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Review Article

Impact of Endocrine Disrupting Chemicals on Reproductive Health: A Conceptual Review

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Abstract

Endocrine Disrupting Chemicals (EDCs) are external agents that alter hormonal production, release, transport, metabolism, or receptor activity, thereby negatively influencing reproductive function. Growing exposure to environmental contaminants—including plastics, pesticides, industrial compounds, cosmetics, and heavy metals—has been increasingly linked to menstrual disturbances, ovulatory disorders, infertility, and unfavorable pregnancy outcomes. In Ayurvedic terms, such substances may be considered *Āgantuja Nidāna*, which provoke *Doṣa* imbalance, weaken *Agni*, encourage *Āma* accumulation, and cause vitiation of *Rasa*, *Rakta*, and *Ārtava Dhātu*. These pathological changes impair *Ārtavavaha Srotas*, resulting in conditions such as *Vandhyatva* and *Ārtava Vyāpada*. This conceptual review seeks to integrate contemporary scientific knowledge of endocrine disruptors with classical Ayurvedic concepts and to explore preventive and therapeutic strategies described in Ayurveda for safeguarding reproductive health. Emphasis is placed on *Nidāna Parivarjana*, lifestyle regulation, *Pañcakarma* therapies, and *Rasāyana* interventions as potential measures to reduce reproductive toxicity caused by endocrine disruptors.

Keywords: Endocrine disruptors, Infertility, Vandhyatva, Ārtava Duṣṭi, Agni, Āma, Ayurveda

Introduction

The World Health Organization recognizes infertility as a significant public health concern, affecting approximately 48 million couples and 186 million individuals globally. Among the various contributing factors, endocrine-disrupting chemicals have emerged as a growing concern, largely associated with advancements in modern industrialized society. Numerous chemicals used in the food industry enter the food chain and exert direct adverse effects on human health. Endocrine disruptors possess the ability to interfere with normal hormonal function, metabolism, and biosynthetic pathways, thereby disturbing physiological hormonal balance. Exposure to these substances has been strongly linked to conditions associated with female infertility,

including polycystic ovary syndrome, endometriosis, menstrual irregularities, as well as disruptions in steroidogenesis and ovarian follicular development. There is increasing attention on the role of endocrine disruptors in public health, particularly concerning female reproductive health. Contemporary lifestyle changes at both individual and societal levels have significantly contributed to increased exposure to these hazardous substances. Endocrine-disrupting chemicals originating from agricultural practices, industrial waste, and environmental changes related to climate impact represent major sources of exposure. These chemicals are now widely distributed in the environment, contaminating food, food packaging, and various consumer products such as cosmetics and everyday household items, with additional exposure occurring through inhalation of contaminated air and airborne particles. Furthermore, evidence indicates that endocrine disruptors can be transferred from the mother to the developing fetus or infant during pregnancy and lactation via the placenta and breast milk. Ayurveda offers a holistic framework for understanding and addressing the adverse effects of endocrine-disrupting chemicals on female reproductive health. Environmental toxins can be conceptually correlated with *Āgantuja Nidāna*, which disturb the internal homeostasis of the body and initiate pathological processes. These external factors primarily impair *Agni*, leading to the formation and accumulation of *Āma*, which further contributes to *Doṣa* vitiation and obstruction of bodily channels (*Srotorodha*), particularly *Ārtavavaha Srotas*. This article is about **how environmental chemicals that disturb hormones affect female reproductive health, and how Ayurveda explains and manages these effects**.

Aim

To conceptually analyze the impact of endocrine disrupting chemicals on reproductive health through Ayurvedic principles.

Objectives

1. To review endocrine disrupting chemicals and their effects on reproductive health
2. To correlate endocrine disruptor-induced pathology with Ayurvedic concepts
3. To explore preventive and therapeutic Ayurvedic approaches for reproductive protection

METHODOLOGY

This study is a **conceptual, narrative review** aimed at correlating the effects of endocrine-disrupting chemicals on reproductive health with classical Ayurvedic principles

ENDOCRINE DISRUPTORS

Endocrine Disrupting Chemicals (EDCs) are external agents that interfere with the body's natural hormonal systems. They possess the ability to alter hormone production, release, transport, metabolism, or receptor activity. Because they can mimic or block natural hormones, they disturb physiological hormonal balance and metabolic pathways.

Common Sources of Exposure

These chemicals have become widely distributed in the environment due to industrialization and modern lifestyle changes. Major sources include:

1. **Industrial and Commercial Products:** Plastics (BPA, Phthalates), non-stick cookware (PFAS), and flame retardants in electronics or furniture.
2. **Agriculture:** Pesticides such as DDT and organophosphates used on crops.
3. **Personal Care:** Cosmetics, shampoos, and lotions containing parabens or phthalates.
4. **Food Chain:** Contaminated water, fish, meat, and food packaging or canned linings.
5. **Air and Maternal Transfer:** Inhalation of contaminated air and transfer from mother to child via the placenta or breast milk.

Impact on Reproductive Health

EDCs are recognized as a significant public health concern because they negatively influence reproductive functions in both males and females.

- **Female Reproductive Effects:** Exposure is linked to polycystic ovary syndrome (PCOS),

endometriosis, menstrual disturbances, and reduced oocyte quality.

- **Male Reproductive Effects:** Disruptions during critical fetal development windows can lead to conditions such as cryptorchidism (undescended testes), hypospadias (penile malformation), and reduced sperm quality in adulthood.

Table no.1 showing endocrine disruptors its sources and its effects

SR. NO	ENDOCRINE DISRUPTORS	SOURCES	EFFECTS
1	**Bisphenol A (BPA)**	Plastics, canned food linings, thermal paper receipts	Menstrual irregularities, anovulation, polycystic ovary syndrome (PCOS), reduced fertility
2	**Phthalates**	Plastics, personal care products (lotions, shampoos), medical tubing	Hormonal imbalance, delayed ovulation, endometriosis, low oocyte quality
3	**Polychlorinated Biphenyls (PCBs**	Industrial waste, contaminated fish and meat	rregular menstrual cycles, implantation failure, altered steroidogenesis
4	**Dioxins (TCDD)**	Industrial emissions, waste incineration,	nfertility, endometriosis, miscarriage risk
		contaminated food	
5	**Pesticides (e.g., DDT, organophosphates)**	Agriculture, contaminated fruits/vegetables, water	Ovulatory dysfunction, PCOS, early menopause, miscarriage
6	**Perfluoroalkyl Substances (PFAS)**	Non-stick cookware, water-repellent fabrics, food packaging	Hormonal disruption, delayed menarche, reduced fertility
7	**Heavy Metals (Lead, Cadmium, Mercury)**	Industrial pollution, contaminated water/food, cosmetics	Disrupted menstrual cycle, reduced ovarian reserve, miscarriage, developmental toxicity
8	**Parabens**	Cosmetics, personal care products, processed foods	Estrogenic activity, menstrual disturbances, reduced fertility
9	**Flame Retardants (PBDEs)**	Electronics, furniture, household dust	Endocrine disruption, altered ovarian hormone levels, delayed puberty
10	**Phytoestrogens (Excessive intake)**	Soy products, herbal supplements	Altered menstrual cycle, interference with ovulation (dose-dependent)

Male Disorders Linked to Developmental Endocrine Disruption

Several male reproductive disorders have been associated with disruptions in endocrine signaling during critical periods of fetal development, particularly when androgen activity is reduced. Androgens play a central role in guiding masculinization during sexual differentiation. In animal studies, such as in rats, the masculinization programming window (MPW) occurs between gestational days 16–21 (Welsh et al., 2008), a period thought to be comparable across mammals, including humans, where it roughly corresponds to 12–20 weeks of gestation. This window coincides with a surge in fetal testosterone production, which is essential for the proper differentiation of male reproductive structures, including the prostate, seminal ducts, gubernaculum, and external genitalia. Suppression of androgen signaling during this crucial period can lead to incomplete masculinization of these tissues. For example, testicular descent occurs in two stages: the first requires Leydig cell-derived INSL3 and other factors, while the second depends on androgen action. Androgens influence the gubernaculum, the tissue connecting the developing testes to the scrotum, promoting its differentiation and guiding the testes into the scrotal sac. Disruption of androgen signaling during this stage can result in cryptorchidism. Both anti-androgenic and estrogenic endocrine-disrupting chemicals (EDCs)—such as dioxins, organotins, phthalates, and bisphenols—have been linked to cryptorchidism in humans.

Similarly, the genital tubercle, initially bipotential, differentiates into the penis in response to the fetal androgen surge. Impaired androgen signaling during this process can cause incomplete penile development, including malposition of the urethral opening (hypospadias). Dihydrotestosterone (DHT), a potent androgen synthesized locally from testosterone by 5-alpha reductase, is critical for masculinization of androgen-sensitive structures distant from the testes. Individuals with 5-alpha reductase deficiency, despite normal fetal testosterone production, often present with ambiguous genitalia or cryptorchidism, highlighting the importance of DHT. Evidence also suggests that estrogens contribute to penile development, as disruption of the androgen-estrogen balance by EDCs—such as diethylstilbestrol, atrazine, phthalates, and bisphenol A—can induce hypospadias.

Other disorders linked to developmental endocrine disruption in males include reduced fertility and testicular germ cell cancers. Reduced fertility, characterized by low sperm count or poor sperm quality, may originate from fetal endocrine disruption. Although establishing a direct causal link in humans is challenging due to the long latency between fetal exposure and adult disease, abnormal testis differentiation or function during development can impair the spermatogonia pool or damage germ cells, leading to persistent deficits in sperm number and quality. Disruption of primordial germ cells may also predispose to testicular germ cell cancers. It is hypothesized that such cancers arise from disturbed fetal gonocytes, which remain dormant as pluripotent carcinoma in situ cells and may later develop into tumors postnatally. Molecular profiles of testicular germ cell cancers closely resemble those of pluripotent fetal germ cells, supporting the idea that early-life endocrine disruption can increase the risk of malignancy in adulthood.

Female Disorders Linked to Developmental Endocrine Disruption

Similar to males, female reproductive health is vulnerable to exposure to endocrine-disrupting chemicals (EDCs) during critical developmental windows, including fetal and early postnatal periods. Such exposures can interfere with hormone signaling, potentially leading to long-lasting effects on reproductive function. Disorders linked to developmental exposure to EDCs in females include **precocious puberty, polycystic ovary syndrome (PCOS), premature ovarian insufficiency (POI), reduced fertility, early menopause**, and possibly an increased risk of reproductive cancers. Chemicals implicated in these effects include **phthalates, bisphenols, dichloro-diphenyl-trichloroethane (DDT), and organochlorine pesticides**.

Unlike males, females generally do not present with overt congenital anomalies directly attributable to EDC exposure, such as cryptorchidism or hypospadias. This difference may arise because female sexual differentiation is less dependent on specific hormonal surges, whereas male development relies on a critical androgen peak for proper

masculinization. Nevertheless, subtler disruptions in female fetal development may remain underrecognized.

Ovarian development follows a distinct timeline from testicular development. Formation of ovarian follicles begins in the second trimester, with germ cells entering meiosis I and primordial follicles being established, forming the ovarian reserve that largely determines future fertility. Strong evidence of EDCs impacting fetal ovarian development comes from gestational exposure to **diethylstilbestrol**, which is associated with a shortened reproductive lifespan, likely due to accelerated follicular depletion and reduced fertility in adulthood. Mechanisms include impaired follicular development, decreased oocyte quality, hormonal imbalances, and disruption of normal ovarian function.

Androgen signaling also plays a critical, often underappreciated role in female development. Excess fetal androgen exposure can lead to **virilization**, including masculinization of external genitalia (e.g., clitoromegaly, labial fusion) and disturbances in reproductive tract development. Beyond anatomical effects, elevated androgens during development have been linked to **PCOS, altered puberty timing, infertility, and potential neurodevelopmental effects**. While most environmental EDCs exert anti-androgenic rather than androgenic effects, the impact of androgenic EDCs should not be overlooked. Evidence also indicates that anti-androgenic chemicals, such as certain azole pesticides, may affect adult female fertility, reflecting the role of androgens in regulating folliculogenesis.

Overall, these findings emphasize the essential role of endocrine signaling in female reproductive health and highlight the vulnerability of developing female reproductive systems to EDCs. Exposure during critical developmental windows can have immediate and long-term consequences, including reduced fertility, reproductive dysfunction, and an elevated risk of reproductive cancers later in life.

In Ayurveda, according to Susrutha, the essential factors for conception are mentioned as Ritu (reproductive period), Kshethram (female reproductive tract), Ambu (nutritional factors), and Beejam (sperm and ovum) [8]. Any abnormality or malformation of any of these harms the fertility outcome. Ayurveda takes into account an individual's constitution and aims to enhance the body's systems involved in fertilization.

Discussion

The integration of contemporary toxicology with Ayurvedic principles reveals a profound overlap in how external environmental factors compromise reproductive health. Endocrine Disrupting Chemicals (EDCs) found in plastics, pesticides, and industrial compounds act as **Agantuja Nidana** (external causes) that disrupt the body's internal homeostasis.

Pathological Correlation

From an Ayurvedic perspective, these chemicals do not merely interfere with hormones; they fundamentally impair **Agni** (metabolic fire). This impairment leads to the production and accumulation of **Ama** (toxic bio-metabolites), which causes **Srotorodha** (obstruction of channels), specifically within the **Artavavaha Srotas**.

This channel blockage and tissue vitiation manifest as modern clinical diagnoses:

- **Bisphenol A (BPA) and Phthalates:** Linked to menstrual irregularities, polycystic ovary syndrome (PCOS), and reduced oocyte quality.
- **Pesticides and Heavy Metals:** Associated with ovulatory dysfunction, early menopause, and reduced ovarian reserve.
- **Dioxins and PCBs:** Correlated with endometriosis, infertility, and increased miscarriage risk.

Developmental Vulnerability

A critical finding is the "programming window" of vulnerability during fetal development.

- **In Males:** Interference with androgen signaling during the masculinization programming window (MPW) can lead to structural anomalies like cryptorchidism or hypospadias.
- **In Females:** Exposure to EDCs such as diethylstilbestrol can cause accelerated follicular depletion, leading to a shortened

reproductive lifespan and reduced fertility in adulthood.

Ayurvedic Management Strategy

Ayurveda provides a comprehensive framework to address these environmental toxins through purification and stabilization:

- **Nidana Parivarjana:** The primary step is the avoidance of the root cause by reducing exposure to EDCs in food, packaging, and consumer products.
- **Shodhana (Purification):** Therapies such as **Vamana** (emesis), **Virechana** (purgation), and **Basti** (enema) serve to eliminate accumulated toxins and clear the **Srotas** (channels).
- **Shamana & Rasayana:** These therapies help balance the **Doṣas** and rejuvenate the **Dhatus**, specifically enhancing the quality of **Shukra** (semen) and **Artava** (ovum).
- The ayurvedic treatment of shodhana (purification) and shamana (balancing) therapies assists in eliminating blockages in the channels, pacifying imbalanced doshas, and facilitating the optimal formation of healthy semen (shukra dhatu) and ovum (stree shukra). This, in turn, promotes the chances of conception by creating a conducive environment for fertilization.
- Shodhana refers to the purification or cleansing therapies in Ayurveda. It aims to eliminate the root cause of the disease by removing toxins or imbalances from the body. Mostly virechan (therapeutic purgation), vamana (therapeutic vomiting), and basti (therapeutic enema) are used in the treatment of infertility. Shamana refers to the palliative or pacifying therapies in Ayurveda. These treatments aim to alleviate symptoms, balance the doshas, and restore harmony to the body .
- Ayurveda management of infertility has shown quite effective results in cases of infertility due to polycystic ovarian disorder (PCOD), tubal blockage, oligoasthenozoospermia, and others. However, there are limited reviews available that offer a comprehensive perspective on Ayurveda treatments for treating infertility. Thus, this systematic review aims to consolidate and analyze the published literature that explores the application of Ayurveda principles in treating infertility.

Conclusion

The rising global concern regarding infertility is significantly linked to the pervasive presence of endocrine-disrupting chemicals in modern industrialized society. This conceptual review concludes that EDCs act as potent **Agantuja Nidāna**, leading to the vitiation of **Rasa, Rakta,** and **Artava Dhatu**, thereby impairing the essential factors for conception: **Ritu, Kshethram, Ambu,** and **Beejam**.While modern science identifies the molecular mechanisms of endocrine disruption, Ayurveda offers a holistic therapeutic pathway through **Pancakarma** and lifestyle regulation. By integrating the principles of **Nidana Parivarjana** (avoidance) and **Shodhana** (detoxification), it is possible to mitigate reproductive toxicity and restore hormonal harmony. This approach highlights the relevance of ancient wisdom in managing contemporary environmental health challenges.

References

1 International Agency for Research on Cancer Report of the advisory group to recommend priorities for the IARC monographs during 2020–2024. IARC Monogr Eval Carcinog Risks Hum. 2020;2014:i–ix. [Google Scholar]

2 Pivonello C, et al. Bisphenol A: an emerging threat to female fertility. Reprod Biol Endocrinol. 2020;18(1):14. doi: 10.1186/s12958-019-0558-8. [DOI] [PMC free article] [PubMed] [Google Scholar]

3 W.M. Al-Amoudi Toxic effects of Lambda-cyhalothrin, on the rat thyroid: involvement of oxidative stress and ameliorative effect of ginger extractToxicol Rep(2018)

4 C. AtkinsonLignan and isoflavone excretion in relation to uterine fibroids: a case-control

study of young to middle-aged women in the United StatesAm. J. Clin. Nutr.(2006)
5 AxmonAltered menstrual cycles in women with a high dietary intake of persistent organochlorine compoundsChemosphere(2004)
6 M. BartonTwenty years of the G protein-coupled estrogen receptor GPER: historical and personal perspectivesJ. Steroid Biochem. Mol. Biol.(2018)
7 S.C. BathEffect of inadequate iodine status in UK pregnant women on cognitive outcomes in their children: results from the Avon Longitudinal Study of Parents and Children (ALSPAC)Lancet(2013)
8 P. BouchardEndocrine-disrupting chemicals, a multifaceted dangerComptes Rendus Biol.(2017)
9 C.J. CharlierPolychlorinated biphenyls contamination in women with breast cancerClin. Chim. Acta(2004)
10 Marya g Zlatnik Endocrine-Disrupting Chemicals & Reproductive HealthJ Midwifery Womens Health. 2016 Jul 8;61(4):442–455.
11 Aparna mahakali zama Effects of Endocrine-disrupting Chemicals on Female Reproductive Health The Open Biotechnology Journal, 2016, 10, (Suppl-1, M6) 54-75
12 Saqib HASAN Endocrine disruptors: Unravelling the link between chemical exposure and Women's reproductive health