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EFFECT OF ENVIRONMENTAL CONDITIONS ON NUTRITIONAL STATUS AND HEALTH

Tejashree A. Joshi and Prajakta J. Nande

Assistant Professor in Food & Nutrition, Department of Home Science, Rashtrasant Tukadoji Maharaj Nagpur University, Mahatma Jyotiba Phule Educational Campus, Amravati Road-440033, Nagpur (Maharashtra)

Corresponding Author's E-mail ID: tejashreejoshi27@gmail.com

Abstract:

The world has progressed a lot, but with this progress, the amount of harmful and toxic wastes due to environmental pollution has increased. This problem has topped the list of environmental issues. This if not taken care of in time may cause harm to all living things on the earth with the inclusion of human species and eventually end up with the destruction of our planet. Hence, the present article briefs about the effects of environmental conditions on nutritional status and health of human being. Environmental pollutants enter the human body simply by air (inhalation) and water (which gets absorbed by soil and in turn used by plants and animals that are to be eaten by human beings), which are released by industries or home sewage. Through different exposures, many harmful and life threatening heavy metals mainly lead, cadmium, mercury and arsenic (arsenic is a metalloid, but is usually classified as a heavy metal) enter human body, causing several adverse health effects.

Keywords: *heavy metals, food contamination, soil pollution, water pollution, air pollution*

Introduction:

Earth is one of the most beautiful planets of the solar system. It supports life and hence, is the home to numerous species. The environment is considered in terms of the most tangible aspects like air, water and food, and the less tangible, though no less important, the communities we live in. There are so many environmental issues today, which if not taken care of in time may end up with the destruction of our planet which include global warming and climate change, deforestation, energy crisis, ozone layer depletion, oil spills, depletion of resources, overpopulation, nuclear issues, pollution and waste (Gore, A., 1997).

Environmental pollution is the presence of a pollutant in the environment; air, water and soil, which may be poisonous or toxic and will

cause harm to living things in the polluted environment. There are many types of environmental pollution: water pollution, air pollution, soil pollution, noise pollution, etc. which can cause a serious impact on living beings. Air pollution is related to the emission of harmful gases in the earth's atmosphere which is resulting in global warming. Water pollution on the other hand, is related to the dumping of waste materials in the water which causes harm to the aquatic as well as terrestrial life. Soil pollution is also related to the dumping of waste material in the soil which causes degradation of the soil. Noise pollution, which is related to the high frequency sound ways which are harmful for the ears, can affect health adversely (http://www.buzzle.com/articles/list-of-environmental-issues-today.html).

Heavy Metals:

Concern with the great quantity of urban and industrial residues produced by humans is constantly on the increase in modern society (Manahan, S. E., 1994). Many industries which have waste materials like mercury, lead, motor oil, etc. do not process them properly as well as home sewage is frequently disposed of in land or water without any treatment which further results in the toxification of soil and water sources endangering the environment (Przybysz, L., 1997). The availability of metallic ions in soil solutions depends on a series of factors, such as pH, cations exchange capacity (CEC), level and type of organic matter, texture, composition of soil clay, competition of other cations by exchange systems, absorption, chelation, temperature (Pavan, M., 1984; Oates, K., 1985; Sposito, G., 1989; Smith, S., 1994 & Zhu, B., 1993). Among other factors, temperature, humidity, aeration and nutrient levels control the microbiological activity responsible for degradation process of residue (mineralization) and consequent solubility and availability of metallic ions in the soil (Cavallaro, N., 1993 & Ladonin, D., 1997).

These pollutants enter the body system through food, air, and water and bio-acumulate over a period of time. Pollution of surface and underground water source results in considerable soil pollution and pollution increases when mined ores are dumped on the ground surface for

manual dressing. Surface dumping exposes the metals to air and rain thereby generating much AMD (acid mine drainage). When agricultural soils are polluted, these metals are taken up by plants and consequently accumulate in their tissues (Trueby, P., 2003). Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers and groundwater. Heavy metal toxicity & chemical element toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative processes that mimic Alzheimer's disease, Parkinson's disease, muscular dystrophy, and multiple sclerosis (Millis, P., 2004 & Verma, R. & Dwivedi, P., 2013). Animals that graze on such contaminated plants and drink from polluted waters, as well as marine lives that breed in heavy metal polluted waters also accumulate such metals in their tissues, and milk, if lactating (Gabarino, J., 1995; Horsfall, M., 1999 & Peplow, D., 2003). Humans are in turn exposed to heavy metals by consuming contaminated plants and animals, and this has been known to result in various biochemical disorders. Thus, all living organisms within a given ecosystem are variously contaminated along their cycles of food chain. The most important routes of contamination are respiratory, mostly for gaseous and particulate matters, dermal, for chemicals able to cross the skin barrier, and digestive, for food contaminants.

The dietary contribution for toxic metal intake has been extensively studied (Santos, E., 2004). An estimated dietary intake of Pb, Cd and Hg from the total diet, in some selected countries, was studied by Chen and Gao (1993). It was found in their study that intake of dietary toxic metals was higher in Guatemala i.e. Pb 254 µg, Cd 29 µg, Hg 10.8 µg per person per day, while the global dietary intake of toxic metals was Pb 153 µg and Cd 25 µg per person per day. Dietary intake of toxic metals of other countries like China, Japan, USA, UK and Sweden was medium to high. These results clearly show the importance of socio-economic and cultural factors on the

dietary intake of these toxic metals. Furthermore, this study has confirmed the importance of vegetables and cereals as significant sources for the dietary intake of these toxic metals. It was revealed that cereals contain about 39.6% of Pb, 54% of Cd and 0.4% of Hg and vegetables contain 27% of Pb, 23.9% of Cd and 8.7% of Hg, while other food items like legumes and nuts, meats, eggs, milk, fruits aquatic foods contain some significant amount of these toxic metals (Chen and Gao, 1993).

Cadmium:

Natural as well as anthropogenic sources of cadmium, including industrial emissions and the application of fertilizer and sewage sludge to farm land, may lead to contamination of soils, and to increased cadmium uptake by crops and vegetables, grown for human consumption. The uptake process of soil cadmium by plants is enhanced at low pH. The exposure was also caused by cadmium-contaminated water used for irrigation of local rice fields. Cadmium is present in most foodstuffs, but concentrations vary greatly, and individual intake also varies considerably due to differences in dietary habits (Jarup, L., 2003).

Cadmium is toxic at extremely low levels. In humans, long term exposure results in renal dysfunction, characterized by tubular proteinuria. Recently, an association between cadmium exposure and chronic renal failure [end stage renal disease (ESRD)] was shown. Using a registry of patients, who had been treated for uraemia, the investigators found a double risk of ESRD in persons living close to (<2 km) industrial cadmium emitting plants as well as in occupationally exposed workers (Hellstrom, L., 2001). High exposure can lead to obstructive lung disease, cadmium pneumonitis, resulting from inhaled dusts and fumes. It is characterized by chest pain, cough with foamy and bloody sputum, and death of the lining of the lung tissues because of excessive accumulation of watery fluids. Cadmium is also associated with bone defects, viz; osteomalacia, osteoporosis and spontaneous fractures, increased blood pressure and myocardic dysfunctions (Nordberg, G., 2002; (European Union, 2002 & Young, R. A., 2005).

Mercury:

The general population is primarily exposed to mercury *via* food; fish being a major source of methyl mercury exposure, and dental amalgam. Several experimental studies have shown that mercury vapour is released from amalgam fillings, and that the release rate may increase by chewing (WHO, 1991). Mercury is toxic and has no known function in human biochemistry and physiology. Inorganic forms of mercury cause spontaneous abortion, congenital malformation and GI disorders (like corrosive esophagitis and hematochezia). Poisoning by its organic forms, which include monomethyl and dimenthylmecury presents with erethism (an abnormal irritation or sensitivity of an organ or body part to stimulation), acrodynia (Pink disease, which is characterized by rash and desquamation of the hands and feet), gingivitis, stomatitis, neurological disorders, total damage to the brain and CNS and are also associated with congenital malformation (Ferner, D. J., 2001 & Lennetech, 2004). A high dietary intake of mercury from consumption of fish has been hypothesized to increase the risk of coronary heart disease (Salonen, J. T., 1995).

Lead:

Lead is the most significant toxin of the heavy metals, and the inorganic forms are absorbed through ingestion by food and water, and inhalation (Ferner, D. J., 2001). Airborne lead can be deposited on soil and water, thus reaching humans *via* the food chain. A notably serious effect of lead toxicity is its teratogenic effect. Lead poisoning also causes inhibition of the synthesis of haemoglobin; dysfunctions in the kidneys, joints and reproductive systems, cardiovascular system and acute and chronic damage to the central nervous system (CNS) and peripheral nervous system (PNS) (Ogwuebgu, M. O. & Muhanga, W., 2005). Other effects include damage to the gastrointestinal tract (GIT) and urinary tract resulting in bloody urine, neurological disorder and can cause severe and permanent brain damage. While inorganic forms of lead, typically affect the CNS, PNS, GIT and other biosystems, organic forms predominantly affect the CNS (Lenntech, 2004). Lead affects children by leading to the poor development of the grey matter of the brain, thereby resulting in poor intelligence quotient (IQ) (Udedi, S. S.,

2003). Acute and chronic effects of lead result in psychosis, confusion and reduced consciousness.

Zinc:

Zinc has been reported to cause the same signs of illness as does lead, and can easily be mistakenly diagnosed as lead poisoning (McCluggage, D., 1991). Zinc is considered to be relatively non-toxic, especially if taken orally. However, excess amount can cause system dysfunctions that result in impairment of growth and reproduction (INECAR, 2000; Nolan, K., 2003). The clinical signsof zinc toxicosis have been reported as vomiting, diarrhea, bloody urine, icterus (yellow mucus membrane), liver failure, kidney failure and anemia (Fosmire, G. J., 1990).

Arsenic:

Arsenic is a widely distributed metalloid, occurring in rock, soil, water and air. Inorganic arsenic is present in groundwater used for drinking in several countries all over the world whereas organic arsenic compounds (such as arsenobetaine) are primarily found in fish, which thus may give rise to general population exposure to arsenic *via* intake of food and drinking water. Contaminated soils such as mine-tailings are also a potential source of arsenic exposure (WHO, 2001). Arsenic acts to coagulate protein, forms complexes with coenzymes and inhibits the production of adenosine triphosphate (ATP) during respiration (Ferner, D. J., 2001). It is possibly carcinogenic in compounds of all its oxidation states and high-level exposure can cause death (Ogwuegbu, M. O. and Ijioma, M. A., 2003). Arsenic toxicity also presents a disorder, which is similar to, and often confused with Guillain-Barre syndrome, an anti-immune disorder that occurs when the body's immune system mistakenly attacks part of the peripheral nervous system, resulting in nerve inflammation that causes muscle weakness (Kantor, D., 2006). Inorganic arsenic is acutely toxic and intake of large quantities leads to gastrointestinal symptoms, severe disturbances of the cardiovascular and central nervous systems, and eventually death.

To reduce all these health hazards following steps should be taken to reduce environmental pollutions:

- There should be proper clearance or processing of industrial wastes as well as home sewage, it should not be drained into the sources of drinking water and where it can cause harm to marine lives or water which further results in the toxification of soil and water.
- Preference should be given to the use of the things that can be recycled so there will be less wastage.
- Before re-dumping or using sewage sludge for farming due to the great diversity of this waste and chiefly because of pathogenic germs and other non-soluble materials, it is necessary to know its chemical composition and biological analysis so that its effects may be quantified, so that the incorporation of pollutants into the crops will be less.
- Water quality should be checked before allowing for fishing. Since there is a risk to the fetus in particular, pregnant women should avoid a high intake of fish taken from polluted fresh water.
- The use of lead-based paints should also be abandoned, and lead should not be used in food containers. In particular, the public should be aware of glazed food containers, which may leach lead into food.
- While heavy metals are in many ways indispensable, good precaution and adequate occupational hygiene should be taken in handling them.

Thus, it can be concluded that environmental pollution through air, water and soil is increasing with the increase in industrialization and urbanization which in turn get directly or indirectly into the animal food chain. Anthropogenic activities have being contributing to the spread of toxic chemicals into the environment, including several toxic metals and metalloids, increasing the levels of human exposure to many of them. Contaminated food is an important route of human exposure and may represent a serious threat to human health.

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