

Maternal and Foetal Exposure to Pesticides Associated to Genetically Modified Foods in Eastern Townships of Quebec, Canada



Study Summary and Demand for Urgent Regulatory Action

May 2011

This is a summary by GM Freeze of the study “Maternal and Foetal Exposure to Pesticides Associated to Genetically Modified Foods in Eastern Townships of Quebec, Canada”, followed by our demand for political action to halt cultivation and imports based on findings of whole Bt proteins in human blood, which contradicts assurances from regulators that have always maintained the toxic Bt protein in GM crops is broken down during digestion.

Study authors: Aziz Aris and Samuel Leblanc, University of Sherbrooke Hospital Centre, Sherbrooke, Quebec, Canada.

Study status: Accepted for publication as peer reviewed paper for the journal *Reproductive Toxicology*.

Study methodology

The researchers investigated the levels of three pesticides associated with genetically modified food in the blood of two groups of women – 30 pregnant women and 39 non-pregnant but fertile women, all of a similar age and body mass index.

Blood sample were taken as follows:

- Pregnant women before delivery.
- Umbilical cord blood after birth.
- Non-pregnant women during sterilisation procedures.

No subject had worked with, or lived with a spouse working in contact with, pesticides.

The diet of the women in the study is typical of the middle-class population of Western industrialized countries. A food market basket, representative for the general Sherbrooke population, contains various meats, margarine, canola oil, rice, corn, grain, peanuts, potatoes, fruits and vegetables, eggs, poultry, meat and fish. Beverages include milk, juice, tea, coffee, bottled water, soft drinks and beer. Most of these foods come mainly from the province of Quebec, the rest of Canada and the United States of America. No attempt was made to quantify the levels of pesticides associated with GM foods in the diets of the subjects.

The researchers stated, “Given the widespread use of GM foods in the local daily diet (soybeans, corn, potatoes), it is conceivable that the majority of the population is exposed through their daily diet.”

Blood Analysis

The following were sampled for:

- Glyphosate and its metabolite aminomethyl phosphoric acid (AMPA) – glyphosate (marketed as Roundup by Monsanto) is widely sprayed on Roundup Ready GM crops genetically modified to be used with it, including soybeans, maize, cotton and canola (oilseed rape).
- Glufosinate and its metabolite 3-methylphosphinopropionic acid (3-MPPA) – glufosinate (marketed as Liberty by Bayer) is widely sprayed on Liberty Link GM crops genetically modified to be used with it, including maize, cotton, soybeans and canola (oilseed rape).

- Cry1Ab protein (a Bt toxin) – genetically engineered into maize and cotton to help them resist attack by moth larvae (Lepidoptera species).

Study results

Table 1: Presence in blood serum and foetal cord serum in nanograms/millilitre(ng/ml)

	Pregnant women (n=30)	Foetal cord (n=30)	Non-pregnant women (n=39)
Glyphosate	nd	nd	nd-93.6 (5%)
AMPA	nd	nd	nd
Glufosinate	nd	nd	nd-53.6 (18%)
3-MMPA	21.9-417 (100%)	8.76-193 (100%)	nd-337(67%)
Cry1Ab Bt toxin	nd-1.5 (93%)	nd-0.14 (80%)	nd-2.28(69%)

nd = not detectable

Significance

This is a groundbreaking study which shows that three pesticides associated with GM crops and food have been detected in human blood serum in women not associated with the use of the pesticides or GM crops. 3-MMPA, the metabolite of glufosinate/Liberty, and the Cry1Ab toxin crossed the placenta and would have been in the blood of the growing foetus.

Yet more evidence

There is growing concern about the toxicity of glyphosate and glufosinate, particularly as GM herbicide tolerance means they can be applied directly to growing crops, increasing the chances residues being present in food.

The detection of the Bt toxin Cry1Ab is very significant. Previous studies and advice from food safety agencies (like the European Food Safety Authority and UK Food Standards Agency, EFSA and the FSA) have always maintained that this toxic protein is broken down during digestion of GM food, and only GM DNA has previously been found in the blood/tissues of farm animals. This study suggests that the whole protein, not just pieces of DNA, has survived in the human gastric tract and passed into human blood, a complete contradiction of current safety advice on GM foods. Concerns have been expressed about the potential allergenicity of Bt proteins, as well as other potential toxic effects on internal organsⁱⁱ.

Food safety failures

The FSA has relied on EFSA's opinion in developing its advice concerning GM protein in animal products such as meat and milk:

“Transfer of GM material from feed

“There have been some concerns that functional transgenes from GM-derived feed materials might be incorporated into livestock products for human consumption (milk, meat and eggs).

“Biologically active genes and proteins are common constituents of food and feed, but digestion in both animals and humans is known to rapidly degrade their DNA, and the subsequent uptake of DNA fragments from the intestinal tract into the body is a normal physiological process.

“In a statement published on 20 July 2007, EFSA advised that 'a large number of experimental studies with livestock have shown that recombinant DNA fragments or proteins derived from GM plants have not been detected in tissues, fluids or edible products of farm animals such as broilers, cattle, pigs or quails'.

“When reviewing the issue later the same year, EFSA noted that 'the recombinant sequence

is present in the GM plant only as a single or low copy number, which makes the potential absorption a rare event and therefore difficult to detect', and that 'when more studies are carried out with more sensitive detection methods, such recombinant DNA fragments may be more frequently found in the future'. It is therefore possible that DNA fragments derived from GM plant materials may occasionally be detected in animal tissues, in the same way that DNA fragments derived from non-GM plant materials can be detected in these same tissues. EFSA also noted that 'no technique is currently available to enable a valid and reliable tracing of animal products (meat, milk, eggs) when the producer animals have been fed a diet incorporating GM plants'."

See www.food.gov.uk/gmfoods/gm/gmanimal, downloaded 13 May 2011

Prior to the FSA issuing this advice there were a number of studies that found GM DNA fragments in the blood of animals fed GM crops:

- Mazza R., Soave M., Morlacchini M., Piva G. and Marocco A., 2005 "Assessing the transfer of genetically modified DNA from feed to animal tissues", *Transgenic Res.*, vol. 14, pp. 775–784.
- Alexander, T.W., Reuter, T., Aulrich, K., Sharma, R., Okine, E.K., Dixon, W.T., and McAllister, T.A. (2007). A review of the detection and fate of novel plant molecules derived from biotechnology in livestock production., *Animal Feed Science and Technology*, 133(1-2), pp. 31-62.
- Agodi A., Barchitta M., Grillo A. and Sciacca S., 2006. Detection of genetically modified DNA sequences in milk from the Italian market, *Int J Hyg Environ Health*, vol. 209, pp. 81–88.

These support the new study on human blood serum rather than the FSA/EFSA opinion.

The Canadian data raises question about why such studies have not be covered by the applicants for Bt crops or demanded by regulators. This is a failure of both hazard identification and hazard characterisation the regulators of the EU need to urgently address.

Cry1Ab Toxin in the European Union

One of two GM crops approved for cultivation in the EU is genetically modified to produce the Cry1Ab toxin – the Bt maize Mon810 licensed to Monsanto and mainly grown in Spain. The other GM crop authorised for cultivation in the EU is the GM potato Amflora (grown on a very limited scale, 17 hectares in two countries in 2011), genetically modified to produce a starch used for non-food industries (not Bt toxin production), but the pulp would be fed to livestock in the food chain.

A number of GM crops are imported to the EU, primarily for use in animal feed, but also in labelled GM foods. The table below shows the GM glyphosate tolerant, glufosinate tolerant and Bt (NB several different Bt proteins are present in these) crops are approved for import for food/feed use in the EU.

Furthermore 58 GM crops in the authorisation pipeline are genetically modified with either a form of Bt gene, glyphosate or glufosinate tolerance or stacked (multiple mixed) insect resistance (Bt) and herbicide tolerance. Maximum residue levels for glyphosate are higher for crops sprayed directly with the herbicide, such as RR (RoundUp Ready) GM crops, and crops where glyphosate is permitted to be used to desiccate the crop prior to harvest.

Table 2: GM crops imported to the EU

GM Crop	Glufosinate tolerant	Glyphosate tolerant	Insect resistant (Bt)	Stacked Bt and glyphosate/glufosinate tolerance
Cotton	1	-	5	-
Maize	1	2	7	12
Oilseed rape	1	1	-	-
Soybeans	1	1	-	-
Sugar beet	-	1	-	-

GM Freeze conclusions and recommendations

The research by Aziz and Leblanc throws serious doubts over the advice from EFSA and the FSA on the survival of GM protein in the gut – it is no longer valid and needs to be urgently reviewed.

In the meantime the import and cultivation of all Bt crops should be suspended pending a review of safety for humans exposed to Bt protein in food using the safeguard clause of Directive 2001/18 and Regulation 1829/03. Similarly the license to cultivate Mon810 should be suspended with immediate effect.

The safety of glyphosate and glufosinate needs to be swiftly reviewed under the Plant Protection Products Directive 91/414, and imports of all HT crops should be halted pending a thorough review of herbicide residues and exposure data and models. Given this new evidence that glyphosate can be detected in blood as a result of consuming a typical diet, it is totally unacceptable that the planned formal EU re-assessment of the safety of 39 pesticides has been postponed, allowing glyphosate to remain in use until at least December 2015ⁱⁱⁱ.

At present the authors make no linkage between the presence of pesticides associated with GM crops in human blood serum and any health effect. However, there is already enough concern about glyphosate, glufosinate and Bt proteins to justify the actions outlined above.

Notes

ⁱ Aziz A. and Leblanc S., 2010, *Reproductive Toxicology*, accepted 13 February 2011. Currently available online or from GM Freeze.

ⁱⁱ Seralini G-E., Mesnage R. Clair E., Greese S., Spiroux de Vendômois J.ann Cellier D., 2010. *Environmental Sciences Europe* 2011, 23:10 <http://www.enveurope.com/content/23/1/10>

ⁱⁱⁱ See www.europarl.europa.eu/sides/getDoc.do?type=WQ&reference=P-2010-010522&language=RO#def4 and <http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=P-2010-010522&language=RO#ref1>.