

Endocrin Disrupting Chemicals and Toxic Effects II

Chemicals that affect any aspect of hormonal function are referred to as endocrine disruptors (EDs)

Exposure during critical periods of development, such as fetal and early postnatal life, may have particularly critical consequences with implications in research, patient care, prevention and public health

In humans, though several epidemiologic studies have linked the exposure to exogenous chemicals to a variety of endocrine and nonendocrine dysfunctions and even organ malformations, the cause-effect relationship is less clear due to the objective difficulty in studying the complexity of human-environment interactions.

Fetal growth restriction, premature birth, reproductive disorders,
alterations of pubertal timing,
thyroid and immune dysfunction,
certain cancers, especially of the reproductive organs,
birth defects of the genitalia and poorer sperm quality,
cryptorchidism,
neurological effects, neuropsychiatric disorders,
diabetes, obesity and other metabolic disorders have
been associated with the exposure to EDs

EDs are divided into major classes of chemicals including

- various types of pesticides,
- industrial chemicals,
- plastic packaging components,
- fuels and other materials that are used in daily life

The exposure may occur early in life as every pregnant woman has EDs in her body and may transfer them through the placenta to the fetus and through milk to the infant.

Inhalation, oral and dermal exposures are the main routes of adult exposure to environmental chemicals

EDs may act via classical nuclear receptors, nonnuclear steroid hormone receptors, nonsteroid receptors, orphan receptors, enzymatic pathways involved in steroid biosynthesis and/or metabolism and other mechanisms involved in endocrine and reproductive system function.

- Unfortunately, the study of the biology and impacts is extremely complicated by a number of factors
- Each human being is exposed to many different EDs over a lifetime and always to a mixture rather than a single compound
- Exposure to low-dose mixtures of endocrine disrupting chemicals characterizes environmental conditions in human and wildlife

Effects may be not dose dependent, and even exposure to low doses of chemicals may induce disrupting effects.

Different animal species react differently to the same compound, making it impossible to reliably infer effects from the observation of what occurs in wildlife to human beings.

Age groups and sexes react differently.

- Humans are exposed to EDCs via ingestion of food, dust and water, inhalation of gases and particles in the air and dermal uptake.

- EDCs are also transferred to a developing fetus, or infant by transplacental route and breast milk .

- EDCs mimic or antagonize the effects of endogenous hormones, disrupt the synthesis of endogenous hormones or their receptors, or may alter target cell sensitivity .
- The mechanisms by which EDCs affect developmental events are identified to be numerous and include changes in the neuroendocrine system, epigenetic mechanisms and/or direct effects on gene expression

- Children are at risk of higher exposures to these chemicals due to their hand-to-mouth activity and higher metabolic rate
- They may touch, handle or suck on furniture, bedding and toys: this hand-to-mouth activity can mean they are also more exposed to certain chemicals in the home. Concentrations of certain chemicals being evaluated as potential EDCs, used in common household items, have been found to be much higher in indoor than outdoor environments.
- They also have immune systems which are yet to develop completely . Their exploratory or probing behavior and ignorance of impending risks maximize their contact with harmful chemicals in the environment during developmental period.

- Recent decades have witnessed an unusual spurt in the incidence of genital malformations, infertility due to low semen quality, adverse pregnancy outcomes, neurobehavioral disorders associated with thyroid disruption, endocrine-related cancers (breast, endometrial, ovarian, prostate, testicular, thyroid), premature thelarche, obesity and Type II diabetes mellitus
- Congenital disorders such as cryptorchidism, hypospadias, early puberty and thyroid dysfunction have also been shown to have clear endocrine association.

- Common examples of exposure to EDCs include Bisphenol A used in the manufacture of polycarbonate plastics and epoxy resins which have been found to be causative for obesity and polycystic ovarian syndrome
- Phthalates used in nail polish, hair spray, deodorants and shampoos have been found to be associated with impaired genital development in male children

- Lavender and tea tree oil on repeated use can stimulate estrogenic activity and cause male pubertal gynaecomastia .
- Flame retardants used in car seats and table pads may be inhaled by or absorbed through the skin of the baby and cause a greater risk of tumors .
- Early exposure to lead has been found to cause significant changes in hypothalamo-pituitary-adrenal axis while maternal smoking has been associated with obesity

- Chemicals such as persistent organic pollutants (POPs), methylmercury which enter the bodies of younger children persist for a longer time due to their long half-lives and present their harmful effects later in life or cause multigenerational effects .
- The Stockholm Convention (2001) ratified by the international community recommended the elimination or phasing out of POPs . Some EDCs like dichloro-diphenyltrichloroethane banned years ago in some countries, still persist in the environment and human bodies and manifest in older age groups

- EDCs often produce their impacts with relatively low doses
- Most EDCs do not have traditional dose response curves.
- The timing of exposure decides the magnitude of impact. Effects such as learning difficulties, increased susceptibility and sensitivity to infections, testicular dysgenesis syndrome, infertility, fibroids, premature menopause, obesity, atherosclerosis, cardiovascular disease, Alzheimer's disease, Parkinson's disease, breast and prostate cancers manifest after a variable latent period depending on the time and the specific tissue exposed .
- Multi-chemical exposures are frequent and often have additive or synergistic potential

- Prevention of exposure is the single most effective measure to protect children against these toxic chemicals.
- But prevention of exposure may not be an immediate possibility due to the ubiquitous and often masked presence of EDCs in the environment.
- Exposure control could be effectively implemented as a short-term measure. Exposure control of lead has been found to have proven favorable consequences.

Some suggestions you can do yourself to reduce exposure to EDCs:

- Don't smoke;
- Minimize unnecessary use of plastics, in particular try to avoid plastic food packaging;
- Wash new clothes before you wear them;
- Reduce the use of cosmetics and personal care products and in the future, once they become available use products certified as EDC free;
- Do not heat food in plastic containers in the microwave;
- Avoid use of pesticides and air fresheners;
- Eat organic food when it's available and affordable;
- Use old-fashioned cleaners like vinegar and baking soda;
- Ventilate your home, keep rooms well aired, vacuum and clean regularly to remove chemicals that can be found indoors.

Overview of strategies and actions required to control endocrine disrupting chemicals

- Knowledge on EDCs should be imparted to all streams of students in schools and colleges.
- The general population should be educated through mass media and local representatives. Community education, education of parents and teachers is an essential need.
- Community level decisions and strict adherence are required for safe use of substances involving EDCs.
- Production and consumption of organic food products should be encouraged.
- Stringent regulatory measures for manufacturing and processing units to curb the use of toxic chemicals and promote the use of harmless, neutral substitutes.
- Restrain indiscriminate discharge of effluents into the environment Implement strict measures to motivate manufacturers in proper labelling and declaration of constituent ingredients of products .
- Consumers should be educated to peruse the relevant ingredient details.
- Promote safe agricultural practices with the restriction of the use of pesticides and other