THE TOXICITY OF NEW GENERATION PFASs

A TOXIC-FREE FUTURE FACTSHEET
JANUARY 2018

Manufacturers are making claims about the low toxicity of new generation PFAS. But studies on these chemicals have found health effects similar to those caused by the older, partially phased-out compounds.

REPRODUCTIVE AND DEVELOPMENTAL TOXICITY

- PFBS showed reproductive and developmental effects in a laboratory study. Offspring of mice exposed prenatally to PFBS had delayed development and reproductive effects including disrupted reproductive cycles and impaired growth of the uterus and ovaries.[1]
- Prenatal exposure to PFBA in mice caused developmental delays and delayed onset of puberty, and more incidences of litter resorption (full litter loss).[2]
- Mice exposed to PFHxA suffered toxicity resulting in larger numbers of stillborn offspring and more dying shortly after birth.[3]

LIVER AND KIDNEY EFFECTS

The liver and kidney are known target organs for PFASs, and laboratory studies are finding new generation PFASs impact these organs as well.

- A 90-day study in rats peformed by Dupont scientists found increases in liver and kidney weights after exposure to PFHxA.[4]
- The same study found PFAS exposure resulted in lesions in the liver.[4]
- Mice exposed to 6:2 FTOH had increased kidney and liver weights as well as liver lesions.[5]
- A two-year industry-sponsored study of PFHxA-exposed rats found kidney degeneration was one of the most sensitive effects.[6]
- Laboratory animals exposed to PFHxA had significant changes in liver parameters, indicating damage to liver function.[7]

SYSTEMIC TOXICITY

- Laboratory animals exposed to 6:2 FTOH suffered convulsions, tremors, labored breathing, and death.[5]
- In a certified GreenScreen assessment, PFHxA was given a score of High for systemic toxicity based on reduced body weight at a single oral dose.[8]

ENDOCRINE DISRUPTION

- There is epidemiological and experimental evidence indicating several of the PFASs are associated with disrupted thyroid hormone signaling which is important for proper neurodevelopment .[9-12]
- Like PFOA, multiple new-generation PFASs activate a key nuclear receptor involved in lipid metabolism. They include PFBA, PFPeA, PFHxA, PFHpA, and PFBS.[13-15]
- Two precursor compounds, 4:2 FTOH and 6:2 FTOH, are estrogenic in laboratory tests .[13,16,17]

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REFERENCES

1. Feng, X.; Cao, X.; Zhao, S.; Wang, X.; Hua, X.; Chen, L.; Chen, L., Exposure of pregnant mice to perfluorobutanesulfonate causes hypothyroxinemia and developmental abnormalities in female offspring. Toxicol Sci 2017, 155, (2), 409-419.
2. Das, K.; Grey, B.; Zehr, R.; Wood, C.; Butenhoff, J.; Chang, S.-C.; Ehresman, D.; Tan, Y.-M.; Lau, C., Effects of perfluorobutyrate exposure during pregnancy in the mouse. Toxicol Sci 2008, 105, (1), 173-181.
3. Iwai, H.; Hoberman, A., Oral (gavage) combined developmental and perinatal/postnatal reproduction toxicity study of ammonium salt of perfluorinated hexanoic acid in mice. Int J Toxicol 2014, 33, (3), 219-237.
4. Loveless, S.; Slezak, B.; Serex, T.; Lewis, J.; Mukerji, P.; O'Connor, J.; Donner, E.; Frame, S.; Korzeiowski, S.; Buck, R., Toxicological evaluation of sodium perfluorohexanoate. Toxicology 2009, 264, 32-44.
5. Mukerji, P.; Rae, J.; Buck, R.; O'Connor, J., Oral repeated-dose systemic and reproductive toxicity of 6:2 fluorotelomer alcohol in mice. Toxicology Reports 2015, 2, 130-143.
6. Klaunig, J.; Shinohara, M.; Iwai, H.; Chengelis, C.; Kirkpatrick, J.; Wang, Z.; Bruner, R., Evaluation of the chronic toxicity and carcinogenicity of perflurohexanoic acid (PFHxA) in Sprague-Dawley Rats. Tox Path 2015, 43, 209-220.
7. Chengelis, C.; Kirkpatrick, J.; Rodovsky, A.; Shinohara, M., A 90-day repeated dose oral (gavage) toxicity study of perfluorohexanoic acid (PFHxA) in rats (with functional observational battery and motor activity determinations). Reproductive Toxicology 2009, 27, 342-351.
8. ToxServices LLC Perfluorohexanoic Acid (CAS #307 24-4) GreenScreen for Safer Chemicals (GreenScreen®) Assessment; Washington, D.C., 2016.
9. Li, Y.; Cheng, Y.; Xie, Z.; Zeng, F., Perfluorinated alkyl substances in serum of the southern Chinese general population and potential impact on thyroid hormones. Scientific Reports 2017, 7, 43380.
10. Shah-Kulkarni, S.; Kim, B.-M.; Hong, Y.-C.; Kim, H.; Kwon, E.; Park, H.; Kim, Y.; Ha, E.-H., Prenatal exposure to perfluorinated compounds affects thyroid hormone levels in newborn girls. Environ Int 2016, 94, 607-613.
11. Vongphachan, V.; Cassone, C.; Wu, D.; Chiu, S.; Crump, D.; Kennedy, S., Effects of perfluoroalkyl compounds on mRNA expression levels of thyroid hormone-responsive genes in primary cultures of avian neuronal cells. Toxicol Sci 2011, 120, (2), 392-402.
12. Ballesteros, V.; Costa, O.; Iñiguez, C.; Fletcher, T.; Ballaster, F.; Lopez-Espinosa, M.-J., Exposure to perfluoroalkyl substances and thyroid function in pregnant women and children: a systematic review of epidemiologic studies. Environ Int 2017, 99, 15-28.
13. Rosenmai, A.; Taxvig, C.; Svingen, T.; Trier, X.; van Vugt-Lussenburg, B.; Pedersen, M.; Lesné, L.; Jégou, B.; Vinggard, A., Fluorinated alkyl substances and technical mixtures used in food paper-packaging exhibit endocrine-related activity in vitro. Andrology 2016, 1-11.
14. Ishibashi, H.; Kim, E.-Y.; Iwai, H., Transactivation potencies of the Baikal seal (Pusa sibirica) peroxisome proliferator-activated receptor αby perfluoroalkyl carboxylates and sulfonates: estimation of PFOA induction equivalency factors. Environ Sci Technol 2011, 45, 3123-3130.
15. Wolf, C.; Schmid, J.; Lau, C.; Abbott, B., Activation of mouse and human peroxisome proliferator-activated receptor-alpha (PPARα) by perfluoroalkyl acids (PFAAs): further investigation of C4-C12 compounds. Reproductive Toxicology 2012, 33, 546-551.
16. Ishibashi, H.; Yamauchi, R.; Matsuoka, M.; Kim, J.; Hirano, M.; Yamaguchi, A.; Tominaga, N.; Arizono, K., Fluorotelomer alcohols induce hepatic vitellogenin through activation of the estrogen receptor in male medaka (Oryzias latipes). Chemosphere 2008, 7, (10), 1853-9.
17. Maras, M.; Vanparys, C.; Muylle, F.; Robbens, J.; Berger, U.; Barber, J.; Blust, R.; De Coen, W., Estrogen-like properties of fluorotelomer alcohols as revealed by MCF-7 breast cancer cell proliferation. Environ Health Perspect 2006, 114, (1), 100-105.