



INTERACTION BETWEEN ENVIRONMENTAL EXPOSURE AND NUTRITIONAL STATUS: EFFECT ON HUMAN HEALTH

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Abstract:

With modernization, industrialization and advanced technology, pollution and pollutants have become a part of our life. Day by day the graph of pollution is going up and that of human health is going down. Exposure to pollutants is inevitable, may it be an air pollutant, water pollutant, radioactive pollutants or soil pollutants. The damage ranges from mild tissue irritation to development of carcinogenic cells and DNA damage. People living and working in industrial area, children, pregnant women and foetus in her womb are vulnerable to these hazardous exposures. Food can be a medium for pollutants to enter in a human body. Toxic chemicals can be introduced into food while it is being grown, processed or stored. Once these toxic compounds are entered and absorbed by human body, they may interact with nutritional status. If nutritional status of an individual is good, one can sustain these illnesses for some period. But if it is not and the exposure is regular it is possible that toxicants may affect nutrient absorption and stores resulting in micronutrient deficiency or specific health outcome. Many studies have shown that exposure to polychlorinated biphenyls, dioxins, lead affected cognitive and endocrine development of children negatively. Many pollutants are transferred prenatally as well as postnatally which resulted in reduced birth weight, low intelligent quotient, and behavioural changes as well. Balanced diet is a powerful tool in protecting, healing and overcoming the dangerous effects of pollutants on human body.

Keywords: *pollutants, nutrition, toxicants, balanced diet*

Introduction:

People talk a lot about pollution-like air, water, soil, noise and many other such types. But what is pollution all about? Generally, pollution occurs when pollutants contaminate the natural surroundings; which brings about changes that affect the normal lifestyles of population adversely. Effects of pollution can create long-term or short-term damage. Pollution disturbs the ecosystem and the balance in the environment. Rise in global





warming, lowered immunity with increase in illness are the outcome of environmental stressors (<http://en.wikipedia.org/wiki/Pollutant>).

Exposure to pollutants is inevitable, may it be an air pollutant, water pollutant, radioactive pollutants or soil pollutants. A healthy human can adapt to mild and periodic exposure to pollutants in the environment. But long term exposures to these dangers should not be overlooked. The damage due to this exposure may range from mild tissue irritation or immune suppression up to the formation of carcinogenic cells. The damage may include congestion, throat inflammation, respiratory disease like asthma and allergy, immune and autoimmune diseases, neuro-developmental and neuro-degenerative diseases, infertility, some cancers, osteoporosis, depression, schizophrenia, sarcopenia, skin irritations and rashes. Similarly, noise pollution leads to hearing loss, stress and sleep disturbance. People living in industrial area, people who are chronically or acutely exposed to particular chemical agents like artists, chemical workers, metal workers, electronics workers, people who use pesticides, printers, those exposed to x-rays, either as technicians or as patients, and those who work around or at nuclear or other power plants are vulnerable to the damages caused by pollutants (Elson, Haas. M., 2014 & environment.nationalgeographic.com).

Pollutants, Nutritional Status and Effects on Human Body:

Let's see how pollution, its effect on human life and nutrition are related to each other.

There are three main ways in which toxicants and nutrition are connected. We also recognize there may be other determinants of health and disease that are not depicted here but that may interact with toxicants, nutrients, or both. Food may carry and deliver the toxicants and may increase an individual's exposure and toxicant body burden. Toxic chemicals can be introduced into food while it is being grown, processed or stored. Once these toxic compounds are entered and absorbed by human body, they may interact with nutritional status and do the harm. It is also possible that toxicants may affect nutrient absorption and stores. Also, once inside the body, nutrients and nutrient metabolism may also interact with the toxicant in affecting a specific health outcome. Other factors, such as





gender and age, need to be considered in this model because they affect both nutritional status and toxicant exposure (hand-to-mouth behaviour is common in young children). The examples that illustrate the interactions between heavy metals and nutrients are outlined below-----

Examples of foods as a source of toxicant exposure are fish and seafoods for methyl mercury. Inorganic mercury is released into the air, settles in water, undergoes methylation, is accumulated in fatty tissues of fish, and is particularly high in fish at the top of the predatory food chain. Two prospective cohort studies in the Faroe Islands and New Zealand have shown that prenatal and early postnatal exposure from seafood is associated with cognitive deficits in children, including attention, perceptual deficits, select language, and general cognitive deficits (Kordas K., 2007).

Nutritional deficit is another factor of concern. The micronutrient deficiency can make one more susceptible to the effects of environmental contamination. Even milder forms of lead intoxication can cause cognitive impairment in children and has recently been implicated in hypertension in lead-exposed women. Evidence exists for interactions between lead and micronutrients at the level of intestinal absorption, brain neurochemistry, and cognitive function. Effects of lead toxicity can be controlled by maintaining good iron status. The lead exposure is related to smaller size at birth. Studies have reported decrements that range up to about 200 grams. Noise stress from transportation sources is found to be related to reduced prenatal growth with somewhat smaller decrements reported. Studies of humans exposed to polychlorinated biphenyls have reported reduced size at birth, advanced sexual maturation and altered hormone levels related to thyroid regulation. Thus, different pollutants exert effects through different physiological pathways (Kordas K, 2007; Schell L. M. et al., 2006).

Polychlorinated biphenyls (PCBs) and dioxins are derived mainly from waste incineration and food contamination. Lundqvist C. et al. (2006) studied effects of PCBs and dioxins exposures on human beings. Large amounts are transferred from mother to the child prenatally, as well as postnatally through breast feeding. Especially when exposed during development period PCBs and dioxins affected endocrine and cognitive





systems negatively. Measurable outcomes include reduced IQ and changed behaviour. Foetotoxic effects with reduced birth weight and increased congenital anomalies such as cleft lip have also been described. Hennig B. et al. (2012); in his study suggests that antioxidant nutrients, such as vitamin E and dietary flavonoids, as well as a high ratio of omega-3 to omega-6 fatty acids, can protect against endothelial cell damage mediated by these PCBs. Boersma E. R. & Lanting C. I. (2000) in their study gave evidence that prenatal exposure to PCBs do have subtle negative effects on neurological and cognitive development of the child up to school-age. Human breast milk volume and fat content is adversely affected by the presently encountered PCB levels in Western Europe. Their studies showed evidence that breast feeding counteracts the adverse developmental effects of PCBs and dioxins.

Heavy metal toxicity like cadmium toxicity produces a nephropathy resulting in loss of certain micronutrients. When an individual is exposed to zinc, his/her iron and copper nutrition status would be affected. This is because the absorption of zinc in high amounts produces an intestinal blockade to the passage of these trace metal nutrients. Both deficiency states lead to a microcytic anaemia (Noel, W., 2014).

Xenobiotic includes plastics (bisphenol A), surfactants used in food packaging, household chemicals, industrial chemicals (PCBs and dioxins), and heavy metals (lead, mercury, and cadmium). In humans, Xenoestrogens work like human estrogens because they have a chemical structure that allows them to fit into estrogen receptor sites. As per 2006 study, they can prevent normal hormone binding to hormone receptors, influence cell signalling pathways, and increase cell division thus, affecting human health. Xenoestrogens are just one example of how pesticides and other toxins that humans use in food are impacting our environment and our health (www.takingcharge.csh.umn.edu).

Radioactive Exposures:

Increased radioactive exposure is another cause of worry now-a-days. Fallout from nuclear weapons or power plants, X-rays, microwaves, power lines, cell phones and computer monitors leads to radioactive pollution. Some radioactive isotopes like strontium-90 from nuclear fallout can remain





in the body and damage the DNA within cells resulting mutations. When Electro-magnetic radiations from electronic devices are passed through the body DNA gets damaged and free radicals are formed. Let's have a look at some nutrients that naturally eliminate isotopes and free radicals from the body.

According to "*Fighting Radiation and Chemical pollutants with Foods, Herbs and Vitamins*", pectin(a polysaccharide found in the cell walls of plants and fruits) has the ability to bind radioactive residues and remove them from the body. Pectin acts as a natural chelating agent; a compound that has an affinity for other molecules. Chelating agents bind to other compounds, drag them out of tissues or the bloodstream, and remove from the body via urine or feces. Apples, especially the skin, guavas, plums, gooseberries, oranges and other citrus fruits can be eaten as pectin source.

Some studies have found that chlorophyll-rich foods, such as chlorella, spirulina, alfalfa, lettuces, spinach, chard, and kale; leafy greens like celery, parsley, bean sprouts and wheatgrass can decrease toxicity. Especially chlorella has the ability to neutralize radiation and mercury-related conditions in the body, and remove poisonous substances, including cadmium, dioxins and PCBs. Chlorella can also detoxify uranium, lead and copper (Bond, O. 2014).

Dietary Vitamins as Antioxidants:

A healthy, well-balanced diet that avoids toxins, such as nitrates and pesticides, provides adequate proteins, high in complex carbohydrates and low in fat and sugar, includes plenty of fresh fruits and vegetables loaded with antioxidants is the key to stay healthy . Ten to twelve glasses of purified water helps in elimination of toxins (Elson, Haas. M., 2014 & environment.nationalgeographic.com).

Antioxidants are substances that may prevent or delay some types of cell damage. Antioxidants help in removal of free radicals from the body. They also inhibit enzymes that cause cancer, and help the body to repair the damage done by oxidants. Vegetables and fruits are good sources of antioxidants. Diets high in vegetables and fruits have been found to be beneficial in cases of environmental exposures. Examples of antioxidants





include vitamins C and E, selenium, and carotenoids, such as beta-carotene, lycopene, lutein, and zeaxanthin. Green tea is less processed, contains higher levels of antioxidants and thus, listed as a very good antioxidant. Catechin from green tea is proved to be beneficial. Vitamin E works best as an antioxidant. The antioxidant known as alpha-tocopherol is the most active ingredient in vitamin E. Vegetable oils, nuts and green leafy vegetables are the main sources of vitamin E (Wolf, V. & Owen, J. D., 2004 & www.betterhealth.vic.gov.au).

Vitamin C (ascorbic acid) is a water-soluble antioxidant and is found in the water compartments of the body where it interacts with free radicals. It is the most important antioxidant. It acts as a "decoy". Any roaming radical goes immediately to it first, instead of attacking the body cells. It binds with them and makes them harmless. Combined antioxidants may be more effective when one antioxidant is used in combination with another. Vitamins C and E work great together as a team to scavenge and fight off foreign pollutants in the body. Vitamin E donates an electron from its outer shell to a free radical and vitamin C donates an electron to vitamin E, maintaining the ability of vitamin E to continue donating electrons to free radicals. Vitamin C may then receive an electron from glutathione that would enable vitamin C to remain active as an antioxidant. A diet rich in vitamins C & E not only prevent or cure chemical poisoning but may also lessen the harmful effects of air pollution for people suffering from chronic lung diseases.

Researchers studied the patients with asthma or chronic obstructive pulmonary disease (COPD) and found that those with low levels of vitamins C & A had an increased risk of breathing problems on days when outdoor air pollution levels were high. Researchers supported that vitamin C along with vitamin A & E could protect against the effects of air pollution. Vitamin A provides immune support and tissue protection. The negative effects of ionizing radiation, carcinogenicity of many chemicals, especially airborne ones and the chemicals in cigarette smoke decreases by beta-carotene (Konkel, L., 2012; Encyclopedia of Food and Culture, 2003 & Lee, N., 2000).





Other foods which should be a part our diet are the anticancer foods. These include cruciferous vegetables, such as cabbage, cauliflower, broccoli, and brussels sprouts. In addition to these foods, most sprouts are good sources of vitamin K. Foods rich in beta-carotene, such as these same cruciferous vegetables, carrots and sweet potatoes, will add more of this antioxidant nutrient. Miso, a fermented soybean paste used for soup broth, is known to protect against pollution and radiation. Seaweeds, considered being antipollution foods are high in aligns (natural metal-chelating compound). Seaweeds in supplement form can be utilized to decrease absorption of minerals, especially the heavy metals and radioactive metals used in nuclear power plants and medical testing. Fibre, such as wheat bran (insoluble), and psyllium husks, encourage natural detoxification in the colon, binding toxins and reducing absorption of metals.

Minerals:

Many minerals are useful in detoxification. Zinc is the most important immune strengthener followed by selenium. Zinc acts as a tissue healer that is needed for the functioning of many detoxifying enzymes. So, it helps to protect the cells from pollutant toxins. Selenium is one of the powerful antioxidant. Calcium and magnesium help to neutralize some colon toxins and decrease heavy metal absorption from the gastrointestinal tract. It is observed that adult women and children with higher amounts of dietary calcium show lower blood lead concentrations (Elson, Haas. M., 2014 & environment.nationalgeographic.com).

People who are compromised nutritionally are more vulnerable to hazardous effects of pollutants throughout their life span. In contrast, people whose diets are rich in anti-oxidants, fibre, vitamins, minerals & phytochemicals can improve health and decrease vulnerability to environmental exposures. We can say that foods, nutrients and balanced diet are powerful tools in protecting, healing and overcoming the dangerous effects of pollutants on human body.





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