids common in food may facilitate the paracellular intestinal absorption of aluminium.

Mechanisms of aluminium toxicity include inhibition of enzyme activity and protein synthesis, alterations in nucleic acid function, and changes in cell membrane permeability.

Aluminium toxicity is usually found in patients with impaired renal function. Acute intoxication is extremely rare; however, in persons in whom aluminium clearance is impaired, it can be a significant source of pathology.



DISEASES ASSOCIATED WITH ALUMINIUM INTOXICATION

Various disorders associated with aluminium intoxication are

- (1) **Mouth ulcer-** The patient complains of recurring ulcers on the mucous membrane of the cheeks and lips.
- (2) **Oesophagus ulcer-** The patient complains of inability to swallow—liquids passing no more easily than solids. It is due to an uneven action of the muscles making up the tube.
- (3) **Duodenum ulcer-** It may cause attendant misery, pain, and discomfort. The rise in the incidence of duodenal ulcers runs paripassu with the rise in the use of aluminium utensils.
- (4) **Affect of small bowel-** It is affected by an alteration in the germs which normally grow in the bowel contents.

(5) **The appendix**-Aluminium is a potent cause of appendicitis. It is extremely common for aluminium sensitive to get acute appendicitis, whereupon the appendix is removed.

(6) **The large bowel and kidneys**-This is the organ commonly affected in all aluminium sensitive. It is generally the very first organ to suffer damage. The changes due to aluminium poisoning are of two sorts. There is first of all an alteration in the function of the large bowel; other effects produced are an alteration in the normal species of germs present in the bowel. Such germs can get into the bloodstream and be excreted by the kidney and a group of diseases in kidneys and bladder: kidney inflammations, stones in the kidney, inflammation of the bladder are all pretty common.

(7) **The defect in rectum**-The rectum shows a muscular weakness whereby large faecal masses are retained inside the organ unknown to the patient

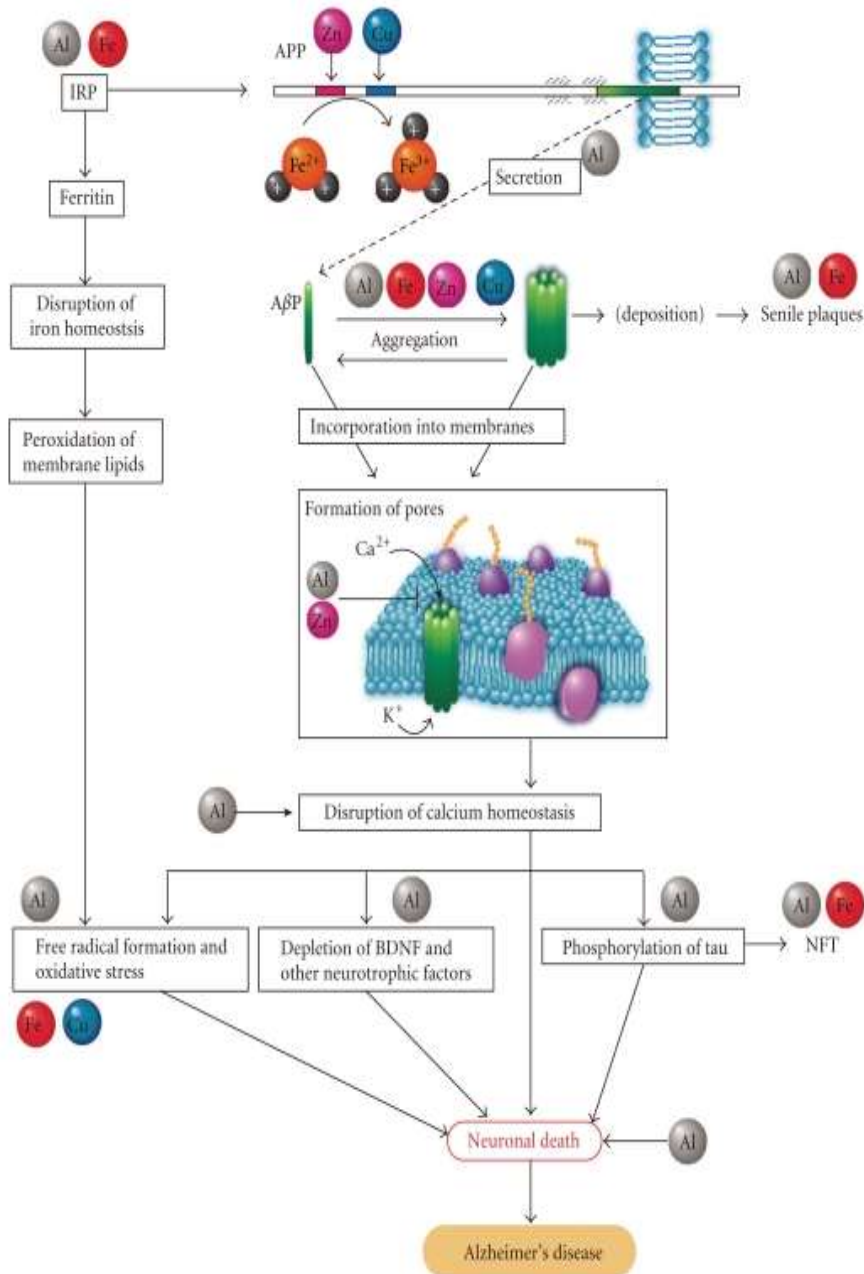
(8) **The skin, the ductless glands and cancer**-The rashes and itching were occurred in the skin due to the affection of Aluminium. It is due to the intestinal intoxication produced by aluminium.

(9) **Thrombosis**-Thrombosis may cause sudden death. It may leads to the clotting in a leg vein.

ALZHEIMER'S DISEASES

Alzheimer's disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills and, eventually, the ability to carry out the simplest tasks. In most people with Alzheimer's, symptoms first appear in their mid-60s.

Aluminium found in food, cosmetics and medicines could be poisoning our brain. Aluminium builds up in the brain, eventually causing contamination that may cause Alzheimer's disease. Al^{3+} has strong positive charges and a relatively small ionic radius. Thus, Al^{3+} firmly binds to metal-binding amino acids (histidine (His), tyrosine (Tyr)) and acts as a cross linker. By binding to various proteins, Al can cause the oligomerization of proteins, inducing conformational changes that can inhibit their degradation by proteases. Strong binding of Al^{3+} to phosphorylated amino acids promotes the self-aggregation and accumulation of highly phosphorylated cytoskeleton proteins, including neurofilament and microtubule-associated proteins (MAPs), and so forth. Consequently, Al causes apoptotic death of neurons and glial cells. Finally, Al causes spatial memory deficit, influences emotional reactivity, and impairs various brain functions related to learning and memory. These adverse effects may be involved in the mechanisms that underlie Al-induced memory disorder.



SYMPTOMS OF ALUMINIUM POISONING

Early symptoms of aluminium toxicity include:

- The primary side-effect or "wake-up call" that indicates aluminium has intoxicated the brain is a very serious condition called **HYPERSENSITIVITY**
- 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.

HOW ALUMINUM AFFECTS CHILDREN

Some of the symptoms that seen with aluminium poisoning in children are

- Countless disputes
- emotional stress among children
- childhood misconduct
- When children grow older this misconduct or emotional stress may lead to violence.

ALTERNATE TO ALUMINIUM VESSEL

Good cookware is an integral part of cooking and can have a far reaching impact on health. Some alternate for aluminium vessel include;

1. **Cast Iron cookware** is heavy, inexpensive and doesn't rust easily. Food cooked in iron vessels enhances the iron content of the food substantially. Cooking in iron pots may benefit those suffering from anaemia.
2. **Copper and its alloys** (brass and bronze) are ancient metals. They are good conductors of heat and distribute it evenly. However, they are easily tarnished and are reactive to acids and salt. Organic acids from food can interact with it and may have adverse effects on health. So copper vessels must be coated with tin and requires periodic renewal.
3. **Stainless Steel cookware** has replaced iron, copper and aluminium in a big way owing to its strength, durability and easy handling. However, stainless steel is not a good conductor of heat may cause food to burn which can be overcome by using copper bottom stainless steel.
4. **Non-stick Cookware** has a Teflon coating and is largely safe. Some concerns regarding PFOAs (Perfluorooctanoic acid, a suspected human carcinogen) associated with non-stick cookware have been raised. But as long as you don't cook on scratched and dented surfaces, it's a good cooking medium.
5. **Ceramic Pots** are porous and unfit for cooking unless glazed. Glazing resists wear and tear, discolouration and corrosion. Glazes that are approved for use are safe for cooking and storage.

6. **Enamel-coated iron and steel** is stain and scratch resistant and does not pick up food odours. With proper care, a fine enamel pot lasts a lifetime.
7. **Microwaveable Plastics** have a bad reputation of chemicals leaching in the food. Overheating and cooking oily foods in plastic containers is not good for health. Only use containers marked as microwave safe and discard the ones that are visibly damaged and stained.

CONCLUSION

The amount of the metal that leaches into food from aluminium cookware and utensils depends on a variety of factors. Acidic foods, such as tomato sauce, because more aluminium to leach from this cookware compared to the effects of lower-acid foods, such as chicken or meat. Prolonged food contact with this metal -- such as longer cooking or storage times -- also increases the amount that seeps into the food.

Thereby recommended to change usual beverages and food cooking practices. This could apply to storage materials also. For reducing the leach ability of aluminium from aluminium cookware into foods, we must boil water in aluminium kitchen utensils (such as pots, pans), used for cooking the food. Non-aluminium cookware like glass bake ware and stainless steel or cast iron pots are convenient solution. Aluminium foil should not be used to barbecue meat that has been marinated with lemon juice or other acidic liquids. Non-aluminum cookware like glass bake ware and stainless steel or cast iron pots are convenient solution.

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