

ENVIRONMENTAL CHEMICALS AS REPRODUCTIVE TOXICANTS

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ABSTRACT

Environmental chemicals have the ability to alter natural hormone functions. They interfere with hypothalamic and pituitary release of hormones. These endocrine disruptors are dangerous that they affect the normal metabolism and reproductive health which leads to fertility issues. In humans and farm animals, these substances develop a reproductive toxicity. So, research is required to identify these compounds, and understanding its impacts caused in the environment. This article overviews the cause, impact and possible solution for the ill-effect of the environmental chemicals.

KEYWORDS: Environment, Including Animals and Humans

INTRODUCTION

A possibility exists that some environmental chemicals may disrupt the endocrine systems in humans and animals and hence, has received considerable attention in the scientific and public community. Endocrine disruption is on the agenda of many experts' groups, committees and panels of governmental organizations, industry and academia throughout the world. As the disturbance of the endocrine system is a very sensitive issue, scientific findings or observations are often controversially discussed among scientists, environmentalists and authorities.

ENVIRONMENTAL CHEMICALS

environmental chemicals commonly called endocrine disruptors are a group of compounds that are able to alter human and other animals' natural hormone functions i.e. interference with the synthesis, secretion, transport, metabolism, binding, action, or elimination of natural blood-borne hormones. Some of these compounds are found naturally in plants, some are the products of fungi but the majority are artificially manufactured and found in pesticides, industrial chemicals used in the production of certain products such as plastics, and in sewage from household products (detergents, soaps) and excreted contraceptives (Caserta et al. 2008).

SOURCES OF ENVIRONMENTAL CHEMICALS

Humans and farm animals ingest these substances with food and drinking water. Their stability and lipid solubility has led to increased concern that these substances may compromise the reproductive health of both humans and animals. Environmental chemicals in certain instances have had clearly defined effects on animal fertility. The biggest challenge currently is to determine if a particular chemical or a mixture of chemicals to which animals is all exposed, in embryo or fetal stage or as adults is detrimental to reproduction. The dilemma is that we may not know about reproductive toxicity until large-scale epidemiological studies are conducted.

IMPACT OF ENVIRONMENTAL CHEMICALS

The environment, including animals and humans, is increasingly exposed to endocrine-disruptors (Boerjan et al. 2002, Brevini et al. 2005) and these chemicals are found in follicular fluid and seminal plasma (Kamarianos et al. 2003 a, b). These chemicals impact both male and female reproductive system (Danzo 1998; Nandi et al, 2010, 2011, Selvaraju et al. 2011). It is still not fully elucidated; however, what changes these compounds cause and which compounds are dangerous (Veeramachaneni 2000). Many of the endocrine-disruptors are termed estrogenic or anti-androgenic, because they influence the sex hormone profile, the development of male- and female sex organs and secondary sex characteristics and thereby create fertility problems. Some of these compounds mimic or partly mimic the sex steroid hormones (estrogens and androgens (testosterone) by binding to hormone receptors or influence the cell signaling pathways that the hormone-receptor complex initiates (Pflieger-Bruss et al. 2004). Other endocrine-disruptors block or alter the hormones binding to the receptors. Finally, some block or alter the production or breakdown of either the hormone itself or its receptor. In contrast to natural steroid hormones, many of the synthetic endocrine disruptors are slow to break down in the environment and can accumulate in nature and in fat and muscle tissue in animals.

The effects that can be seen in an animal exposed to endocrine disruptors depend on which hormone system is targeted. For example, if an animal is exposed to sex hormone disrupting pesticides in the womb, then the sort of effects that may be evident include effects on sexual behaviour, structural deformities of the reproductive tract, including intersex type conditions and undecided testes, deficits in sperm counts, and effects on sex ratios. However, if the primary action is on the thyroid hormones, then as these hormones are responsible for metabolism and normal brain development, exposure in the womb may cause effects on intelligence and growth. Laboratory tests have confirmed that endocrine disruptors do cause such effects in exposed animals, but all the effects listed above have also been noted in wildlife or humans exposed to endocrine disrupting pesticides or industrial chemicals. Some endocrine disruptors may exert their action by interfering with the hypothalamic and pituitary release of hormones, which in turn regulate the production of other hormones that control the growth and the activity of many other endocrine glands (Weltje et al 2005). The pituitary has been termed the conductor of the endocrine orchestra, and pollutants that cause the pituitary region in the brain to malfunction may therefore have multiple effects.

WHAT ARE ENVIRONMENTAL CHEMICALS?

Environmental chemicals capable of acting as reproductive toxicants are ubiquitous in our environment (Rhind et al. 2002; Sweeney et al. 2002):

- The natural environment (air, water, soil)
- Food products (soybeans, legumes, flax, yams, and clover)
- Plants (phytoestrogens are chemicals naturally found in plants that can act as endocrine disruptors and are present in fruits, veggies, beans, and grasses)
- Household products (breakdown products of detergents and associated surfactants, including nonylphenol and octylphenol)
- Pesticides (DDT metabolites, endosulfan, mancozeb, atrazine, nitrofen, and tributyltin)

- Plastics (bisphenol A, phthalates)
- Pharmaceuticals (drug estrogens - birth control pills, DES, cimetidine)
- Industrial chemicals (polychlorinated biphenyls (PCBs), dioxin and benzo(a) pyrene)
- Byproducts of incineration, paper production, and fuel combustion.
- Heavy metals (cadmium, lead, mercury)

Speculated Health Effects Include

- Reproductive Effects/Birth Defects
- Cancer
- Low sperm count/Sexual Dysfunction
- Heart Disease
- Cognitive Disorders
- Sex Reversal
- Premature puberty
- Altered immune function

Research Needs to be Done Include

- Identifying compounds able to act as reproductive toxicants and then developing reliable and sensitive assays to test for them.
- Ascertaining the health effects
- Understanding the impact of age, dose, length of exposure, timing of exposure, and genetics has on health effects.
- Learning more about the interactions between multiple synthetic chemicals and how they react in the body and the environment.

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