SciMedCentral

Journal of Pharmacology & Clinical Toxicology

Editorial

What's in our water supply?

David R. Luthin*

Associate Professor of Pharmaceutical Sciences, McWhorter School of Pharmacy, Samford University, USA

***Corresponding author**

David R. Luthin, Ph.D. Associate Professor of Pharmaceutical Sciences, McWhorter School of Pharmacy, Samford University, 800 Lakeshore Drive, Birmingham, AL 35229, Office: (205)726-4223, Fax: (205)726-2088, Email: drluthin@samford.edu

Submitted: 03 July 2013

Accepted: 21 July 2013

Published: 26 August 2013

The presence of pharmaceuticals in the water supply has been reported since the 1970's [1] and yet, there is little monitoring or regulation of the water supply with respect to concentrations of various pharmaceutical agents. Since some agents may persist due to continuous discharge from treatment facilities, they need to be continuously monitored throughout the seasons. Waste water treatment facilities are not designed nor regulated on their ability to remove pharmaceuticals from influents. An average of 100 pharmaceutical and personal care products have been routinely detected in U.S. municipal drinking water supply [2]. The most commonly detected agents include: synthetic hormones, antibiotics, blood lipid regulators, blood pressure medicines, pain medications, antidepressants and seizure medications [3]. Since these pharmaceutical agents are designed to be active at very low concentrations, it follows that even though some of these may be found in concentrations as low as ng/mL or parts per trillion (ppt), they may still have biological activity or effects after chronic exposure. Of particular concern are synthetic or naturally-occurring steroid hormone agents such as those found in oral contraceptives and also released to the environment by other sources such as livestock feedlots, and paper mills [4]. These types of agents have been referred to as "endocrine disrupting compounds" or EDCs and have potential to have important effects not only in humans that consume them, but also in the fish and other fauna in the environment. In fish, work from investigators at Samford University found that progesterone contaminants from paper mills were shown to be converted in the environment to androgenic agents that had the effect to masculinize feminine fish. On outward appearance, the fish appeared to be predominantly males; however, some were actually shown to be pregnant females [5-8]. Others [9] have shown feminization of various fish species living downstream of waste-water treatment facilities that included altered sex ratios, "intersex" characteristics (ie. both female and male features), reduced gonad size, and disrupted testicular and ovarian development. The sources of estrogens in the environment are numerous and include oral contraceptives and hormone replacement therapy and importantly, sources of natural estrogens from livestock and even plant sources [4]. In addition, industrial sources such as soy-processing facilities may contribute a number of plant estrogens known as "phytoestrogens" [4]. One study of 19 industrial wastewater streams in Minnesota and Iowa found plant estrogens at levels of 250 times higher than required for the feminization of fish [10]. In human raw sewage, naturally-occurring 17-β-estradiol (E2) levels range from 0.5-125 ng/L, whereas animal waste may range from 30-2500 ng/L [11]. Surface runoff from grasslands in Arkansas that had been sprinkled with poultry waste had E2 levels of 3500 ng/L [12]. It is therefore imperative that effluent from waste water plants be monitored and the effects of contamination on fish and potential harm to humans determined.

ACKNOWLEDGEMENTS

This work was supported by a Samford University Faculty Development Grant (FDG043).

REFERENCES

1. Brun GL, Bernier M, Losier R, Doe K, Jackman P, Lee H. Pharmaceutically-active compounds in Atlantic Canadian sewage treatment plant effluents and receiving waters, and potential for environmental effects as measured by acute and chronic aquatic toxicity. Environ. Toxicol. Chem. 2006 25(8):2163-2176.
2. Kreisberg J. There is medicine in these waters. Symbiosis J. 2006; 4(1):4-7.
3. Kreisberg J. Pharmaceutical pollution: ecology and toxicology. Symbiosis J. 2007; 4(2):5-13.
4. Wise A, O'Brien K, Woodruff T. (2011) Are oral contraceptives a significant contributor to the estrogenicity of drinking water? Environ. Sci.Toxicol. 2011; 45:51-60.
5. Carson JD, Jenkins RL, Wilson EM, Howell WM, Moore R Environ. Toxicol. Chem. 2008; 27:1273-1278.
6. Jenkins RL, Wilson EM, Angus RA, Howell WM, Kirk M. (2003). Androstenedione and progesterone in the sediment of a river receiving paper mill effluent. Toxicol. Sci. 2003; 73:53-59.
7. Jenkins RL, Wilson EM, Angus RA, Howell WM, Kirk M, Moore R, Nance M, Brown A. Production of androgens by microbial transformation of progesterone in vitro: a model for androgen production in rivers receiving paper mill effluent. Environ. Health Persp. 2004; 112:1508-1511.
8. Raloff J. Macho Waters: some river pollution spawns body-altering steroids. Science News 2001; 159:8-10.
9. Vajda AM, Barber L, Gray J, Lopez E, Woodling J, Norris D. Reproductive disruption in fish downstream from an estrogenic wastewater effluent. Environ. Sci. Toxicol. 2006; 42(9):3407-3414.
10. Lundgren M, Novak P. Quantification of phytoestrogens in industrial waste streams. Environ. Toxicol. Chem. 2009; 28:2318-2323.
11. Combalbert S, Hernandez-Raquet G. Occurrence, fate and biodegradation of estrogens in sewage and manure. Appl. Microbiol. Biotechnol. 2010; 86:1671-1692.
12. Nichols DJ, Daniel TC, Moore PA, Jr., Edwards DR, Pote DH. Runoff of estrogen hormone 17-estradiol from poultry litter applied to pasture. J. Environ. Qual. 1997; 26:1002-1006.

Cite this article

Luthin DR (2013) What's in our water supply? J Pharmacol Clin Toxicol 1(1): 1002.