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Fluorochemicals used in food packaging inhibit male sex hormone synthesis

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Background & Aim

Polyfluorinated alkyl phosphate surfactants (PAPS) are widely used in food contact materials (FCMs) of paper and board and have recently been detected in 57% of investigated materials. Human exposure occurs as PAPS have been measured in blood; however knowledge is lacking on the toxicology of PAPS. Metabolic products of PAPS, fluorotelomer alcohol (FTOH) and perfluorocarboxylic acids (PFCAs) have shown potential to interfere with the endocrine system and thus the aim of this study was to elucidate the effects of six fluorochemicals on sex hormone synthesis and androgen receptor (AR) activation in vitro. Four PAPS and two metabolites, perfluorooctanoic acid (PFOA) and 8:2 fluorotelomer alcohol (8:2 FTOH) were tested.

Results

Hormone profiles, including eight steroid hormones, generally showed that 8:2 diPAPS and 8:2 FTOH led to decreases in testosterone, dehydroepiandrosterone, and androstenedione in the H295R steroidogenesis assay. Decreases were observed for progesterone and 17-OH-progesterone as well. None of the compounds showed effects in the AR reporter gene assay.

Conclusion

Overall, the results demonstrate that of the tested endpoints interference with steroidogenesis is the main target of the test compounds. Specifically, fluorochemicals used in food packaging and their metabolites can affect steroidogenesis through decreased Bzrp and increased CYP19 gene expression causing lower androgen and higher estrogen levels.

Materials and Methods

Materials and methods are described in detail in the paper Fluorochemicals used in food packaging inhibit male sex hormone synthesis. The tested compounds include 8:2 triPAPS, 10:2 PAPS, 8:2 diPAPS and 8:2 monoPAPS. Bzrp mRNA levels for 8:2 monoPAPS and 8:2 FTOH exposures indicating that this is a contributing factor to the decreased androgen and the increased estrogen levels.

Percentage changes in relative level of mRNA and n.s. indicates no statistically significant change were observed.

Cortisol, estrone and 17β-estradiol levels were in several cases increased with exposure. In accordance with these data CYP19 gene expression increased with 8:2 diPAPS, 8:2 monoPAPS and 8:2 FTOH exposures indicating that this is a contributing factor to the decreased androgen and the increased estrogen levels.

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