

# Mercury and Autism

# Abstract

This study was initiated to see if levels of excreted mercury in head hair could be used as an accurate indicator of autistic spectrum disorder. Cold vapor atomic absorption was used to quantitatively measure the level of mercury excreted in head hair. Hair samples were taken from both autistic and non-autistic volunteers. The parent of each autistic volunteer cut a small lock of hair from the back of the head. This was accomplished in the student's home during a regularly scheduled hair cut without any disturbance in the child's environment or routine. In addition, individual volunteers will be followed for mercury excretion over a period of time.

The preliminary results showed that the control participants were better able to excrete mercury through their hair follicles. The data supports the hypothesis that people with Autistic Spectrum Disorder developed the disorder in part, not because they were exposed to mercury, but rather they were unable to excrete mercury as efficiently as the control volunteers.

# Introduction

## Mercury

Mercury (Hg) is a metallic element that is liquid at room temperature. Mercury is often used in a number of industrial processes including the production of batteries, thermometers, florescent lamps, barometers, and thermostats (all can be found in a typical household environment). However, due to widespread health concerns, toxic use reduction efforts are cutting back or eliminating mercury in said products. For instance, many thermometers now use pigmented alcohol in place of mercury.

One of mercury's more striking characteristics is that its vapors and compounds are highly toxic. When inhaled, ingested, or contacted, mercury may cause irreparable damage to the liver and nervous system.

Mercury is ubiquitous. It enters the environment as a pollutant from various industries, coal burning power plants being the number one source. Today trace amounts of mercury can even be found in our water supply. However, in this setting it is largely unabsorbed. Some of the more common ways by which mercury is absorbed include the following:

- 1. Fish and shellfish:** Seafood is a known source of organic mercury (methylmercury). Methylmercury is absorbed through the gastrointestinal tract. Methylmercury is bio-accumulative. As a result, fish that are higher up the food chain such as tuna or swordfish are usually of greater concern.
- 2. Dental Amalgams:** Mercury vapor is known to be released from dental amalgams.
- 3. Vaccines:** Many vaccines that are administered at birth contain relatively large amounts of thimerosal, which is 49.6% ethyl-mercury by weight.

## Mercury & Autism

Autism, now referred to as Autism Spectrum Disorder (ASD), is a disability resulting from a neurological disorder that affects the normal development of the brain. The degree of autism can vary from mild to severe. ASD is also one of the five Pervasive Developmental Disorders that are characterized by "severe and pervasive impairment in

several areas of development”. ASD is the most prevalent of the five disorders occurring in approximately 1 in 166 births (Centers for Disease Control and Prevention 2004).

Every person with autism is an individual and should be treated accordingly. The most common symptoms of ASD include difficulties in the areas of verbal communication, social interaction, and leisure activity. Repetitive motion and self-injurious activity are common symptoms among patients with severe autism.

At present there are several methods of treatment but no known cure. One modern method of treatment is chelation therapy. Chelation therapy is a series of intravenous infusions containing ethylenediaminetetraacetic acid (EDTA) and various other substances. Heavy metals such as mercury are bound and cleared from the bloodstream.

In recent years, it has been suggested that there exists a direct link between the levels of mercury exposure a person receives during early development, and their chances of developing ASD. It is believed, that when mercury enters the body, it binds to sulfhydryl groups on enzymes and other proteins. Furthermore, when the mercury enters the brain and spinal chord, it affects the uptake of dopamine, serotonin, acetylcholine, and norepinephrine. This is what is believed to cause the lack of motor coordination and difficulty with communication that is seen in many autistic persons.

# Materials

**Potassium Permanganate:** a poisonous salt that forms dark purple crystals and is purple when dissolved in water; used as an oxidizing and bleaching agent and as a disinfectant and antiseptic

**Stannous-Chloride:** a white crystalline solid with the formula  $\text{SnCl}_2$

**Argon:** a colorless, odorless, inert gaseous element

**Nitric Acid:** ( $\text{HNO}_3$ ), otherwise known as **aqua fortis**, is a colorless, corrosive liquid; colorless, highly corrosive, poisonous liquid that gives off choking red or yellow fumes in moist air

**Hydrochloric Acid:** a clear, colorless, fuming, poisonous, highly acidic aqueous solution of hydrogen chloride

**Reagent Grade Water:** water that has been distilled, deionized, and filtered

**Mercury Analyzer:** quantitatively measure levels of mercury with the use of an atomic absorption spectrometer (Perkin-Elmer FIMS-100)

**BOD Bottle:** used to safely and securely store samples without unwanted exposure to air or leakage

**Water Bath:** temperature controlled container filled with water

**Analytical Balance:** a beam balance of great precision used in quantitative chemical analysis

**Chloride-Hydroxylamine:** colorless solution; used as a reducing agent

# Problem

**There are four primary research questions being addressed by this study:**

1. Is cold vapor atomic absorption capable of quantitatively measuring the level of mercury excreted in head hair?
2. Can levels of excreted mercury in head hair be used as an accurate indicator of autistic spectrum disorder?
3. If everyone is exposed to mercury in some form or another, why hasn't everyone developed autism spectrum disorder?
4. Does the excretion of mercury through head hair fluctuate? Furthermore, does it fluctuate in a cyclical pattern?

# Procedure

## Sample Collection

The parent of each Autistic volunteer cut a small lock of hair from the back of the head. Emphasis was placed on accomplishing this at the time of a regularly scheduled hair cut as to avoid any disruption to the child's environment or routine. The aforementioned lock of hair was placed into a Ziplock bag. The outside of the bag was labeled on tape with the gender, age, and a code known only to the parents of the student.

## Acid Extraction

Step 01) A representative 0.60g portion of sample was weighed and placed in the bottom of a BOD bottle

Step 02) 5 mL of RGW, 1.5 mL of nitric acid, and 3.5 mL of hydrochloric acid were added

Step 03) The mixture was heated in a water bath for two at 95°C

Step 04) 15 mL of a 5% potassium permanganate solution and 50 mL of RGW were added

Step 05) The bottle was heated additional 30 minutes at 95°C

Step 06) After the mixture cooled, 6 mL of sodium chloride-hydroxylamine sulfate was added to reduce the excess potassium permanganate

Step 07) 50 mL of RGW was added and the bottle was gently mixed

Step 08) The sample was filtered through qualitative filter paper and stored at room temperature until analysis

## Analysis

The sample was analyzed by atomic absorption using the Perkin-Elmer FIMS-100 mercury analyzer. Samples were analyzed more than once to ensure accuracy.

# Preliminary Data

Mercury Levels (parts per million)

Gender: Male

<b>Age</b>	<b>Code</b>	<b>ppm</b>	<b>Notes</b>
14	D-FHS	1.19	CONTROL
12	1392	0.44	HIGH FUNCTIONING AUTISTIC
15	KFI	0.028	LOW FUNCTIONING AUTISTIC
15	KFI	0.037	SECOND SAMPLE (MEAN= 0.0325)

Mercury Levels (parts per million)

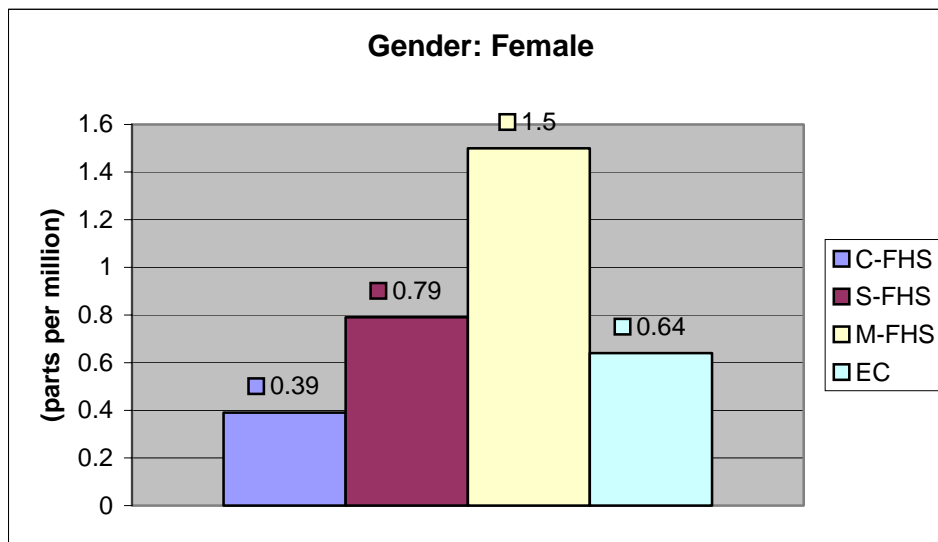
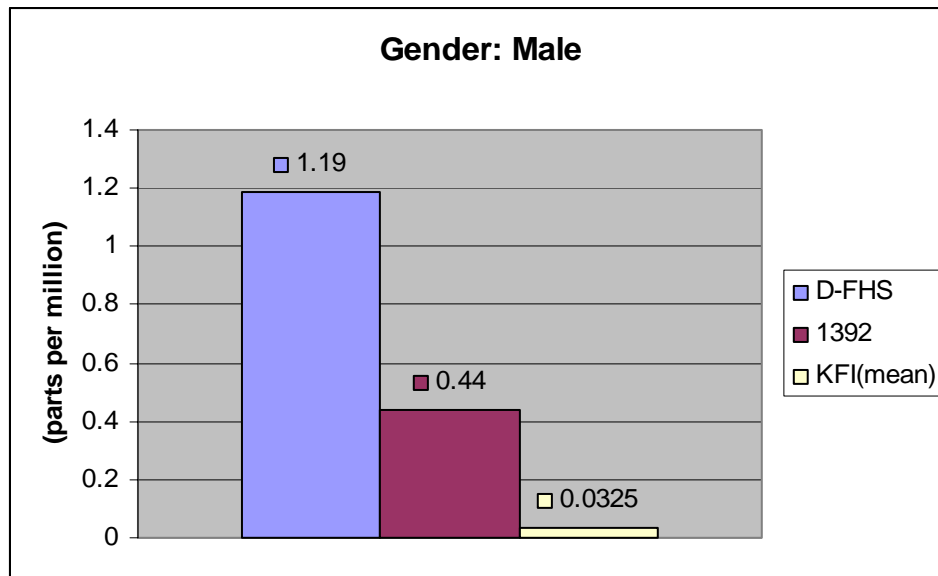
Gender: Female

<b>Age</b>	<b>Code</b>	<b>ppm</b>	<b>Notes</b>
14	C-FHS	0.39	CONTROL
16	S-FHS	0.79	CONTROL
14	M-FHS	1.50	CONTROL
8	EC	0.64	HIGH FUNCTIONING AUTISTIC: CHELATION THERAPY



# Preliminary Data

(Graphical Representation)



# Discussion

The preliminary results show that the control participants were better able to excrete mercury through their hair follicles. This supports the idea that persons with ASD developed the disorder not due level exposure, but rather they were unable to release the mercury.

The data pertaining to EC who received chelation therapy are currently not understood. It is unclear whether she is a high functioning autistic due to the treatment, or, because she is capable of releasing a substantial amount of the element.

# Future Work

This study is on going. New samples will be collected and analyzed. The data that was collected for the student who received chelation therapy will be compared to new samples and possible explanations will be investigated. Better ways to report data that has been collected will be considered. Further more, additional aspects of the study will be explored in order to answer the underlying questions.

Participants will be followed over a period of time to examine possible cyclical patterns. This new data will be further examined to find a possible correlation to hormonal imbalances.

# References

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