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INTERACTION BETWEEN NUTRITION AND ENVIRONMENTAL EXPOSURE: EFFECT ON HEALTH OUTCOMES IN PREGNANT WOMEN AND CHILDREN

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ABSTRACT:

Human health and well-being is affected appreciably by the environment around us. Chronic exposure to environmental chemicals is an increasing problem globally, adversely affecting the quality of life of large numbers of people. Polluted indoor and outdoor air, contaminated water, lack of adequate sanitation, toxic hazards, disease vectors, ultraviolet radiation, and degraded ecosystems are all important environmental risk factors for children and in most cases for their mothers as well. Toxicants are present at all stages of development, potentially accumulating to cause a lifetime of ill health. If chemical exposures interact with poor nutrition, the result maybe high costs to health and well-being of resource-poor individuals and communities who are least able to cope with those costs. Better understanding of the interactions between nutrition and environmental exposures is needed to guide action from governments and individuals.

Keywords: *toxicants, environment, health*

INTRODUCTION:

Exposure to environmental chemicals is increasing globally. Nutritional status may modify susceptibility to chemical exposures. However, there are a large number of toxicants, and malnutrition takes many forms including deficiency and excess. Thus, the relation between environmental exposures and nutritional status is complex.

Nutrition is perhaps the most influential non-genetic factor in fetal development. Maternal body composition, nutritional stores, diet, and ability to deliver nutrients through the placenta determine nutrient availability for the fetus. Prenatal nutrition influences fetal growth, normal development of physiological function and gestational weight gain *(http://www.mednet.ca/en/report/impact-of-maternal-nutrition-on-fetal-developmen.html).* More than three million children under five die each year

from environment-related causes and conditions. This makes the environment one of the most critical contributors to the global toll of more than ten million child deaths annually -- as well as a very important factor in the health and well-being of their mothers (*www.who.int/ceh/publications/factsheets/fs284/en/*).

In developing countries, environmental hazards and pollution are a major contributor to childhood deaths, illnesses and disability from acute respiratory disease, diarrhoeal diseases, physical injuries, poisonings, insect-borne diseases and perinatal infections. Childhood death and illness from causes such as poverty and malnutrition are also associated with unsustainable patterns of development and degraded urban or rural environment (*www.who.int/ceh/publications/factsheets/fs284/en/).*

Effect on Health

Malnourished individuals, especially women of reproductive age and young children, may be more vulnerable to adverse health effects of chemical exposures. The very nature of children's growth and development creates windows of vulnerability to both nutritional deficiencies and toxicant exposures. With a double burden of nutrient deficiencies and environmental exposures, a substantial portion of the world's children may never realize their right to optimal health and development. Women of reproductive age are also vulnerable to nutritional deficiencies. This is especially true during pregnancy, when maternal and fetal growth create high nutrient demands. Environmental exposures in women of reproductive age are especially precarious because women may become sources of exposure to their fetuses and infants through placental exchange and breast milk. Finally, with a connection between toxicants and chronic diseases, environmental exposures may contribute to the development and course of diseases in adulthood, particularly neurodegenerative diseases, beyond the effects of suboptimal nutritional status (Kordas et al., 2007).

Health-damaging exposure to environmental risks can begin before birth. Lead in air, mercury in food and other chemicals can result in long-term, often irreversible effects, such as infertility, miscarriage, and birth defects. Women's exposure to pesticides, solvents and persistent organic

pollutants may potentially affect the health of the fetus. Small children, whose bodies are rapidly developing, are particularly susceptible - and in some instances the health impacts may only emerge later in life (*www.who.int/ceh/publications/factsheets/fs284/en/*).

Environmental toxins and fetal development is the impact of different toxins from the environment on the development of the fetus. The human embryo or fetus is relatively susceptible to impact from adverse conditions within the mother's environment. Sub-par fetal conditions often cause various degrees of developmental delays, both physical and mental, for the growing baby.

Preterm birth

Exposures to environmental toxins such as lead, tobacco smoke, and DDT have been linked with an increased risk for spontaneous abortion, low birth weight, or preterm birth.

Structural congenital abnormality

Further information: Teratology and Congenital abnormality

Toxic substances that are capable of causing structural congenital abnormalities can be termed teratogens. They are agents extrinsic to embryo or fetus which exert deleterious effects leading to increased risk of malformation, carcinogenesis, mutagenesis, altered function, deficient growth or pregnancy wastage. Teratogens are classified in four main categories:

- Drugs and chemicals. In addition to environmental chemicals, this category also includes recreational and pharmaceutical drugs in pregnancy.
- Vertically transmitted infections
- Radiation, such as X-rays
- Mechanical forces, such as oligohydramnios

Teratogens affect the fetus by various mechanisms including:

- Interfering with cell proliferation rate, such as viral infection and ionization.
- Altered biosynthetic pathways, as seen in chromosomal defects.
- Abnormal cellular or tissue interactions, as seen in diabetes.

- Extrinsic factors.
- Threshold interaction of genes with environmental teratogens.

Individual substances and toxin classes and their effects

Substances which have been found to be particularly harmful are lead (which is stored in the mother's bones), mercury (a neurological toxicant consumed through fish), carbon dioxide, and ionizing radiation.

Lead

Lead may come from pipes carrying water combustion of fossil fuels and from exhausts of automobiles run on petrol containing lead compounds, which are added as anti-knock agents (Asthana & Asthana, 2012).

Plants growing near busy highways are regularly exposed to fumes and smoke discharged from automobiles containing plenty of lead. Leafy vegetables, therefore, are likely to possess a higher lead concentration as compared to others. Lead is also accumulated by green plants and is passed on to higher trophic levels. In animal including man, gastro-intestinal absorption of lead ranges between 5-15% of the total amount ingested (Asthana & Asthana, 2012).

Adverse effects of lead exposure in pregnancy include miscarriage, low birth weight, neurological delays, anemia, encephalopathy, paralysis, blindness. The developing nervous system of the fetus is particularly vulnerable to lead toxicity. Neurological toxicity is observed in children of exposed women as a result of the ability of lead to cross the placental barrier (WIKI...en.wiki2.org/wiki/Environmental_toxicants_and_fetal_development).

Many lead-exposed populations are also at risk for nutritional deficiencies. Evidence exists for interactions between lead and micronutrients at the level of intestinal absorption, brain neurochemistry, and cognitive function. Iron and lead share a common intestinal transporter, the divalent metal transporter, and it is thought that iron deficiency contributes to increased lead absorption. There is some evidence that adult women and children who consume higher amounts of dietary calcium have lower blood lead concentrations. Placental transfer of lead was shown to be lower in women who consume diets rich in iron and in those who have

higher hemoglobin levels. Various nutritional interventions have attempted to reduce lead absorption in children and women. Although primary prevention of lead exposure is optimal, it may not be feasible when exposure is ubiquitous or when it involves sources not under the control of the caregiver or community (Kordas et al., 2007).

Nutrition can play a pivotal role in preventing childhood lead poisoning. It is important to help minimize the amount of lead that is absorbed and stored in the bones. Good nutrition helps accomplish this goal. A child's body requires certain minerals, especially calcium and iron. When these minerals are deficient in the body, lead absorption is increased. Children whose diet is deficient in these minerals retain more of the lead than they would have otherwise.

Mercury

Elemental mercury and methyl mercury are two forms of mercury that may pose risks of mercury poisoning in pregnancy. Methyl mercury, a worldwide contaminant of seafood and freshwater fish, is known to produce adverse nervous system effects, especially during brain development. Eating fish is the main source of mercury exposure in humans and some fish may contain enough mercury to harm the developing nervous system of an embryo or fetus, sometimes leading to learning disabilities. Mercury exposure in pregnancy may also cause limb defects (WIKI 2...en.wiki2.org/wiki/Environmental_toxicants_and_fetal_development).

CADMIUM

Cadmium exposure is associated most critically with renal tubular toxicity, but there is increasing evidence of effects on bone (decreased bone density, and increased bone turnover and fractures) even at low-level environmental exposure. Cadmium-related health effects are more common in women than men. Besides tobacco smoke, diet is the main source of environmental cadmium exposure. Shellfish, leafy vegetables, rice, cereals, and legumes may contain relatively high levels of cadmium. The mechanism of cadmium absorption is similar to that of iron, calcium, and zinc. There is evidence that low iron stores and intake are associated with higher body cadmium burdens. Cadmium and iron are both absorbed into small

intestine by the divalent metal transporter .Once inside enterocytes, cadmium (and lead) is likely shuffled into the blood stream via calcium transporters in addition to ferroportin. There is some speculation that the absorption of cadmium may increase at very early stages of iron deficiency, even before increased iron absorption is observed (Kordas et al., 2007).

Air pollution

Air pollution can negatively affect a pregnancy resulting in higher rates of preterm births, growth restriction, and heart and lung problems in the infant.

Compounds such as carbon monoxide, sulfur dioxide and nitrogen dioxide all have the potential to cause serious damage when inhaled by an expecting mother. Low birth weight, preterm birth, intrauterine growth retardation, and congenital abnormalities have all been found to be associated with fetal exposure to air pollution. Although pollution can be found virtually everywhere, there are specific sources that have been known to release toxic substances and should be avoided if possible by those who wish to remain relatively free of toxins. These substances include, but are not limited to: steel mills, waste/water treatment plants, sewage incinerators, and automotive (WIKI 2...en.wiki2.org/wiki/Environmental_toxicants_and_fetal_development).

Pesticides

Pesticides are created for the specific purpose of causing harm to insects, rodents, and other pests, pesticides have the potential to serious damages to a developing fetus, should they be introduced into the fetal environment. Studies have shown that pesticides, particularly fungicides, have shown up in analyses of infant's cord blood, proving that such toxins are indeed transferred into the baby's body. Overall, the two pesticides most frequently detected in cord blood are diethyltolaumidea commonly used repellant and vinclozolin a fungicide. Although pesticide toxicity is not as frequently mentioned as some of the other methods of environmental toxicity, such as air pollution, contamination can occur at any time from merely engaging in everyday activities such as walking down a pathway near

a contaminated area, or eating foods that have not been washed properly WIKI ...en.wiki2.org/wiki/Environmental_toxicants_and_fetal_development).

Other

- Heat and noise have also been found to have significant effects on development.
- Carbon dioxide – decreased oxygen delivery to brain, intellectual deficiencies.
- Ionizing radiation – miscarriage, low birth weight, physical birth defects, childhood cancers.
- Environmental exposure to per chlorate in women with hypothyroidism causes a significant risk of low IQ in the child.

Avoiding relevant environmental toxins in pregnancy

Precautions to minimize exposure to relevant environmental toxins in pregnancy:

- Avoid foods stored in lead-soldered cans, glazed ceramic dishes or crystal.
- Avoid foods that could have picked up lead dust, such as food that has fallen on the floor.
- Avoid vegetables grown in lead-contaminated soil.
- Avoid food stored in printed plastic bread bags (the inks used for the wrapper may contain lead).
- Avoiding paint supplies such as stained glass material, oil paints and ceramic glazes, and instead using watercolor or acrylic paints and glazes.
- Checking the quality of the tap water or bottled water and changing water drinking habits if necessary.
- To decrease exposure to pesticides; washing all produce thoroughly, peeling the skin from fruits and vegetables or buying organic produce if possible.

CONCLUSION

Solutions for environment and health problems exists. Simple filtration and disinfection of water even at household level dramatically improves the microbial quality of water and reduces the risk of diarrheal

disease at low cost. Relatively small risk factors make a notable contribution to disease when large population is exposed. Better understanding of interactions between nutrition and environmental exposures is needed to guide action from Government and individuals. Information received by mothers through education is also a Key to understand the environmental risk present in their homes and communities. To reduce and eliminate exposure appropriate action and proper implementation would help in preventing and reducing toxicity.

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