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How Aluminum Damages Your Brain

Analysis by Dr. Joseph Mercola ✔ Fact Checked | January 23, 2023

STORY AT-A-GLANCE

- Research has found a strong link between aluminum exposure and Alzheimer's disease. Patients with a genetic mutation that predisposes them to early onset of Alzheimer's and more aggressive disease have universally high aluminum content in their brains
- According to a British researcher, without aluminum in the brain, Alzheimer's does not develop
- When aluminum was first approved for use in vaccines, it was approved based on its efficacy. It was never actually tested for safety. It was simply assumed to be safe
- Aluminum has been shown to cause mitochondrial dysfunction and depletion of adenine-triphosphate (ATP), which sets the stage for virtually any chronic disease. Aluminum salts can increase levels of glial activation, inflammatory cytokines and amyloid precursor protein within the brain
- Recent research found the U.S. Centers for Disease Control and Prevention's vaccine schedule — when adjusted for bodyweight — exposes children to a level of aluminum that is 15.9 times higher than the recommended "safe" level

For years, I've warned that aluminum is a serious neurotoxic hazard involved in rising rates of autism and Alzheimer's disease (AD). I've also warned that vaccines are a significant source of such exposure, and may be one of the worst, since by injecting it, the aluminum bypasses your body's natural filtering and detoxification systems.

My comments above were one of the reasons the self-appointed global arbiter of fake news, **NewsGuard**, refused to give us "green" status as a site that follows "basic standards of accuracy and accountability." In other words, our reporting of aluminum hazards was deemed "fake news."

Not only were my earlier reports based on published science, but now we have yet another study,[1] published in the Journal of Alzheimer's Disease, strongly linking aluminum exposure to AD. As reported by SciTech Daily:[2]

> *"Researchers found significant amounts of aluminum content in brain tissue from donors with familial AD. The study also found a high degree of co-location with the amyloid-beta protein, which leads to early onset of the disease.*
>
> *'This is the second study confirming significantly high brain accumulation in familial Alzheimer's disease, but it is the first to demonstrate an unequivocal association between the location of aluminum and amyloid-beta in the disease.*
>
> *It shows that aluminum and amyloid-beta are intimately woven in the neuropathology,' explained lead investigator Christopher Exley, PhD, Birchall Centre, Lennard-Jones Laboratories, Keele University, Staffordshire, UK."*

The Association Between Aluminum and Amyloid-Beta

To gain a better understanding of the link between aluminum exposure and beta-amyloid generation, the researchers examined the brain tissue of donors diagnosed with familial Alzheimer's disease who also had a specific gene mutation known to increase levels of amyloid-beta, leading to early onset and more aggressive disease.

Aluminum levels were compared to controls with no neurological disease diagnosis. They found striking differences between these two groups. Donors with the genetic mutation had universally high aluminum content.

While all samples had some level of aluminum, 42% of the samples from those with familial Alzheimer's had "pathologically significant" aluminum levels, and the aluminum

was primarily co-located with amyloid beta plaques. As reported by SciTech Daily:[3]

> *"The results strongly suggest that genetic predispositions known to increase amyloid-beta in brain tissue also predispose individuals to accumulate and retain aluminum in brain tissue ...*
>
> *'One could envisage increased amyloid-beta in brain tissue as a response to high levels of aluminum content, or that aluminum fosters the accumulation of amyloid-beta,' said Dr. Exley.*
>
> *'Either way, the new research confirms my resolve that within the normal lifespan of humans, there would not be any AD if there were no aluminum in the brain tissue. No aluminum, no AD.'"*

Aluminum Adjuvants Have Never Been Tested for Safety

Exley's conclusion deserves repeating: "No aluminum, no AD." Without aluminum, Alzheimer's doesn't develop. That's not fake news. This research provides conclusive evidence for concern, which means it would be foolish in the extreme to pretend that injecting infants and young children with aluminum-containing vaccines is harmless.

As revealed in my 2015 interview with Dr. Lucija Tomljenovic, featured in "How Vaccine Adjuvants Affect Your Brain," when aluminum was first approved for use in vaccines, some 95 years ago, it was approved based on its efficacy. It was never actually tested for safety.

Even the total allowable limit was based on efficacy data, not safety data. They simply assumed it was safe. As noted by Tomljenovic in that interview:

> *"A document[4] from 2002 from the U.S. Food and Drug Administration (FDA) ... discussing the assessment of vaccine ingredients ... and testing specifically in animal models ... stated that the routine toxicity studies in animals with vaccine ingredients have not been conducted because it was assumed that these ingredients are safe.*

When I read that I was kind of pulling my hairs out [thinking] 'So, this is your indisputable evidence of safety?' These documents never made it to mainstream media. It's just a lie perpetuated over and over again; that we've been using these things for over nine decades and it's been proven safe. No, it's been ASSUMED safe."

Industry Propaganda and Political Interference

The propaganda responsible for hiding the dangers of aluminum was addressed in a 2014 review article[5] in the journal Frontiers of Neurology. In it, Exley (who also co-authored the featured Journal of Alzheimer's Disease study above) wrote:[6]

"The aluminum industry is a pillar of the developed and developing world and irrespective of the tyranny of human exposure to aluminum it cannot be challenged without significant consequences for businesses, economies, and governments ...

There has been and there continues to be systematic attempts by the aluminum industry to suppress research on aluminum and human health.

While independent research in this field is prevented the questions concerning human toxicity remain unanswered. Lack of required research does not equate to lack of biological effect or safety ...

Herein, I will make the case that it is inevitable both today and in the future that an individual's exposure to aluminum is impacting upon their health and is already contributing to, if not causing, chronic diseases such as Alzheimer's disease."

Exley points out that one of the most significant factors driving complacency about aluminum exposure is the aluminum industry's insistence that, since it's everywhere and found in virtually everybody,[7] it must be harmless if not essential — we just haven't figured out how it benefits us yet. However, no beneficial role of aluminum has ever been elucidated, and its presence is in no way evidence of benefit.

Why Aluminum Toxicity Flies Under the Radar

Exley also notes that aluminum is rarely acutely toxic, which adds to the complacency problem. Problems only arise once a certain threshold is reached, and even then, its role in disease is rarely if ever investigated.

Yet another factor that helps hide the influence of aluminum in disease is the fact that it acts on many different pathways and acts as a substitute for essential minerals, so aluminum toxicity doesn't have one specific hallmark.

> *"The potential for aluminum to interact with and to influence so many biochemical pathways means that the symptoms of its toxicity could be deficiency or sufficiency, agonistic or protagonistic, and any combination of these and other physiology-based events,"* Exley writes, adding:[8]
>
> *"For aluminum to play a significant role in any disease-related event some degree of toxicity threshold must have been achieved. Essentially, the rate of delivery of Al3+(aq) to target ligands must be sufficient to overcome the inherent robustness of systems that are under attack.*
>
> *In achieving this threshold either aluminum must accumulate over time within a particular compartment or possibly the administration of a single dose of aluminum could achieve such a threshold instantaneously.*
>
> *The latter is probably more unusual in human being's everyday exposure to aluminum except, for example, where aluminum is administered as an adjuvant in vaccination and allergy immunotherapy."*

Importantly, aluminum has the ability to cross the blood-brain-barrier, so any aluminum in the blood can be transported into the brain. "Indeed, aluminum is known to increase the leakiness of epithelial and endothelial barriers and in doing so could concomitantly increase the passage of aluminum from the blood to the brain," Exley writes.[9]

Biological Effects of Aluminum

Exley also points out aluminum can damage your brain function by:

- Adversely influencing neuronal function and survival
- Potentiating damaging redox activity
- Disrupting intracellular calcium signaling that systematically wears down cellular defenses
- Worsening the adverse effects of other heavy metals
- Influencing gene expression

A 2010 paper[10] also pointed out that aluminum salts "can increase levels of glial activation, inflammatory cytokines and amyloid precursor protein within the brain," and that "Both normal brain aging and to a greater extent, Alzheimer's disease are associated with elevated basal levels of markers for inflammation."

Similarly, a 2018 paper[11] in the Journal of Research in Medical Sciences cites research showing aluminum affects:

Axonal transport	Neurotransmitter synthesis
Synaptic transmission	Phosphorylation or de-phosphorylation of proteins
Protein degradation	Gene expression
Peroxidation	Inflammatory responses

When it comes to altering gene expression, aluminum has been shown to do this via many different routes and mechanisms, including by:[12]

Binding to histone-DNA complex	Inducing conformational changes of chromatin

Inducing topological changes of DNA	Decreasing expression of neurofilament
Decreasing expression of tubulin	Altering expression of neurofilament genes
Altering expression of amyloid precursor protein	Altering expression of neuron-specific enolase
Decreasing expression of transferrin receptor	Altering expression of RNA polymerase I
Altering expression of oxidative stress marker genes such as SOD1 and glutathione reductase	Altering expression of beta-APP secretase

Importantly, as noted in the Journal of Research in Medical Sciences, aluminum has been shown to "cause mitochondrial dysfunction and depletion of adenine-triphosphate (ATP),"[13] which sets the stage for virtually any chronic disease, not just neurodegenerative diseases.

Vaccine Schedule Overexposes Infants to Aluminum

In December 2019, The Highwire reported[14] the findings of a study[15] published in the Journal of Trace Elements in Medicine and Biology, which found the U.S. Centers for Disease Control and Prevention's childhood vaccine schedule — when adjusted for bodyweight — exposes children to a level of aluminum that is 15.9 times higher than the recommended "safe" level.

The researchers point out that previous efforts to assess the aluminum burden created by vaccines were based on "whole-body clearance rates estimated from a study involving a single human subject."

What's more, they used an aluminum citrate solution that is not used in vaccines, which may affect the excretion rate. Importantly, infants also have immature renal function, which will inhibit their ability to filter and excrete toxins in the first place.

Other studies[16] have used orally ingested aluminum to assess and defend safety limits for aluminum in vaccines. This is clearly an unwise comparison, as only 0.1% of orally ingested aluminum is absorbed and made bioavailable from the gastrointestinal tract.[17,18]

In the Journal of Trace Elements in Medicine and Biology study,[19] the researchers used several different models in an effort to estimate the expected acute and long-term whole-body accumulation of aluminum in children following one of the three possible vaccine schedules:

1. The CDC's childhood vaccine schedule as of 2019
2. The CDC's vaccine schedule modified to use low dose aluminum DTaP and aluminum-free Hib vaccines
3. Dr. Paul Thomas' "vaccine-friendly plan,"[20] which recommends giving only one aluminum-containing vaccine per visit (max two) and delaying certain vaccinations

The CDC's standard schedule resulted in the greatest expected aluminum burden in all model assumptions, while Thomas' schedule resulted in the lowest. According to the authors:[21]

> *"Medically, proper organ, cellular and body aluminum detoxification appears to be of ever-increasing importance: Aluminum has been found in the brains of patients with Parkinson's Disease, Alzheimer's disease, epilepsy, and autism.*
>
> *Evidence is growing that a host of chronic illnesses of unknown cause that are difficult to diagnose such as PANDAS/PANS, chronic fatigue syndrome may at least in part be due to vaccine aluminum intolerance.*
>
> *Aluminum compounds occur naturally in the environment and in food, but very little ingested aluminum is absorbed through the intestines. Total aluminum*

exposure is affected by the aluminum amount in individual vaccines and the timing of repeated vaccinations in the first two years of life.

Dórea and Marques compared the expected levels of aluminum uptake into the body from intravenous and oral intake and concluded that human infants have higher exposure to aluminum from vaccination than from food, water, and formula.

Our calculations confirm that for the CDC schedule, infants up to six months of life receive most of their metabolically available aluminum from vaccines.

It should be expected that most aluminum retained in the body of infants comes from vaccinations combined with the levels of exposure from other exposures to manifest health risks from total exposure, making the timing and total aluminum content of different vaccine schedules an important consideration."

CDC Vaccine Schedule Exceeds Aluminum Limit for Adults

As noted in the Journal of Trace Elements in Medicine and Biology study,[22] the "safety" limit for aluminum is not weight dependent. The maximum safe limit is based on an adult, and the same limit is transposed to infants weighing a fraction of that.

Importantly, this study found that when multiple aluminum-containing vaccines are given together, as per the CDC schedule, the total aluminum dose ends up exceeding even the assumed safety limit for an adult.

"Adjusting the safe dose limit based on a child's weight at these ages therefore results in doses that far exceed the estimated safe limit of acute toxicity," the authors warn,[23] adding that *"on all days of injection the safe limit for a child is exceeded for all three schedules; this points to acute toxicity ...*

The CDC schedule has the largest violation at 15.9 times the recommended safe level. This occurs at 2 months, when four recommended vaccinations

containing aluminum are simultaneously administered.

In addition, modeling the time to clear aluminum from the body using Priest's equation estimates that for this schedule a child will be over the safe level of aluminum in the body for 149 days from birth to 7 months, constituting about 70 % of days in this period. This points to chronic toxicity ...

The modified CDC schedule assumes the same vaccinations at the same times as the CDC schedule, but like the Vaccine Friendly Plan it assumes a lower dose aluminum DTap vaccine, and also combines the ActHib (containing no Al) with low aluminum DTap or PVC13 so that the aluminum adjuvant in the aluminum containing vaccine (ACV) activates an immune response for the ActHib vaccine.

This drops the maximum level of exposure to about 60 % of the original CDC plan with (from 15.9 to 9.3) and drops days above the estimated safe limit in the first 7 months from 70 % of days to 26 % and in the first 2 years from 24 % of days to 8 %.

The Vaccine Friendly Plan schedule skips some vaccinations in the first two years (like HepB) and avoids giving more than two vaccinations containing aluminum together.

The VFP thus further limits maximum exposure to approximately 25 % of the original CDC schedule (from 15.9 to 4.2) and drops days above the estimate limit in the first seven months from 70 % of days to 5 % and in the first two years from 24 % of days to 2 %."

Aluminum Is a Proven Neurotoxin

The health hazards of aluminum are also addressed in a 2017 scientific review[24] published in the German journal, Deutsches Ärzteblatt International, which also reviews the threshold values associated with various types of exposure.

"Aluminum's neurotoxic effects in humans and its embryotoxic effects in animal models have been proven," the paper states, adding that while the acute toxicity of ingested aluminum is low, long-term exposure and buildup is associated with neurotoxic effects, resulting in disorientation, memory impairment and dementia. As noted in this paper:[25]

> *"In addition to inducing oxidative stress and binding to negatively charged membrane structures in neurons, aluminum is able to modify hippocampal calcium signal pathways that are crucial to neuronal plasticity and, hence, to memory. Cholinergic neurons are particularly susceptible to aluminum neurotoxicity, which affect synthesis of the neurotransmitter acetylcholine."*

Aluminum as a risk factor for neurological disorders is also detailed in a 2018 paper[26] in the Journal of Research in Medical Sciences. Here, the authors again note that "it is widely accepted that [aluminum] is a recognized neurotoxin, which could cause neurodegeneration." They also point out that aluminum "affects more than 200 important biological reactions and causes negative effects on [the] central nervous system."

Aluminum Detected in Organs a Year After Vaccination

A 2013 study[27] shed important light on the vaccine adjuvant alum, a "nanocrystalline compound" that has been shown to spontaneously form "micron/submicron-sized agglomerates." According to this paper:

> *"Alum is occasionally detected within monocyte-lineage cells long after immunization in presumably susceptible individuals with systemic/neurologic manifestations or autoimmune (inflammatory) syndrome induced by adjuvants (ASIA) ...*
>
> *Intramuscular injection of alum-containing vaccine was associated with the appearance of aluminum deposits in distant organs, such as spleen and brain where they were still detected one year after injection ...*

Particles linearly accumulated in the brain up to the six-month endpoint; they were first found in perivascular CD11b+ cells and then in microglia and other neural cells ... Cerebral translocation was not observed after direct intravenous injection, but significantly increased in mice with chronically altered blood-brain-barrier ...

Continuously escalating doses of this poorly biodegradable adjuvant in the population may become insidiously unsafe, especially in the case of overimmunization or immature/altered blood brain barrier or high constitutive CCL-2 production."

Clearly, Alzheimer's and autism are not caused by a single factor. Your diet and lifestyle play significant roles, as do other toxic exposures. Still, aluminum appears to be a significant concern that cannot be overlooked, especially where vaccines are concerned. Can we really justify loading infants up with aluminum at doses that are toxic even to an adult?

To learn more about the factors that raise your risk for Alzheimer's and recommended prevention strategies, see "How Excess Iron Raises Your Risk for Alzheimer's," "Trans Fats Linked to Increased Risk for Alzheimer's," and "Lifestyle Factors Linked to Alzheimer's."

Sources and References

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