Effects of BPA and Alternatives on Human Health Concerning the NFLPA

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To Whom It May Concern:

My name is Jeremy Martell. I am a senior biology major at St. John Fisher College in Rochester, New York. I am particularly interested in the healthcare field of biology and I plan to become a physician assistant in the coming years. I am writing this letter as a project for my reproductive biology course. As a little background I am an avid fan of the NFL. I have been a Miami Dolphins fan my entire life and I watch every game religiously. St. John Fisher College is even the home of the annual Buffalo Bills training camp. As a fan, I am concerned with the health and well being of all NFL players. Given the increased attention to new health and safety rules throughout the past few years, I felt now a better time than any to bring to your attention another area of concern.

Bisphenol A (BPA) is polymer commonly used as an additive in the production of thermal receipt paper, epoxy resins, and plastic containers. Within the past few decades, it has come to the attention of the public that BPA is an endocrine disrupting compound. These are chemicals that, at certain doses, can interfere with the endocrine (or hormone) system in mammals. [4] They can lead to a variety of neurological and developmental effects that are a danger to human health. Given this increased publicity, manufacturers of beverage containers have generals stopped the use of BPA. Although there are no legal measures taken against it, many bottles will have a disclaimer on them that reads “BPA-
free”. Given that athletes use plastic beverage containers regularly, I felt the NFLPA might be concerned with this particular topic. Now as I have stated, manufacturers no longer commonly use BPA in the production process. However, a replacement chemical is obviously needed to because it was essential to the production of these plastics. Throughout the past decade Bisphenol S (BPS) and Bisphenol F (BPF) have began implementation as claimed safe alternatives to BPA. [6] Unfortunately, researchers have found very similar endocrine disrupting effects in these two compounds. With this said, I feel it may be important to determine if NFL players are being exposed to these compounds on a frequent basis.

The way these compounds work is fairly simple. The 18-carbon containing hormone estrogen is synthesized by removing a carbon atom from a 19-carbon containing group of hormones called androgens (a common example of an androgen is testosterone). [10] This is performed through interaction of androgens with an enzyme called aromatase. Aromatase, through a series of biochemical reactions, removes a carbon from an androgen to form estradiol (crude estrogen). When any of these bisphenol compounds enters the body, they trigger an alternative action pattern for aromatase and therefore cause estrogen to be produced at times and places it normally wouldn't be. [7,9] This results in a myriad of health implication in the human body. In the brain, neural circuitry can be altered in a way that affects many downstream pathways. Obesity, sexual dysfunction, thyroid problems and multiple forms of cancer are just a few of the many possible health risks posed by these chemicals. [5,8]
In the next section of this letter, I would like to discuss important findings about these chemicals referenced from primary research articles. In this first article, the effects of low-dose exposure to BPA were tested on developing zebrafish. Zebrafish are a known human model for embryonic development and are used in a wide range of studies. The developmental cycle of this model closely resembles that of humans, which is why it was the organism of choice in this study. These zebrafish embryos were subjected to 0.0068 μM concentration of BPA, 1,000-fold lower than the accepted human daily exposure amount, and the results were observed. The birth of new neuron cells in the hypothalamus was measured along with the subsequent hyperactivity of the larvae was monitored during three periods: 10-16 hours post-fertilization (hpf), 16-24hpf, and 24-36hpf. Overall, a significant increase in hypothalamus cell birth was noted in each time period resulting in an overall 180% increase in hyperactivity. This hyperactivity lasted into adulthood long after initial exposure to BPA. In order to compare these effects with BPS, the same experiment was conducted using BPS instead. In this experiment, BPS also resulted in a significant increase in the birth of hypothalamus neuronal cells resulting in a 240% increase in hyperactivity. This shows that not only does BPS possess similar endocrine disrupting abilities to BPA, but it may actually have a more significant impact on overall health. [2]

In another study involving zebrafish, adult zebrafish pairs were exposed to 0.5, 5, and 50 μg/L of BPS for 21 d, and the effects on reproduction, sex steroid hormones, and transcription of the genes belonging to the hypothalamic-pituitary-gonad (HPG) axis were investigated. The effects on the pair’s offspring without further exposure to BPS were also recorded in this study. It was found that in the 0.5 and 5 female groups, egg production
were significantly decreased. In all male groups, a significant decrease in blood plasma testosterone levels was observed. In all of the male and female groups, blood plasma levels of estradiol (estrogen) were significantly increased compared to the control. Finally, BPS exposure of the parental generation resulted in delayed and incomplete hatching rates of their offspring. With these results in mind, it is clear that BPS has significant health implications in both males and females. Even more astonishingly, the offspring of these zebrafish were affected by their parent’s exposure to BPS. [1]

In a final study, two different lines of human cell assays were cultured in the presence of 14 different plastic resins labeled as BPA-free. These plastics were either unstressed, autoclaved (extreme heat and temperature), microwaved, or UV radiated (to represent high exposure to sunlight). 4 out of 14 types plastics studied, including one type of polystyrene plastic and three types of Tritan™ plastic resins, leached chemicals having significant levels of estrogenic activity. [3]

Given these three studies out of the vast majority of others that exist, it is clear that BPA and its replacement compounds such as BPS pose serious health risks to humans. With nearly no regulation of these chemicals in the United States by the FDA, it is almost certain that we are being subjected to their exposure on a daily basis. As I pointed out earlier, NFL players likely have a higher amount of exposure to these chemicals than the average citizen. I would like to make it clear that I am not seeking any sort of recognition or compensation for this letter. I am simply a fan concerned with the wellbeing of all members of the NFL. It is my hope that at the very least, this information is kept in mind when teams purchase beverage containers for their players in order to keep them as safe as
possible. I genuinely appreciate your time in reading this letter and wish the best of luck to the NFL in the coming season.

Sincerely,

Jeremy Martell
References


