

Does aluminium cause Alzheimer's and breast cancer?

April 1 2013, by Ian Musgrave



The vast majority of us will never be exposed to aluminium in high enough concentrations to do damage. Credit: ezioman/Flickr

Silvery, ductile, malleable and so very, very useful, aluminium is the most common metal in the Earth's crust. But despite its importance (or perhaps because of it), there are fears that this metal causes everything from cancer to Alzheimer's disease.

From aircraft to tableware, aluminium forms an important and ubiquitous part of our lives. It's so common now, in fact, that it's difficult to believe that, at one stage, metallic aluminium was so hard to make that having aluminium plates was a symbol of wealth.

But as it has become more commonplace, aluminium's safety profile has come into question, with particular emphasis on aluminium in antiperspirants. The evidence for its supposed harms is weak, if not non-existent.

Yes, aluminium can be toxic, but in the spirit of my blog's patron, remember it's the dose that makes the poison.

The metal's [toxic effects](#) can be seen in people working at aluminium smelters or those who have had similar industrial exposures with inadequate workplace [safety measures](#). People on dialysis who have been exposed to higher than normal aluminium levels in their dialysis fluid also show a range of [adverse effects](#), including damage to the brain and the nervous system.

And you can show [neurotoxic effects](#) in animals at lower (but still substantial) concentrations, if you inject aluminium directly into the brain. But the vast majority of us will never be exposed to such high concentrations of aluminium as in these cases. Our exposures will come from drinking water, food, antacid tablets and rubbing antiperspirant with aluminium on our skin.

The aluminium we're exposed to in these ways is in the form of aluminium salts. These salts are surprisingly hard to get into the body; only 0.1% of ingested aluminium is absorbed into the body.

Skin absorption is also quite weak and skin absorption of aluminium from antiperspirants contributes to less than 3% of [blood levels](#) of

aluminium (the rest comes from gut absorption). So you need to go to some effort to get toxic levels of aluminium from these sources.

Indeed, according to the results of long-term animal studies you need to consume around 10,000 times the amount of aluminium in our water supplies to see the beginnings of neurotoxicity. Even if you were chewing antacids every day while rubbing antiperspirants all over yourself, you would still not have enough aluminium in your system to suffer from neurotoxicity.



Beta amyloid. Credit: Ian Musgrave via Jmol

So, while animal studies are all very well, is there any evidence from humans that our modest consumption of aluminium over long periods of time is toxic?

Alzheimer's disease

A common misconception about aluminium is that it causes Alzheimer's

disease. And since a large chunk of [my research](#) is on finding treatments for Alzheimer's disease, I have a bit of insight into such claims.

Some very early studies suggested that there was more aluminium in the brains of people with Alzheimer's disease than those without. Almost immediately, people selling stainless steel cookware seized on this result to promote their pots over aluminium ones (we were buying new cookware at this time, and I had some interesting discussions with these people).

Aluminium is rather hard to measure at the low levels that are in the brain, and [later studies with better methods](#) failed to find elevated aluminium levels in the brains of people with Alzheimer's. Actually, there's good evidence the positive results were due to contamination.

Personally, I wouldn't have been surprised to find increased aluminium in the brains of Alzheimer's sufferers. There's an accumulation of a toxic protein called beta amyloid in the brains of people with Alzheimer's disease. This protein binds metals including aluminium, but it binds copper, zinc and iron more strongly. In part, this binding of copper and zinc contributes to the protein's toxicity. Despite significant amounts of copper in the accumulated amyloid in the brains of people with Alzheimer's however, there's no evidence that high levels of copper exposure increase the disease's incidence.

What's more, people on dialysis who are exposed to much higher concentrations of aluminium than most people for long periods of time don't have a higher incidence of Alzheimer's disease than people not on dialysis.

So, aluminium and Alzheimer's disease, no.

Breast cancer

In [breast cancer](#), the upper outer quadrant of the breast is more likely to be the site where tumours first appear than anywhere else. Since this quadrant is closest to the lymphatic drainage from the armpit, people have leapt to the conclusion that aluminium from application of antiperspirants is the culprit.

But the incidence of tumours is directly related to the amount of breast tissue, and that quadrant happens to have the most breast tissue.

Epidemiological data is rather sparse, but what little there is makes the aluminium-breast cancer link unlikely. A [2002 study](#) found no correlation between aluminium containing antiperspirant use and breast cancer. A [more recent meta-analysis](#) found few high-quality studies, but those they found showed no evidence of an antiperspirant link to breast cancer.

So, aluminium and breast cancer, highly unlikely.

Alzheimer's disease and breast cancer are devastating to both those who develop the diseases and their families. Everyone involved wants to know why these diseases strike. These are complex diseases, with complex and still poorly understood causes, but we can be pretty certain that the aluminium in antiperspirants is not one of those causes.

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