OPINION

Effects of Endocrine Disruptive Chemicals (EDC) on endocrine glands

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ABSTRACT

Endocrine disrupting chemicals have gained interest in human physiopathology and more and more studies aimed to elucidate how these chemicals compounds affect system. A wonderful number of endocrine disrupting chemicals seem to be able to interfere with the physiology of hypothalamus-pituitary-gonadal axis; however, every endocrine axis is additionally a target for each EDCs and their action isn't limited to one axis or organ. Several compounds may additionally have a negative impact on energy metabolic homeostasis altering fat and promoting obesity, metabolic syndrome, and diabetes. Different mechanism are proposed to clarify these associations but their complexity together with the degree of occupational or environmental exposure, the low standardization of the studies, and thus the presence of confounding factors have prevented to see causal relationship between the endocrine disorders and exposure to specific toxicants up to now. This manuscript aims to review the state of art of scientific literature regarding the results of Endocrine Disrupting Chemicals (EDCs) on system.

INTRODUCTION

Scientific literature has ever-increasingly focused on the role of Endocrine Disrupting Chemicals (EDCs) in human pathophysiology. A growing body of evidence, including reviews, clinical trials, and reports highlights new roles and effects of EDCs. EDCs are defined as "exogenous chemicals or a mixture of chemicals that interfere with any aspect of hormone action". Per US Environmental Protection Agency (EPA), an EDC is an exogenous compound that can interfere with the synthesis, secretion, transport, metabolism, receptor binding or elimination of endogenous hormones, altering the endocrine and homeostatic systems. Within the method of defining EDCs criteria proposed by the European Commission, it seems clear that EDCs should exhibit three actions: (1) endocrine activity; (2) deleterious and/or pathologic endocrine mediated activity; (3) cause-effect relationship between substance and endocrine activity in exposed subjects. In line with their origin, EDCs are often grouped as follows: industrial [i.e., dioxins, Poly Chlorinated Biphenyls (PCBs), and alkyl phenols], agricultural (i.e., pesticides, insecticides, herbicides, phytoestrogens, fungicides), residential (phthalates, polybrominated biphenyls, bisphenol A), pharmaceutical (parabens). Even heavy metals like cadmium, lead, mercury, and arsenic could even be included within the long list of EDCs. Recent evidence has shown in several mammals, including humans, how EDCs can influence behaviour and also the way this interaction is different in both sexes. There are differences in males and females after exposure to BPA in utero and early postnatal life.

Recent literature has shown that chromosomal sex could also be a fundamental variable in accounting for the implications of BPA on behaviour. Several studies have confirmed the pliability of BPA and other EDCs to influence rodent brain development in an exceedingly gender-specific way, even at very low doses, altering the standard steroid genesis programmed within the two sexes through epigenetic alterations which will cause the differential natural phenomenon.

Even in human epidemiological studies, it appears that BPA has specific effects on both sexes. Prenatal BPA levels are positively associated with an increase in externalizing behaviours in girls, against greater internalizing behaviour, anxiety, and aggression in boys. Because several neuropsychiatric disorders show a gender-specific incidence. It is important to understand how hormones and other substances modify neurobehavioral dimorphisms.

PITUITARY GLAND

The diencephalic system represents a preferential target of EDCs, which might alter the proper function of CNS mimicking neurotransmitter actions, besides their ability to bind endocrine receptors. Several EDCs act on the secreter, therefore influencing the varied endocrine axes: as a result, an oversized spectrum of clinical manifestations has been associated with exposure to pollutants, like precocious/delayed puberty and circadian disruption.

ADRENAL GLAND

Only some studies have assessed the results of EDC on the ductless gland, especially concerning the risks related to exposure to chemicals. This paucity of evidence isn't easily comprehensible, considering that the proper functionality of the HPA axis is critical for human life and it is a standard target for several drugs and chemicals. Indeed, adrenal glands present some structural and biochemical features that make them ideal targets for EDCs, like an elevated blood flow, and lipophilic structure due to the high content of polyunsaturated fatty acids in the semipermeable membrane, and the presence of CYP 450 enzymes producing toxic metabolites and free radicals.

Hundreds of chemicals and medicines may interact with the HPA axis and every step of steroid genesis could even be stricken by EDCs furthermore as each chemical disruptor may act by altering different steps of steroid genesis. In evaluating the pathologic effects of EDCs on the HPA axis, it should be considered that even a partial impairment of proper adrenal function may have severe effects on human health. During this attitude, bioaccumulation of these chemicals in adipose tissue might generate a "cocktail" with clinical effects which can be observed only after several years of constant, low-dose exposure. Hexachlorobenzene is among the chemical which is prepared to disrupt corticoid hormone function in Wistar rats.

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