

## Toxic Heavy Metals and Autism Spectrum Disorder; Is There a Link????!!

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### Commentary

Although the word “autism” was first used by researchers in 1940s as an expressive term of children who are suffering from social and or emotional problems, definitive etiology of autism has not been figured out yet. Till now, no single factor could be claimed to be the cause of Autism Spectrum Disorder (ASD) but rather, it is one of the disorders that result from the interplay between genetic susceptibility and exposure to environmental hazards [1]. Toxic heavy metals as mercury, aluminum, and lead represent potential environmental hazardous factors that might lead to the development of ASD [2,3].

Mohamed et al., [4] explored the link between intoxication with heavy metals and ASD. They assessed the level of aluminum, lead, and mercury in hair samples of 100 autistic children compared to age and sex matched healthy controls. Hair sampling was chosen by the researchers as it is considered the best non-invasive maneuver indicating the level of a given mineral in the body [5]. They found significantly higher levels of all measured heavy metals in studied autistics compared to controls with positive relation to exposure to risk factors for heavy metals intoxication like extensive antenatal consumption of fish, maternal smoking, cooking in aluminum pots, and anti-D intake. Nevertheless, no significant correlation was found between the recorded levels of the measured heavy metals and the severity of autistic manifestations. They concluded that the limited ability of autistics to excrete heavy metals as well as the increased environmental exposure at key points of fetal and infantile development seems to have a significant role in the occurrence of ASD.

Autistic children are defective in metabolizing sulfur compounds which results in significant reduction of their abilities to detoxify heavy metals and increases their toxicity. Also, they have impaired methylation and redox homeostasis with increased vulnerability to oxidative stress; like what occurs in cases of exposure to heavy metals intoxication, with subsequent negative impact on the development of the brain and normal CNS functions [6].

While ASD is a disorder that is characterized by brain and immune dysfunction, aluminum is a heavy metal that represents a neurotoxin and a strong immune adjuvant. Its neurotoxicity could be attributed to its impact on inducing oxidative stress and liberating DNase; a significant DNA damage inducer [7,8]. On the other hand, lead also causes significant oxidative stress and lipid peroxidation whether directly or indirectly [9], alters synaptic pruning [10], induces dopaminergic dysfunction [11], interferes with glutamate; an excitatory neurotransmitter that is thought to be related to normal development of neurons [12], lowers hippocampal expression of

protein kinase C (PKC) [13], and produces volume loss in vital portions of the prefrontal cortex [14]. Accordingly, many authors postulated that lead is never safe whatever its level is and can result in aberrant learning and defective neuro-behavior at levels as low as 10 µg/dl [15-17]. On the other hand, mercury binds to cysteine thiol groups on intracellular proteins and deactivates them. Such deactivation is counteracted by glutathione that is significantly reduced in autistic children, hence they cannot excrete mercury efficiently with subsequent increased sensitivity to its hazardous effects that include immune, sensory, and motor deficits and behavioral abnormalities [3,6,18,19].

Creating both practitioners and public awareness about the hazards of exposure to heavy metals on pediatric mental health is crucial in order to highlight the importance of measuring the level of such metals in suspected cases and treating them by chelation therapy once documented [20]. Also, it is important to minimize the risk of exposure to heavy metals intoxication by encouraging a lot of healthy habits as thorough hand washing, regular floor cleaning as well as cleaning of anything that is frequently touched by infants and children as bottles, pacifiers, and toys. On the other hand, it seems pivotal to discourage unhealthy and risky habits whether of women in the child bearing age or children, as nail biting and eating fishes that are likely to contain high mercury level as king mackerel and tuna. Also, it is wise to avoid the use or removal of amalgams in pregnant women, substitute thimerosal and aluminum in vaccines, and avoid aluminum pots or old ceramic dishwares in cooking. Furthermore, it is recommended to avoid leaded crystals, paints, water pipes, and engine fuels.

Lastly but by no means least, it is interesting to know that some natural dietary constituents could play a significant protective role against the intoxication with heavy metals. Such protective nutrients might be inadequate in the diet of some autistic children because of their picky eating habits. For instance, fruits and vegetables that are rich in pectins as apples and legumes are known to have chelating effects on heavy metals. Meanwhile, vegetables and fruits that are rich in vitamins such as A, D, and C possess strong antioxidant properties. Chlorophyll rich dark green leafy vegetables and sulfur containing organic foods as onions, eggs, and garlic are also advisable to be included in the diet of autistic children because of their protective potential against heavy metals intoxication. Furthermore, magnesium and selenium containing nutritional supplements are considered as possible antidotes for many heavy metals [21].

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