Reproductive Toxicology 33 (2012) 120–121

Contents lists available at SciVerse ScienceDirect

Reproductive Toxicology

journal homepage: www.elsevier.com/locate/reprotox

Letter to the Editor

Comment: Aris and Leblanc "Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada"

To the Editor

We have reviewed the publication of Aris and Leblanc entitled *Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada* [1], and wish to provide comment. The study has also been the subject of a regulatory review (FSANZ) which reached conclusions similar to our own [2].

Findings for glyphosate and AMPA are consistent with previous publications [3,4], and levels detected are consistent with intakes far below any level of concern [3]. Glyphosate has not demonstrated reproductive or developmental toxicity in repeated mammalian studies [5]. The recent inclusion of glyphosate in Tier-1 endocrine disrupter screening [6] is the result of exposure potential, not evidence of endocrine disruption as implied by Aris and Leblanc.

Attempts to detect Cry proteins in the blood of GM-fed animals have been limited by methodological challenges and commercial immunoassay kits (as used in this study) did not produce valid results in porcine blood [7]. An assay system validated for use in bovine blood [8] failed to detect Cry1Ab (LOD 1 ng/mL) despite very much higher intake (as % diet or per kg body weight) than humans, making assay validation essential. The authors did not provide validation information for the Cry1Ab assay in human blood. A standard curve was said to span a range of 0.1–10 ng/mL, but no statistical limit of detection is reported. It appears that the authors have reported all signals above baseline as confirmed "detects", despite the fact that many samples have concentrations below the likely detection limit of this assay system based on our own experience. Thus, the number of Cry1Ab detects is likely overstated, probably significantly.

The antibody in the Agdia immunoassay kit is known to bind to other cry proteins, and can also bind to fragments derived from the intact protein [9,10]. While protein digestion and absorption primarily takes place as mono to tri-peptides, small quantities of proteins or larger protein fragments are absorbed as a part of normal human physiology [11].

Cry1Ab and related proteins (which may interact in this assay system) are widely used in organic agriculture on foods intended for direct human consumption [12]. Cry1Ab is present in GM maize intended primarily for animal feed and processing to food ingredients (corn syrup, starch, etc.), and human consumption is expected to be quite low. Further, very little corn is consumed by humans in a raw state, and cooking denatures Cry1Ab protein eliminating its biological (insecticidal) activity [13].

Although we believe that the reported rate of detection is elevated, it is possible that Cry1Ab (or fragments) can be found in some individuals with a sufficiently high intake and sensitive assay system. This must be put in proper perspective. Cry proteins as a class are exempt from tolerance (i.e. no maximal intake levels were set), indicating that any potentially achievable exposure raises no safety concern [14]. The no-effect level for purified Cry1Ab in acute animal testing is 4000 mg/kg (highest level tested). For a theoretical 50 kg female, this is the equivalent of 200,000,000 μg of Cry1Ab protein. Detection of 1 ng/mL of Cry1Ab in the blood of a 50 kg female (assuming 20% extracellular fluid volume, as proteins generally do not distribute intracellularly) is crudely equivalent to 10 μg of total Cry1Ab – 20-million times less than a dose which has no discernable effect.

In short, results for glyphosate are unsurprising and raise no health concerns. Detections of Cry1Ab appear to be over-reported. Based upon the limited intake of Cry1Ab and the fact that little protein is absorbed intact, reported detections may be technical artifacts and at best represent protein fragments in addition to intact protein – the vast majority of which are expected to be biologically inactive after processing. Cry1Ab has been subjected to extensive safety assessment [15] accounting for human exposure with a large margin of safety. Contrary to Aris and Leblanc, available traits are approved for human consumption, even if not the primary intent of cultivation. Mammalian toxicity has not been demonstrated with Cry1Ab or related Cry proteins, and all of the women and infants were normal. The reported findings, even if they should prove to be correct, raise no safety concerns.

The authors are full-time employees of Monsanto company, a manufacturer of products incorporating glyphosate and Cry1Ab.

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21 June 2011
Available online 30 October 2011