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HEAVY METALS: IMPACT ON HUMAN BODY: A REVIEW

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ABSTRACT

Metallic elements are an intrinsic component of the environment. Some heavy metals have bio-importance as trace elements but the biotoxic effects of many of them in human biochemistry are of great concern. Heavy metal poisoning may occur as a result of industrial exposure, air or water pollution, foods,medicines, improperly coated food containers or the ingestion of lead based paints. The heavy metals most commonly associated with poisoning of humans are lead, mercury, arsenic and cadmium. Lead poisoning most often affects children between one to three years old while mercury poisoning is unusual in children. Symptoms are physical findings associated with heavy metal poisoning vary according to the metal accumulated, the route of exposure, accidents and environmental factor. This review gives details about some heavy metals and their toxic effects on human health.

KEYWORDS: Heavy Metals, Metal Toxicity

Metals are substances with high electrical conductivity, malleability and luster, which voluntarily lose their electrons to form cations. Metals are found naturally in the earth's crust and their compositions vary among different localities resulting in spatial variations of surrounding concentrations. Heavy metals are metallic elements which are toxic and have high density, specific gravity, or atomic weight. They are found naturally in the earth crust, but due to indiscriminate human activities their geochemical and biochemical balance have drastically changed and they enter our drinking water supply.

There are some essential heavy metals which human body requires in trace amount such as Cobalt, Copper, Zinc, and Manganese but in the excessive amount, it can be detrimental to your health. Other heavy metals found in drinking water such as lead, mercury, arsenic, chromium, coppe, nickel, zinc and cadmium have no beneficial effects on human body. In fact, their accumulation inside the body can cause severe health problems and in the environment (Lambert *et al.*, 2000).

Various sources of heavy metals includesoil erosion, natural weathering of the earth's crust, mining, industrial effluents, urban runoff, sewage discharge, insect and disease control agents applied to crops and many others. (Morais *et al.*, 2012)

The heavy metals are slow poison to human health, poisoning of heavy metals is the accumulation of them in toxic amounts in the soft tissues of the body. The toxicity of heavy metals depends on several factors including the dose, route of exposure, and chemical species, as well as the age, gender, genetics, and nutritional status of exposed individuals. Some heavy metals and their toxic effects on human body are given below-

ARSENIC

Arsenic is used in the manufacture of pesticides. It is discharged into nature by the refining procedure of copper, zinc and lead, and also by the manufacturing of chemicals and glasses. Arsenic is one of the most important heavy metals causing disquiet from both ecological and individual health standpoints (Hughes *et al.*, 1988). Drinking water may get contaminated by use of arsenical pesticides, natural mineral deposits or unintended sources. Contaminated drinking water can cause damage of our skin, liver and eyes. It has a semi metallic property, is prominently toxic and carcinogenic and is extensively available in the form of oxides or sulfides or as a salt of iron sodium, calcium, copper, etc. (Singh *et al.*, 2007). Overexposure may cause headache, drowsiness, confusion, seizures and life threatening complications. Neurological symptoms include brain damage, nerve disease of the extremities, and loss or deficiency of the fatty covering (myelin) around these nerve fibers. Arsenic is a protoplastic poison since it effects primarily the sulphydryl group of cells causing malfunctioning of cell respiration, cell enzymes and mitosis (Gordon and Quastely, 1948).

LEAD

Lead is a highly toxic metal whose widespread use has caused extensive environmental contamination and health problems in many parts of the world. In soil,

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lead levels range from 5-25 mg/kg; in groundwater, from 1-60 mg/liter; and in air below 1µ/m. Lead in the drinking water usually comes from the corrosion of old pipes. The sources of lead exposure include mainly industrial processes, food and smoking, drinking water and domestic sources. The sources of lead were gasoline and house paints, which has been extended to lead bullets, plumbing pipes, pewter pitchers, storage batteries, toys and faucets (Thurmer *et al.*, 2002). In the US, more than 100 to 200,000 tons of lead per year is being released from vehicle exhausts. Lead – poisoning of children is a matter of serious concern like calcium lead is deposited in bones and during pregnancy it is slowly released from the mother's bones to the blood reaching to the fetus .The inhibitory effect of lead to the enzymes involved in home synthesis is well known. Children are at higher risk of lead poisoning ; when they come into contact with dust laden with environmental lead, the severity of poisoning increases (Loh *et al.,* 2016). A moderate exposure to lead with its level in the blood about 50 g/dl causes anemia. Lead affects the nervous system of children and occupational workers. Lead is also known to cause renal failure after long term exposure. Lead is an extremely toxic heavy metal that disturbs various plant physiological processes. Lead causes phytotoxicity by changing cell membrane permeability (Bertrand Pourrut *et al.*, 2011).

MERCURY

The metallic mercury is a naturally occurring metal which is a shiny silver – white, odorless liquid and becomes colorless and odorless gas when heated. Mercury, like lead, is also toxic to the nervous system and fetus and small babies are more sensitive to its adverse effects. Humans are exposed to mercury –toxicity due to food grains treated with mercury fungicide or fish contaminated with methyl mercury. It enters through the leaching soil because of acid rain, coal consumption , and industrial , household and mining waste. Mercury in the drinking water can cause damage to the nervous system and kidneys.

CADMIUM

Cadmium is the seventh most toxic heavy metal as per ATSDR ranking. It is usually found as a mineral combined with others elements such as oxygen, chlorine, or sulfur. It is a byproduct of zinc production which humans and animals may get exposed to at work. Cadmium enters the environment through mining operations and the action of wind and rains. Forest fires and volcanoes also release some cadmium to the air. Exposure to low levels of cadmium in air, food, water, and particularly in tobacco smoke overtime may built up cadmium in the kidney and cause kidney disease and fragile bones. When large amount of cadmium is eaten, it can severely irritate the stomach and cause vomiting and diarrhea. Breathing high levels of cadmium damage people's lungs and can cause death. Over exposure may cause fatigue, headaches, nausea, vomiting, abdominal cramps, diarrhea, and fever. In addition, progressive loss of lung function (emphysema), abnormal buildup of fluid within the lungs (pulmonary edema) and breathlessness (dyspnea) may also be present. In some cases, affected persons may exhibit increased salivation, yellowing of the teeth and unusually rapid heartbeat.

DISCUSSION

Heavy metals are elements that are naturally found in the earth. They are significant environmental pollutants and their toxicity is a problem of increasing significance for ecologica, evolutionary,nutritional and environmental reasons (Jaishanker *et al.,* 2013; Nagajyoti *et al.*, 2010). Heavy metals are generally referred to as those metals which posses a specific density of more than 5gm/cm^3 and adversely affect the environment and living organisms (Jarup, 2003). Heavy metal poisoning occurs when our body's soft tissues absorb too much of a particular metal. The most common metals that the human body can absorb in toxicp amount are mercury, lead, cadmium and arsenic.

Heavy metals containing in drinking water poses a threat to humans and is often the root cause of various severe health issues such as cancer and organ damage. Symptoms and physical findings associated with heavy metal poisoning vary according to the metal accumulation. Common symptoms of heavy metal poisoning include: Diarrhoea, nausea, vomiting, Abdominal pain, weakness, chills, Shortness of breath, tingling in hands and feet Children with heavy metal poisoning may have unusually formed or weakened bones. Pregnant lady may also have a miscarriage or deliver prematurely.

For mild cases of heavy metal poisoning, just eliminating people exposure to heavy metals can be enough to treat the condition. For more severe cases, the standard treatment ischelation therapy. This involves giving medication, either through a pill or injection, that binds to the heavy metals in our body.

Some foods can help us detoxify by getting rid of heavy metals from our body. These foods bind to the metals and remove them in the digestive process. Heavy metal detox foods to eat include: garlic, wild blueberries, lemon water, chlorella, curry, green tea, spirulina, cilentro and probiotics. To minimize the effects of heavy metal poisoning we need to eliminate processed foods and

excess fats. Heavy metal poisoning can trigger a number of harmful side effects. If left untreated, it can be life-threatening. So talk to your doctor who can help you to protect from heavy metal overexposure and also consult with your dietician.

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