

# ENDOCRINE - DISRUPTING CHEMICALS

V. Beena <sup>1</sup>  
K.P. Mini <sup>2</sup>  
and  
P.T. Philomina <sup>3</sup>

Endocrine-disrupting chemicals (EDC) include a diverse group of chemicals, synthetic or natural, circulating in our global ecosystem that can affect hormonal activity in living things. Many EDCs are regarded as significant organic pollutants/heavy metals in the environment. Environmental pollutants with well established endocrine properties currently number more than 100 and include industrial chemicals, pesticides and by products of manufacturing processes as well as products of incineration of industrial and house hold wastes. These known EDCs include polychlorinated biphenyls (PCBs), organochloride pesticides (OCPs) and other pesticides, dioxins, alkyl phenol polyethoxylates, penta chloro phenols, bisphenol A, styrenes, phthalate esters, heavy metals including lead, mercury, cadmium etc.

The first group of endocrine-disrupting chemicals described were oestrogen mimics and were labelled environmental oestrogens. It is a well known fact that EDCs can affect most endocrine systems, from reproductive to pituitary and thyroid glands and in some cases, a single chemical can have multiple effects. Normally, EDCs can mimic or block the transcriptional activation elicited by naturally occurring steroid and thyroid hormones (hormones having nuclear receptors).

## Occurrence of EDCs

Many of EDCs have industrial uses and are commonly found in waste waters that eventually flow into rivers and coastal areas (eg:- PCBs, polyethoxylates, phthalates, bisphenol A etc.). Pesticides are generally dispersed into environment as spray drifts from aerial spraying and run off from agricultural areas after rain fall (eg:-OCPs). Marine pollution by OCP has become a vital issue all over the earth. Volatile EDCs can be easily transported through the atmosphere. These chemicals may also attach themselves to particulate matter in the air and may end up in soil and water through rainfall. Dioxins are also released into environment from the incineration of household and industrial wastes in this manner. Most recent discoveries have demonstrated that common household products (for example, laundry powders, liquid detergents, personal care products and household cleaners) contain non-ionic surfactants that breakdown in the environment to form oestrogen agonists. EDCs enter the animal body mainly through skin, mouth or even via mother *inutero* or *inovo* or through milk.

## Mechanism of endocrine disruption:-

Generally EDCs can interfere with the biosynthesis, transportation, metabolism or binding of hormones. In the case of steroids, biosynthesis is disrupted by reduction of steroid precursors (cholesterol) or alteration of enzyme activity. In addition,

<sup>1</sup>Assistant professor, Department of Veterinary Physiology, COVAS, Pookot.

<sup>2</sup>Veterinary Surgeon, Veterinary Dispensary, Akathethara, Palakkad.

<sup>3</sup>Professor & Head, Department of Veterinary Physiology, COVAS, Pookot.

some EDCs are concentrated in glandular tissue where they cause cell death. In this case, the tissue responsible for hormone production is destroyed or significantly reduced. EDCs may affect hormone transportation by increasing the binding affinity of carrier molecules (eg- sex hormone binding globulin) or by competing with endogenous hormones for access to binding sites, both of which affect hormone concentration in blood plasma. Endocrine disruption may also occur if the rate at which hormones are metabolised is altered. Some chemicals stimulate or inhibit the activity of enzymes such as monooxygenases that are responsible for hormone degradation. Finally, EDCs can bind to hormone receptors and activate or block them; they can also bind to inactive sites and distort receptors to the level that they are rendered dysfunctional.

## Effects of endocrine disruption:-

Individual hormonal systems interact with each other in complex ways. Thus possibility exists for alterations in one specific hormonal pathway to cascade through multiple systems, producing effects that are difficult to interpret. Exposure to PCB and dioxins can alter hypothalamo - pituitary and adrenal axis to stress stimuli and also affect thyroid function. Most OCPs (eg:- DDT, endosulfan etc.) are weakly oestrogenic and some can also alter thyroid and adrenal function. Alteration in thyroid

<sup>1</sup>Asst. Prof. CoVAS, Pookot, <sup>2</sup>Veterinary Surgeon, Palakkad,

<sup>3</sup>Prof. & Head, Dept. of Physiology, CoVAS, Pookot

hormones during the critical period of development can also affect androgen dependent sexual differentiation of the brain. Lead exposure early in development has been shown to disrupt multiple endocrine systems including gonadal steroids, adrenal steroids and thyroid hormones. So the major effects of endocrine disruption include reproductive impairment and abnormalities, reduced immune function, reduced or abnormal growth, decreased cognitive abilities, neurological abnormalities, increased susceptibility to diseases and increased mortality. Wild life, domesticated animals and humans (particularly developing embryo) have all shown adverse health effects to EDCs concentrations found in environment.

### **Peculiarities of endocrine disruption:-**

1. Due to their lipophilic (fat-loving) characteristics many EDCs are able to accumulate in fatty tissues in animals. This facilitates its dispersion through eco-systems and food chains (top predators/superior animals of food chain are the high risk groups due to biomagnification). In pregnancy and nursing transgenerational exposure risk is maximum because these chemicals can be mobilised through maternal fat.

2. The concentration of EDCs may be millions of times greater than the native hormones in the body. For this reason EDCs though less potent than native hormones, may be biologically active at these elevated concentrations.

3. Most EDCs are persistent in nature because of their chemical stability. Heavy metals can not be degraded or destroyed. Likewise the half life of organic pollutants like DDT&PCB in the bodies of some vertebrates can be many years. This gives rise to the possibility of long term environmental contamination and dissipation throughout the global ecosystem.

4. The effects of EDCs differ from those of classical pollutants in that such effects are not always immediate. Exposure to EDCs during critical stages of development can produce permanent organizational changes in anatomy, the consequences of which might not become apparent until adulthood. Very small amounts of EDCs- parts per million or parts per billion- can cause profound effects during early developmental stages in mammals

The wide spread use and exposure of these chemicals have raised concern over their impact on environment. The toxic nature and the possible carcinogenic or mutagenic characteristics of these chemical pollutants may have serious consequences on the global ecosystem. So it is high time to think about this problem seriously. There is a need to conduct regular environmental monitoring and analysis of industrial effluents. Cost effective screening procedures and awareness programmes should be conducted. Above all, more research works are to be conducted for identification of such chemicals and their mode of action. Thus through a combined effort, let us hope that the exposure of nature to EDCs may be minimised in future.



*Best compliments from*

**UNIVERSAL  AGENCIES**

**PALAKKAL ANGADI, THRISSUR-680 001**

**PH: 2440319, 2427031, FAX: 2427038 RES: 2421997,**

**MOB: 9447027038**

**E-mail: universal@sancharnetnet.in, uniage@gmail.com**

