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Editorial

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Endocrine Disrupting Chemicals and Their Impact on Hormonal Health

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Introduction

Endocrine disrupting chemicals (EDCs) are exogenous substances that interfere with the normal function of the endocrine system, leading to adverse health effects in humans and wildlife. These chemicals can mimic, block, or alter the synthesis, transport, metabolism, and action of natural hormones. EDCs are widely present in the environment and are commonly found in plastics, pesticides, industrial chemicals, personal care products, and food packaging. Growing exposure to these substances has raised significant public health concerns due to their potential role inmetabolic, reproductive, developmental, and neurological disorders [1,2].

Discussion

EDCs exert their effects through multiple mechanisms that disrupt hormonal signaling pathways. One primary mechanism involves hormone receptor interactions. Certain EDCs structurally resemble endogenous hormones and can bind to estrogen, androgen, thyroid, or glucocorticoid receptors. For example, bisphenol A and some phthalates act as estrogen mimics, activating estrogen receptors and altering gene expression. Other EDCs function as hormone antagonists, blocking receptor binding and inhibiting normal hormonal action [3,4].

Another important mechanism is interference with hormone synthesis and metabolism. Some EDCs affect enzymes involved in steroidogenesis, leading to altered production of sex hormones and corticosteroids. Others disrupt thyroid hormone synthesis or deiodination, impairing thyroid hormone availability and signaling. These disruptions can have profound effects during critical developmental periods such as fetal life and early childhood, when hormonal balance is essential for normal growth and organ development [5].

EDCs are also implicated in metabolic dysfunction. Increasing evidence links exposure to certain chemicals, often referred to as "obesogens," with obesity, insulin resistance, and type 2 diabetes. These compounds can influence adipocyte differentiation, lipid storage, and energy balance by modifying nuclear receptor signaling, including peroxisome proliferator-activated receptors. Chronic low-dose exposure may contribute to long-term metabolic alterations.

The persistence and bioaccumulation of many EDCs amplify their health impact. Lipophilic compounds can accumulate in adipose tissue and remain in the body for extended periods, leading to continuous hormonal disruption. Additionally, humans are often exposed to mixtures of EDCs, making it difficult to assess individual chemical effects and posing challenges for risk assessment and regulation.

Conclusion

Endocrine disrupting chemicals represent a significant environmental and public health challenge due to their widespread presence and complex effects on hormonal regulation. Through diverse mechanisms, these chemicals can disrupt endocrine signaling and contribute to metabolic, reproductive, and developmental disorders. Reducing exposure, strengthening regulatory policies, and advancing research on combined chemical effects are essential steps toward protecting hormonal health and minimizing the long-term consequences of endocrine disruption.

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