

## Chapter 15

# Environmental Phthalate Exposure in Relation to Reproductive Outcomes and Other Health Endpoints in Humans

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### ABSTRACT

*Phthalates are a group of manmade chemicals which may be regarded as heroes having profound application in industries belongs to dieters of 1, 2-benzenedicarboxylic acid (phthalic acid). They are mainly used as plasticizer. Phthalates may be of high and low molecular weight, and have find their existence in the manufacturing of various products that are of daily use to humans and pose threat to non-occupational humans besides of those working in the industries where phthalate based products are manufactured. Phthalates are now widely used and therefore it is difficult to avoid their exposure; thus, its adverse effects are very certain. The literature present revealed that phthalate exposure has made alteration both to females and males, like reproductive alterations: including damaging the sperm quality, semen concentration and sperm DNA, breast cancer in females, AGD, endocrine disruption. The phthalate exposure has been shown to alter the behavior, which is an indication of nervous system damage. Phthalate exposure has been revealed to affect the respiration. Phthalate after exposure has been found to get metabolized in various end points and their detection by various techniques has made an insight towards understanding the mechanism of phthalates toxicity. Phthalates both of low and high molecular weight have found their way to fauna and created a mess with the physiology of animals or humans. Thus, precaution is better, as said prevention is better than cure. The suggestive remedy for phthalate exposure is to make less use of products that contain phthalate material, more importantly*

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during pregnancy and developmental stage of infants. Utmost care has been taken in regard to the literature cited. The data included in this chapter has been taken from those research articles with indexing of Science Citation Index Expanded, Scopus as for authenticity, and also using the Web of Science Database, which provides interactive citation.

### **INTRODUCTION**

Phthalates (common name) are group of manmade chemicals regarded as heroes which have profound application in industries, medical, automotive and consumer product industries (US Department of Health and Human Services Centers for Disease Control and Prevention, 2013) belongs to diesters of 1, 2-benzenedicarboxylic acid (phthalic acid). They are mainly used as plasticizer to impart flexibility to polyvinylchloride (PVC) (ATSDR, 1995; ATSDR, 1997; ATSDR, 2001; ATSDR, 2002). Phthalates being the family of industrial compounds have found its use in various products like perfumes, lotions, cosmetics, paints, medical devices, pharmaceuticals, flooring and wall coverings, food contact applications, and medical devices etc. (ATSDR, 1995; ATSDR, 1997; ATSDR, 2001; ATSDR, 2002; Blount *et al.*, 2000; Blount, 2000; CERHR, 2000; NTP-CERHR, 2000; Hauser *et al.*, 2004).

Phthalates may be of high molecular weight and of low molecular weight, which have found their existence in the manufacture of various products that are of daily use to humans and pose threat to non-occupational humans besides those working in the industries where phthalate based products are manufactured. Phthalates are now widely used and therefore it is difficult to avoid the exposure, thus its adverse effects are probably very certain.

Di (2-ethylhexyl) phthalate (DEHP), di-isononyl phthalate (DiNP), di-n-octyl phthalate (DnOP), butyl benzyl phthalate (BBzP) are some examples of high molecular weight phthalates that are used as plasticizers in polyvinyl chloride (ATSDR, 1997; David *et al.*, 2001; ATSDR, 2002; Wormuth *et al.*, 2006; Cao, 2010; USEPA, Zota *et al.*, 2014). Low molecular weight phthalates like diethyl phthalate (DEP) and dibutyl phthalate (DBP) have found their use as a solvent in daily usage products like perfumes, lotions, cosmetics, scent, to hold colour for personal care products (Duty *et al.* 2005; Sathyanarayana, 2008) and as plasticizers for making varnishes, lacquers etc., (ATSDR, 1995; ATSDR, 2001; David *et al.*, 2001).

Phthalate use has now become so abundant that it is very difficult to get rid of. Usage of it in daily products has led to an alarming condition and has resulted in various abnormalities both in animals and human beings. On investigation in laboratory animals Phthalates are now known to be carcinogenic causing injury of various vital organs like liver, testes and may cause malformations, reproductive toxicity, anti-androgenic activity and even fetal death (ATSDR, 1995; ATSDR, 1997; ATSDR, 2001; ATSDR, 2002; ATSDR, 2002, Valles *et al.*, 2003), while in humans carcinogenicity of phthalates is uncertain (IARC, 2000; Klaunig *et al.*, 2003; Latini *et al.*, 2004; Wilson *et al.*, 2004). With regard to some of its products it has been held responsible for causing male reproductive deformities, thus is reproductive toxicant (Gray *et al.*, 2000; Parks *et al.*, 2000; Ema, 2001).

Phthalates have also been involved in interfering the function of endocrine system (Damstra *et al.*, 2004; Sharpe and Irvine, 2004; Latini *et al.*, 2004), which are responsible for growth and sexual development of both males and females (Sharpe, 2001; Lovekamp-Swan and Davis, 2003). There is increasing evidence to indicate that environmental exposure to phthalates is associated with adverse effects on human fecundity (Swan, 2008; Meeker *et al.*, 2009).

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