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Short Communication

Heavy Metal (Cadmium) Poisoning

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It is my privilege to write this article to the journal of *Acta Scientific: Pharmaceutical Sciences*. As we all know, heavy metals are one of the important sources of contaminating the environment.

Heavy metals are traditionally defined as elements with metallic properties and an atomic number >20. The most common heavy metal contaminants are Cd, Cr, Cu, Hg, Pb and Zn. It has been reported that some heavy metals like nickel, cobalt, chromium, zinc, manganese, molybdenum and selenium are essential for biochemical and physiological functions of the body while other metals such as arsenic, mercury, lead and cadmium are poisonous to living organisms even at low quantities [1]. When heavy metals are not metabolized by the body, they become toxic and start accumulating in tissues. Now a days, heavy metal environmental contamination is attaining global attention, because human health is being affected by these toxic metals [2].

Cadmium (Cd) is one of the most occurring industrial and environmental pollutants. Cd is a soft, silver-white in metallic form. Cd is 48th element in periodic table having molecular weight: 112.41, boiling point: 765ºC, melting point: 321ºC and vapor pressure: 1 mm Hg at 394ºC. Humans are exposed to Cd more by ingestion than inhalation. Cigarette smoke is a big source of Cd to both smokers and non-smokers. One cigarette contains 2.0 µg of Cd, of which 2-10% is transported to cigarette smoke [3] while there can be difference in the Cd concentration present in cigarettes.

Cd causes tissue injury through oxidative stress. Cd stimulates the production of intracellular reactive oxygen species (ROS) through mitochondrial electron transport chain retardation [4]. Electrons from reduced electron transport chain are transferred to available oxygen which induces the production of ROS. Tissue damage is inevitable when there is imbalance in the ROS production and antioxidant enzymes like superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) or reduced GSH. Long term exposure to cadmium enhances the lipid peroxidation. Increased lipid peroxidation then interferes with the antioxidant defense system and generates the oxidative stress with cadmium [5].

When Cd gets absorbed in the body, it induces the metallothionein generation along with ROS. Metallothionines are low molecular weight proteins which are made up of cysteine rich residues [6]. MTs have the potential to bind metals whether it is physiological like copper, zinc, selenium or it is xenobiotic like mercury, cadmium, arsenic, silver) via its thiol group of cysteine residue [7]. MTs are synthesized in kidney, liver and other tissues. Cd interact with MTs in the intestinal mucosa and then the Cd-MT complex is transported to the blood. Cd is then transported to the liver cells, where it binds to the liver MTs. Cd-MT complex in liver slowly goes back to the plasma. Cd-MT complex easily pass through the glomerulus and the renal tubule due to its small size. Proximal tubules effectively take the Cd-MT complex through pinocytosis. The pinocytic vesicles fuse with lysosomes inside renal tubular cells of kidney, which breaks the Cd-MT complex and release the cadmium. Then the Cd interacts with the new metallothionein's produced by the tubular cells of kidney and then stored there for long time and reducing acute toxicity of the Cd. When Cd concentration increases in comparison to metallothionein level in kidney, then free Cd causes the kidney damage. Then the damaged tubular cells of kidney start releasing cadmium in urine [8].

Cd exposure is mainly determined by calculating Cd concentration in blood and urine. Blood cadmium concentration depicts exposure to Cd recently such as from smoking. Whereas, Cd in urine depicts the accumulation or kidney burden of Cd [9].

Heavy metal contamination in the environment is a matter of major concern, as these metals cause serious health hazards to the living organisms. But in present scenario, many methodologies including natural phytochemicals having medicinal properties help to combat the toxicity of heavy metals.

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