



# Endocrine Disrupting Agents: Toxicological Aspects on Male Reproduction

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## Abstract

In the quest to enhance food production and quality of life, a variety of chemical agents that can protect crops and prevent vector borne diseases have emerged and are used indiscriminately by humans. Thus, they end up in the physiological systems through various routes. The male reproductive system is one of the highly sensitive physiological systems, despite having the blood-testis and blood-epididymis barrier. In this review, we provide a comprehensive analyses by systematically identifying specific studies that reported the relationship between endocrine disruptors and their toxicity on the male reproductive system at multiple levels. The toxicological aspects of pesticides (organophosphates, organochlorines, carbamates, pyrethroids and neonicotinoids), alkyl phenols, plasticizers, fungicides, herbicides, heavy metals, therapeutic agents, heavy metals, synthetic food preservatives, polycyclic aromatic hydrocarbons and other endocrine disrupting agents on the male reproductive system is detailed, with emphasis on the effects on endocrine signaling, HPG axis and the transgenerational toxicity. We report that endocrine disruptors can cause anatomical pathologies, destruction of specific cell types in the male reproductive organs, decreased spermatogenesis and thereby reduced sperm count, abnormality in the male gametes, altered hormonal production and transgenerational inheritance of the toxic effects.

**Keywords** Endocrine disrupting agents · Pesticides · Male reproductive toxicity · Spermatogenesis · Hypothalamo-pituitary axis · Testosterone

## Significance Statement

Endocrine disruptors are implicated in a large variety of physiological and pathological conditions in both humans and animals. Despite the anatomical and biochemical perturbations caused, they have been implicated in the epigenetic and transgenerational effects that can cause long term effects. Importantly, their disruptive effects on the reproductive system and the future generations is very alarming. A comprehensive review of the toxic effects of these compounds needs a thorough review.

## Literature Review Methodology

This review article is prepared with an aim of providing comprehensive information on the toxicological aspects of endocrine disrupting agents (EDA) on the male reproductive system. To download scientific material on EDA, we searched in PubMed, Google and SCOPUS using specific keywords. The following key words were used in combination with the phrase “male reproductive toxicity”: pesticides, organophosphates, organochlorines, carbamates, pyrethroids, neonicotinoids, insecticides, alkyl phenols, plasticizers, fungicides, herbicides, heavy metals, therapeutic agents, synthetic food preservatives, polycyclic aromatic hydrocarbons, etc. Research articles, review articles,

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