

EDITORIAL

Endocrine disruptors: emerging health concerns

Endocrine disruptors (EDs), also called endocrine modulators, endocrine-disrupting chemicals, or endocrine active compounds, are a group of chemicals that interfere with the endocrine system, the most delicate system in the body. These disruptors may mimic, block, or alter the actions of natural regular hormones, leading to various adverse health effects of variable ranges. EDs are found in our day-to-day products, such as plastics, pesticides, and personal care items.

Endocrine disruptors exert their effects by interfering with hormone signaling pathways, which play a pivotal role in numerous physiological processes. Even at low concentrations, these chemicals can lead to significant health consequences due to their ability to disrupt the delicate balance of hormone regulation.

Health consequence

1. **Reproductive health:** In males, exposure to EDs can result in reduced sperm quality, decreased fertility, and testicular abnormalities. For example, bisphenol A (BPA), a common endocrine disruptor found in plastics, has been associated with altered reproductive health in males.¹ In females, disrupted hormone signaling may lead to menstrual irregularities, impaired fertility, and complications during pregnancy.²
2. **Hormone-related cancers:** Several studies have associated EDs exposure with an increased risk of hormone-dependent cancers, including breast, prostate, ovarian, and thyroid cancers. These chemicals can promote abnormal cell growth and interfere with tumor suppressor genes, contributing to carcinogenesis. For instance, exposure to phthalates, commonly used in plastics and personal care products, has been linked to an increased risk of breast cancer.³
3. **Metabolic disorders:** EDs can disrupt metabolic regulation, leading to weight gain, insulin resistance, and an increased risk of obesity and type 2 diabetes. Such disruptions may result from altered hormone levels, affecting appetite regulation and lipid metabolism. Studies have shown that exposure to persistent organic pollutants, such as polychlorinated biphenyls and organochlorine pesticides, is associated with metabolic syndrome and diabetes.⁴
4. **Neurological and behavioral abnormalities:** EDs may impact brain development and its function. Exposure during critical periods of neurodevelopment in early life can lead to cognitive impairments, learning difficulties, and behavioral disorders. For example, prenatal exposure to certain pesticides has been linked to neurodevelopmental disorders like autism spectrum disorder.⁵
5. **Immune system dysfunction:** EDs may affect the immune system's function, leading to altered immune responses and increased susceptibility to infections and autoimmune diseases. Studies have shown that exposure to phthalates and bisphenols can modulate immune responses and contribute to immune-related diseases.⁶

The challenges

1. **Subtle nature and long-term impact:** One of the most challenging aspects of addressing endocrine EDs is their subtle nature, making it difficult to discern their impact on human health. The effects of exposure to these chemicals may not manifest immediately, leading to delayed identification of their adverse health consequences. Moreover, the long latency period between exposure and the onset of health issues complicates establishing causality.
2. **Regulatory challenges:** Regulating EDs presents significant challenges due to the sheer number of chemicals with endocrine-disrupting properties and the vast array of products in which they are used. Traditional toxicological testing methods may

not adequately capture the subtle effects of these chemicals, necessitating the development of more sensitive and specific screening methods.

Actions warranted

Proactive measures are crucial to safeguard public health from the potential future health concerns associated with EDs. EDs pose an emerging future health concern due to their subtle yet serious impact on human health. These chemicals interfere with hormone regulation and have been associated with a range of adverse health effects, including reproductive issues, hormone-related cancers, metabolic disorders, and neurological abnormalities.

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