



## IS ENVIRONMENTAL POLLUTION GREEN AROUND GILLS ? AND ONE FOOT IN GRAVE?

### Microbiology

<b>M.V.Raghavendra Rao*</b>	Avalon University School of Medicine, Curacao, Central America. *Corresponding Author
<b>SireeshaBala.A</b>	Avalon University School of Medicine, Curacao, Central America.
<b>SamirFatteh</b>	Avalon University School of Medicine, Curacao, Central America.
<b>SreepadaPallavi.T</b>	Apollo Institute of Medical Science and Research Institute, Jubilee Hills, Hyderabad, Telangana.
<b>KrishnaSowmya M</b>	Burjill hospital, Abu dhabhi, UAE
<b>Ramanaiah C.J</b>	Burjill hospital, Abu dhabhi, UAE
<b>Sateesh Babu, A</b>	Avalon University School of Medicine, Curacao, Central America.

### ABSTRACT

Pollution is one foot in the grave. It is green around the gills. The only solution to pollution is dilution. Let's nurture the nature, so that we can have a better future. Pollution kills at least nine million people and costs trillions of dollars every year, according to the most comprehensive global analysis to date, which warns the crisis "threatens the continuing survival of human societies".

Toxic air, water, soils and workplaces are responsible for the diseases that kill one in every six people around the world, the landmark report found, and the true total could be millions higher because the impact of many pollutants are poorly understood. The deaths attributed to pollution are triple those from Aids, malaria and tuberculosis combined. Research involving laboratory animals is necessary to ensure and enhance human and animal health and protection of the environment. In the absence of human data, research with experimental animals is the most reliable means of detecting important toxic properties of chemical substances and for estimating risks to human and environmental health.

### KEYWORDS

Aneuploidy, Hyperglycaemia, Glycogenolysis, Dimercaprol, juveniles

Heavy metals are believed to exert their influence on the activity of the enzymes playing a vital role in the biochemical transactions of a living system. Embryonic development is characterized by growth and formation of new tissues. The alterations in the activity of enzymes and/or embryonic tissues would invariably influence the developmental processes in viviparous animals as embryonic nourishment is provided by the maternal sources. Shift in the metabolism of either the maternal tissues or the embryos owing to changes in the enzyme activity influenced by heavy metals can be reflected in the form of deviations from the normal development.

Heavy metals define as any metallic chemical element that has a high density and is poisonous at lower concentration. Heavy metals include arsenic, lead, copper and mercury which mainly effects reproductive system and especially toxic to growing fetus (1)

The soluble compounds of lead is poisonous .lead may access into body through inhalation, by ingestion or by absorption through skin and mucous membrane (2).

When women encountered to lead during pregnancy can cause a miscarriage, premature birth Low birth weight and it effects development of fatuous brain and growth of new born baby also retarded. Lead poses health risks for everyone, but young children and unborn baby more porn to lead toxicity which contributes to effect development of growing children and their behavior and learning ability(3).

Copper in metallic form is not poisonous but some of its salts are poisonous such as blue vitriol and sub acetate. Copper is a powerful inhibitor of enzyme. Sources of copper are common in the diet, particularly in vegetarian diets, and can be found in the water due to copper plumbing(4).

Many multiple vitamins contain relatively high doses of copper. The hormone estrogen promotes the retention of copper and this is why women are particularly vulnerable to the problem of copper toxicity. Copper toxicity may leads to poor fertility rate.

Occupational exposure is often cited as a risk factor for female fertility,

as well as for early pregnancy loss and pre-term delivery. Miscarriage an abrupt end of a pregnancy at a stage where the embryo or fetus is not capable of surviving independently (5), is the most common adverse pregnancy outcome with aggravating emotional consequences for affected individuals and families. Miscarriage is a critical indicator of embryo toxicity. It is an important outcome for the study of embryo toxic effects of chemicals including environmental contaminants and drugs (6,7) and a vital end point to track the progress of reproductive health programs and their impact on maternal health. Pregnant women and their fetuses are more vulnerable to adverse effects from the exposure of environmental toxic substances (8,9)

Meanwhile, exposure to environmental contaminants during Pregnancy may extend negative impacts in early childhood and in later life (10). Although the placenta may act as a selective transporter that prevents the passage of potentially toxic substances to the developing fetus, some environmental contaminants can freely or partially cross the placental barrier (11). Particularly, arsenic, cadmium and lead are well-known environmental heavy metals, and they could extend the health risk to the fetus even at a low level through trans-placental circulation. (12,13,14)The toxicological effects of heavy metals could alter the physiological changes during pregnancy, the critical phase of fetal cell division and differentiation (15,16) As an example, prenatal cadmium exposure could impair steroid genesis that leads to suboptimal fetal growth and development (17). Lead exposure could interfere with calcium deposition in the bone, resulting in decreased fetal bone growth (18)

Human and animal toxicology has had a profound impact on our historical and current understanding of air pollution health effects. Early animal toxicological studies of air pollution had distinctively military or workplace themes. With the discovery that ambient air pollution episodes led to excess illness and death, there became an emergence of toxicological studies that focused on industrial air pollution encountered by the general public. Not only did the pollutants investigated evolve from ambient mixtures to individual pollutants but also the endpoints and outcomes evaluated became more sophisticated, resulting in our present state of the science. (19)

Copper sulphate proved more toxic than zinc sulphate to both the

adults and juveniles were more susceptible than the adults to both metals (24)

Exposure of jetuses and striped dolphin in mercury resulted in higher mercury in suckling stges than the fetal stage (24). Administration of cadmium to laboratory rats induced fetal growth retardation (25), (26), found chromosomal aberration and increased aneuploidy in methyl mercury exposed workers. Heavy metals, finding entry in to an organism induces biochemical and metabolic changes. Exposure of Chenna punctatus to chromium resulted in hyperglycaemia and hyper lactemia(27). Administration of cadmium to the teleost, *Puntius concludonus* produced hyperglycaemia, promoted glycogenolysis and raised myocardial glycoconcentration (28). Kulkarni and Utkal(29) studying the effect of coppersulphate on the biochemical composition of viviparous bengalensis, found marked decrease in the haemolymph glucose and tissue glycogen levels. (30) studied the effect of chromium, cadmium and nickel on biochemical constituents of the rainbow trout *Salmo gairdnerii*. *Rana cynoflictis* exposed to mercury and cadmium exhibited alterations of glycogen content in tissues (31) Mercury and cadmium produced marked depletion in rainbow trout, of glycogen content of both liver and muscle (32). Administration of Mercury to Caspian sea gammarids reduced glycogen content of tissues and glucose concentration of haemolymph (33). Gluconeogenesis and glycogenolysis were induced by mercury in fish, *Channa punctatus* (34) The fresh water mussel *Peeresia rugosa* subjected to mercuric chloride revealed changes in the levels of glycogen (35) Blood level was elevated in a seven month old girl when she was exposed to mercury vapour (36)

Amjnl Islam and Roy (37) reported that that the decline in the protein content in the insect *Cryocorisstellis* exposed to cadmium chloride was due to the effect of the metal which is an enzyme inhibitor known to block m RNA synthesis at the level of transcription. Administration of cadmium to *Daphnia magna* produced significant reduction in protein, mRNA and DNA (38). Exposure of *Channa punctatus* to sub lethal concentration of mercury decreased the uptake of glycine. (39) Heavy metals like mercury, cadmium and lead inhibit the aminoacid transport (40). Heavy metal poisoning is treated often with antidotes which detoxify through the mechanism of chelation and revert the toxic effects. Dimercaprol (2,3-dimercapto propanol, British anti Lewisite-BAL is an antidote used to treat mercury and lead poisoning.

### MAJOR ADVANCES AND DISCOVERIES-

Pollution kills at least nine million people and costs trillions of dollars every year, according to the most comprehensive global analysis to date, which warns the crisis “threatens the continuing survival of human societies”.

Toxic air, water, soils and workplaces are responsible for the diseases that kill one in every six people around the world, the landmark report found, and the true total could be millions higher because the impact of many pollutants are poorly understood. The deaths attributed to pollution are triple those from Aids, malaria and tuberculosis combined.

The vast majority of the pollution deaths occur in poorer nations and in some, such as India, Chad and Madagascar, pollution causes a quarter of all deaths. The international researchers said this burden is a hugely expensive drag on developing economies.

### HISTORY AND MECHANISM

The history of toxicity studies begins with Paracelsus (1493–1541), who determined specific chemicals responsible for the observed toxicity of plants and animals. He demonstrated the harmless and beneficial effects of toxins and proved dose-response relationships for the effects of drugs. Paracelsus, who was a physician, alchemist, and astrologer, is widely regarded as the father of toxicology. The following statement of his is often quoted: “All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy (20) Mathieu Orfila (1787–1853), a Spanish physician, determined the relationship between poisons and their biological properties and demonstrated specific organ damage caused by toxins. Orfila is referred to as the father of modern toxicology. Toxicological screening methods and toxicological research on individual substances developed in the mid-1900s, and environmental toxicological studies developed in the mid-20<sup>th</sup> century.

The use of animals in toxicity studies began in 1920, when J. W. Trevan

proposed the use of the 50% lethal dose (LD<sub>50</sub>) test to determine the lethal dose of individual chemicals. After the introduction of LD<sub>50</sub>, a FDA scientist John Draize developed a method for testing eye and skin irritation using rabbits, and this method was widely accepted for testing the effects of chemicals and pharmaceuticals on the eye and skin. Later, the US National Cancer Institute (NCI) developed a test to identify carcinogenic chemicals through the daily dosing of rats and mice for 2 years. In the early 1960s, thousands of babies were born with debilitating birth defects caused by thalidomide. After this, all the regulatory agencies concentrated on determining the toxicity profiles of all pharmaceutical substances available for regular patient use and made mandatory the submission of toxicity profiles of investigational new drugs (IND). In the late 1980s, the Organization for Economic Cooperation and Development (OECD) and the International Conference on Harmonization (ICH) brought out the guidelines for toxicity testing of pharmaceutical substances.

### Where the research go next

Before conducting any clinical study, the safety of the test substance should be assessed using animals. The target organ toxicity, relationship between the dose and response, relevant human effects, and any complications arising during treatment (adverse drug reactions) should be established through preclinical evaluations. The toxicity study should be carried out with a minimum of three doses viz. low, medium, and high doses in the experimental animals and the toxic effect compared with data from a control group of animals. The Committee for Proprietary Medicinal Products (CPMP) has set guidelines on the toxicological experiment on various animal species. The guideline instructs that the maximum selected dose should be sufficient to identify the target organ toxicity. From the toxicological evaluation, the no observed effect level (NOEL) or NOAEL, which may be useful for human studies, may be established. The low dose, intermediate dose, and high dose used in the toxicity test provide the NOEL, dose–response relationship, and target organ toxicity in animals, respectively.(21,22) Survival of developing fertilized eggs and their hatchability decreased with increasing concentration of mercury and selenium in the rainbow trout *Salmo gairdnerii* (23).

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