Chapter 13
Historical Perspective of Bisphenol A and Phthalates in the Environment and Their Health Effects

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ABSTRACT

Plastics are widely used in modern life, and their unbound chemicals Bisphenol A and Phthalates, which are important chemical-building blocks, can leach out into the surrounding environment. They are also ubiquitous contaminants in the human body, wildlife, and the environment. BPA and PAEs have recently attracted the special attention of the scientific community, regulatory agencies, and the general public because of their high-production volume, widespread use of plastics, and endocrine-disrupting effects.

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INTRODUCTION

In recent years, the impact of environmental exposure to chemicals and their immunological effects, including the development of allergy has been a topic of great interest. Epidemiologic studies indicate that exposure to endocrine disrupting chemicals produced in high volumes, including bisphenol A (BPA) and phthalates are omnipresent. The links between their exposure and the development of allergy, asthma and immune dysfunction have been studied *in vitro*, *in vivo* and through human cohort studies.

BISPHENOL A

BPA is (4,4-isopropylidenediphenol 2,2-bis(4- hydroxyphenyl)-propane). an organic synthetic compound with the chemical formula $(CH_3)_2C(C_6H_4OH)_2$ belonging to the group of diphenylmethane derivatives and bisphenols, with two hydroxyphenyl groups. It contains two functional phenol groups that allow the chemical to interact with estrogen and androgen receptors as both an agonist and antagonist. (Michalowicz J. 2014) BPA is classified as a xenoestrogen (environmental estrogen). Its ability to stimulate the estrogen receptor further classifies it as an endocrine disrupting chemical (EDC). (Vandenberg LN, et al.2007. Vandenberg LN, et al. 2009) (The estrogenic activity of BPA has been estimated to be 1/1,000 to 1/10,000 of that of 17β- estradiol. (Guo H, et al.2010)

BPA is contained in polycarbonate plastics and epoxy resins and is used in the production of polyvinyl chloride. (Rosenfeld CS. 2015) Items containing BPA include children's toys, dental sealants, lining of water pipes, food and beverage containers such as plastic water bottles, food packaging and the inner coating of cans and bottles. (Konieczna A, Rutkowska A, Rachon D. 2015) It estimated that each year greater than 15 billion pounds of BPA are produced and over 100 tons are released into the atmosphere. The primary route of exposure of BPA is oral, mainly from eating or drinking from products containing BPA. Other potential exposures include inhalation from dust particles and atmospheric exposure. Once the compound is introduced via the oral route it is absorbed in the gastrointestinal tract and undergoes hepatic metabolism including oxidation and hydrolysis, which leads to the production of several metabolites including BPA monosulfate, BPA glucuronide, and BPA disulfate. (Matthews JB, Twomey K, Zacharewski TR, 2001) These metabolites then undergo conjugation and can be excreted in the urine and feces. The presence of BPA and its metabolites can be measured in bodily fluids, including urine and serum, by using the combined techniques of solid-phase extraction coupled with isotope dilution high-performance liquid chromatography and mass spectrometry.(Vandenberg LN, et al. 2010) Small studies have estimated the half-life of excretion of urinary BPA to approximate 4-5 hours.(Stahlhut RW,

Figure 1.