EDITORIAL

Effects of Plastics on Human Health and Mechanisms of Action

Over the last few years, it is highlighted an existing problem related to the excessive and growing contamination by plastics, in particular, but not only dispersed on oceans which afflict on environmental healthy worldwide. In particular, the so-called Endocrine-Disrupting Chemicals (EDCs) affect on healthy of human and animal, respectively. Mainly EDCs are: polyurethane, polyethylene, phthalate, polypropylene, poly-vinylchloride, polycarbonate and Bisphenol A (BPA). The latter represents one of the world's major environmental pollutants, through which human individuals come into contact via different routes such as skin contact, inhalation and oral ingestion, thus, favoring the development of several pathologies.

This special issue, entitled “Effects of Plastics on Human Health and Mechanisms of Action”, includes a series of reviews highlighting the harmful effects of EDCs on the endocrine system, on the gut microbiota and on the immune system, which are mutually interconnected.

Sharif and associates [1] have elucidated the role of BPA in modulation of immune responses from animal models where an increase in pro-inflammatory cytokines and alteration of signalling pathways were observed. In particular, an increase in T helper (h)1 and Th17 lymphocytes and their related cytokines, a reduction on the expression of the nuclear transcription factor of Th2 lymphocytes, a reduction of regulatory T cells and an increase in prolactin secretion were detected. This latter event, on the one hand, increases the synthesis of pro-inflammatory Th1-dependent cytokines and, on the other hand, promotes the development of autoantibodies, thus, establishing a pro-inflammatory environment that exacerbates autoimmune diseases such as multiple sclerosis, systemic lupus erythematosus, rheumatoid arthritis and type 1 diabetes mellitus.

Lisco and associates [2] have conducted a narrative review in which the mechanisms of action of EDCs and their toxicity observed in vitro and in animal models were debated. In particular, toxic mechanisms EDCs-mediated such as receptor agonism and antagonism, modulation of hormone receptor expression, interference, epigenetic alteration, hormone synthesis, disturbance with hormone transport, distribution and catabolism were highlighted. The authors emphasise that epidemiological studies in humans need to be increased in order to observe the long-term effects of EDCs.

Schiesaro and associates [3] have examined the effects of EDCs on the male reproductive system. In particular, exposure to EDCs appears to be responsible for hypospadias, cryptorchidism, testicular cancer and male infertility. In fact, BPA acts as an androgen receptor antagonist, interfering with testosterone production at the testicular level. BPA may also affect the male reproductive system through the action of reactive oxygen species, increasing apoptosis of male gametes and reducing their proliferation. Epigenetic mutations due to EDCs and oestrogen and the anti-androgen hypothesis were discussed.

Giattanasio and associates [4] have discussed on the role exerted by EDCs on bone tissue in in vitro and animal studies. Since EDCS act as xeno-oestrogens, the results of studies focusing on hormonal imbalance, direct toxicity on osteoblasts and enhancement of osteoclast activity, leading to osteopenia or osteoporosis, have been reported. In conclusion, since EDCs interfere with bone remodelling and modulate hormone release, the age of first exposure and cumulative exposure to these substances over time is crucial further studies should be conducted to investigate the final effects on bone metabolism.

Charitos and associates [5] have highlighted the relationship between exposure to BPA and alterations of the gut microbiota in animals and humans, respectively. In fact, several animal studies have shown that BPA leads to an alteration of the gut microbiota, causing a condition of dysbiosis similar to those observed in humans affected by inflammatory bowel disease (IBD). Furthermore, intestinal bacterial alterations due to BPA exposure play an important role in local and systemic diseases, since BPA alters lipid and glycaemic metabolism, induces systemic immune imbalances, thus, contributing to the onset of obesity, type II diabetes mellitus and metabolic syndrome. Nowadays, the European Food Safety Authority has stated that the new reduced tolerable daily intake of EDCs value does not represent a risk to human health. Therefore, further clinical studies will be needed to verify the effects of long-term BPA exposure.

Lazurova and associates [6] have described the ability of EDCs to interfere with the immune system. Specifically, BPA would directly influence several immunological reactions and, its exposure would lead to loss of self-tolerance, thus facilitating the development and progression of autoimmune events. Emphasis has been placed on BPA's ability to induce DNA hypermethylation with significant consequences when exposure to it occurs in the prenatal or early postnatal period. Lastly, results obtained in animal and human studies have revealed a relationship between exposure to BPA and the occurrence of systemic autoimmune diseases, such as systemic lupus erythematosus and Sjögren's syndrome and organ-specific autoimmune diseases of the cardiovascular and central nervous systems, on IBDs and on thyroid.

Kalamarz-Kubiak [7] has highlighted the role played by EDCs in the aquatic ecosystem. The relationship between EDCs and their oestrogen-mimetic effects and the action of EDCs on the arginine vasotocin/isotocin (AVT/IT) system in fish was discussed. Further studies are needed on the effects of oestrogenic EDCs on the AVT/IT system and other hormones involved in the neuroendocrine regulation of physiological processes in fish.

Vandenberg and Pelch [8] have conducted systematic review methodologies with the aim of further evaluation of the real risk of BPA and other EDCs on human health. The authors reported result conducted in humans concerning the effects of EDCs...
on fertility in men and women, on the risk of miscarriage or preterm delivery, on metabolic and cardiovascular diseases, respectively, and on the immune system.

REFERENCES


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