



The Two Faces of Endocrine Disrupting Chemicals and Genital Development

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Endocrine-Disrupting Chemicals (EDCs) are substances that interfere with hormone biosynthesis, metabolism, or action resulting in a deviation from normal homeostatic control or reproduction. EDCs represent a broad class of molecules in our environment, food, and consumer products such as plasticizers, polychlorinated biphenyls, organochlorinated pesticides, and many other chemicals. Most of the products that contain these EDCs are requisitely used in everyday life; however the results of several animal models and human clinical research, as well as data from epidemiological studies reveal that EDCs are a significant concern to public health. The mechanisms of EDCs involve divergent pathways including (but not limited to) estrogenic and anti-androgenic pathways, which are highly conserved in wildlife and humans.

EDCs like phthalates and bisphenol A (BPA) have vigorous effects on male and female genital development, reproduction, breast development and genital cancers. Phthalates are phthalic acid derivative synthetic chemicals with a wide spectrum of industrial and commercial applications. Being used mostly as plasticizers to impart flexibility, transparency and durability to plastic materials, they are produced in high volume and therefore considered as the most abundant contaminants in the environment [1,2]. Phthalates are also used to stabilize color and scent in a variety of personal care products, as solvents in insect repellent sprays, paint, and glue [3], as components of some drug coatings, and as solubilizers in a wide variety of plastics, including food wraps, water bottles, milk containers, and medical products [4,5]. Phthalates are suggested to cause "testicular dysgenesis syndrome" which consists of genital system development defects like hypospadias, cryptorchidism, and reduced anogenital distance in newborns and babies, as well as decreased semen quality, decreased in male fertility and testicular cancer in adults [6]. Phthalates show anti-androgenic properties in male rodents, rather than estrogenic effects as shown in many studies as well as ours [7]. On the other hand, BPA, which is used to harden plastic material, is present in baby and water bottles, food and beverage cans as a coating, medical and dental devices, dental fillings, sealants, household electronics, CDs and DVDs, eyeglass lenses, fungicides, carbonless copy papers, thermal papers, flame retardants, foundry castings and in the lining of water pipes. BPA shows estrogenic properties and causes adverse effects when the animals are exposed in neonatal and prenatal periods, mainly affecting genital development and sexual behavior in both sexes [8,9]. Along

with these mentioned effects, both phthalates and BPA affect breast development in boys and girls. In our studies, we observed higher levels of di (2-ethylhexyl) phthalate (DEHP) and its main metabolite mono (2-ethylhexyl) phthalate (MEHP) in gynecomastia patients and in girls with premature thelarche [10]. Moreover, these plasticizers are suggested to be one of the underlying factors of obesity, thyroid dysfunction, and prostate cancer.

The combined effects can be observed as additivity between the same class of EDCs like between two/ more estrogenic or two/more anti-androgenic compounds. On the other hand, the combination effects between different classes of EDCs make this subject more complex and inextricable. Therefore, enhancing basic and clinical research on these substances and on their mixtures is needed to understand their mode of action deeply. For the regulation of EDCs, involvement of individual and scientific society stakeholders is necessary for communicating and implementing changes in public policy and awareness.

Although exposure to EDCs (particularly to phthalates and BPA) and their mixtures, is inevitable, women have to take cautions especially in pregnancy and lactation for not to get exposed to these chemicals at high levels, through plastic material and cosmetics like perfume, nail polish, crèmes, lotions and make-up products. Besides, as newborns and babies are the most susceptible population to the effects of EDCs, extra precaution is needed for preventing their exposure to these chemicals.

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