Genetically Modified Soy Diets Lead to Ovary and Uterus Changes in Rats

If you're still eating genetically modified (GM) soybeans and you plan on having kids, a Brazilian study may make you think again about what you put in your mouth. Female rats fed GM soy for 15 months showed significant changes in their uterus and reproductive cycle, compared to rats fed organic soy or those raised without soy. Published in The Anatomical Record in 2009, this finding adds to the mounting body of evidence suggesting that GM foods contribute to reproductive disorders (see summary at end).

Unlike women whose menstrual cycle starts automatically at puberty, female rats need to be "inspired." Their (estrous) cycle conveniently kicks in only after being introduced to male rats. Since no males were present in this study, the females fed organic soy or no soy were appropriately untriggered (diestrus). For some odd reason, however, those fed GM soy appeared to have their ovulation cycle in full gear.

Although the researchers did not perform a check on the estrous cycle directly, their microscopic analysis of ovaries and uterus tissue showed that the hormone-induced changes (i.e. early ovulation and formation of corpus luteum) were well underway. In addition, the lining of the uterus (endometrium) had more cells than normal and the glands were dilated. In simpler terms, according to senior UK pathologist Stanley Ewen, something in the GM soy diet was "wrecking the ovary and endometrium" of the rats.

Hormonal imbalance and disease risk

Dr. Ewen speculated on the significant hormonal changes in the rats and their implications for women who eat GM soy. He said that the proliferative growth (hyperplasia) of the (endometrial) cells lining the uterus implies changes in important reproductive hormones. There might include excessive production of estrogen, follicle stimulating hormone, and luteinizing hormone, or even damage to the pituitary gland itself.

The presence of the corpus luteum, which is normally formed during the estrous cycle, means that the rats likely have higher amounts of progesterone. This hormone could increase the number of eggs released from the ovary, as well as increase their tendency to implant and be viable. If eating GM soy increased progesterone in women, this might improve their fertility.

On the other hand, if women also experienced similar changes in the uterus lining and altered hormonal levels, Dr. Ewen said it might increase the risk of retrograde menstruation, in which menstrual discharge travels backwards into the body rather than through the uterus. This can cause a disease known as endometriosis, which may lead to infertility. The disorder can also produce pelvic and leg pain, gastrointestinal problems, chronic fatigue, and a wide variety of other symptoms. The cause is unknown.

Dr. Ewen also pointed out that the changes in the rats, if extrapolated to humans, might lead to abnormally heavy or longer menstrual periods (menorrhagia).

He was quick to point out that more studies are needed before any firm conclusions can be drawn, particularly because such a method of study, called histology, "is a static observation—only a snapshot." In addition, follow-up studies may be able to better rule out other variables. In this study, an amino acid (cysteine) was added only to the organic soy diet but not the GMO (although even a cysteine-deficient diet would not explain the reproductive issues). Also, the soybeans used in both...
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diets were purchased commercially. It is much better to use similar genetic varieties grown side by side in the same climatic conditions. Unfortunately, Monsanto doesn't usually make the similar varieties (isolines) available for research.

The variable that Dr. Ewen wants looked at the most is the weedkiller used on GM soybeans, as he mentioned over and over that it is a probable cause of the disruption.

Is Roundup herbicide causing us reproductive problems?

Genetically modified soybeans are called Roundup Ready. They are inserted with a bacterial gene, which allows the plants to survive a normally deadly dose of Roundup herbicide. Although the spray doesn't kill the plant, its active ingredient called glyphosate does accumulate in the beans themselves, which are consumed by rats, livestock, and humans. There is so much glyphosate in GM soybeans, when they were introduced Europe had to increase their allowable residue levels by 200 fold.

Although there is only a handful of studies on the safety of GM soybeans, there is considerable evidence that glyphosate—especially in conjunction with the other ingredients in Roundup—wreaks havoc with the endocrine and reproductive systems. "I think the concentration of glyphosate in the soybeans is the likely cause of the problem," says Ewen.

Glyphosate throws off the delicate hormonal balance that governs the whole reproductive cycle. "It's an endocrine buster," says Ewen, "that interferes with aromatase, which produces estrogen." Aromatase is required by luteal cells to produce hormones for the normal menstrual cycle, but it's those luteal cells that have shown considerable alterations in the rats fed GM soybeans.

Glyphosate is also toxic to the placenta, the organ which connects the mother to the fetus, providing nutrients and oxygen, and emptying waste products. In a 2009 French study at the University of Caen, scientists discovered that glyphosate can kill the cells in the outer layer of the human placenta (the trophoblast membrane), which in turn can kill the placenta. The placenta cells are, in Ewen's words, "exquisitely sensitive to glyphosate." Only 1/500th the amount needed to kill weeds was able to kill the cells. The amount is so small, according to the study authors the "residual levels to be expected, especially in food and feed derived from Roundup formulation-treated crops" could be enough to "cause cell damage and even cell death." Furthermore, the effect of the toxin may bioaccumulate, growing worse with repeated consumption from Roundup laden foods.

Ewen says, "If the endocrine functions of the placenta are destroyed by glyphosate in the test tube, by extrapolation, ovarian and endometrial function would be expected to suffer." The implications for pregnant woman consuming glyphosate, he says, could be abortion.

Indeed, in a Canadian epidemiological study, which looked at nearly 4000 pregnancies in 1,898 couples, women exposed to glyphosate during the three months before getting pregnant had a significantly higher risk of abortions, especially for those above 34 years of age.

Dr. Ewen regrets that he didn't follow up a referral by a local gynecologist about 20 years ago, who told him that women were having abortions when the fields next door were sprayed. He doesn't know what was sprayed.

Fathers exposed to glyphosate also increase reproductive risks

In the Canadian study above, even fathers who were exposed to glyphosate before their wives got pregnant showed an increase in early delivery and abortions. In addition, a study of male rabbits showed that glyphosate can cause a reduction in sexual activity and sperm concentration, and an increase in dead or abnormal sperm.

Birth defects increased in humans and animals

Numerous indigenous people and peasant communities in Argentina have blamed aerial spraying of Roundup on a significant rise of birth defects. Dr. Andreas Carasco of the Embryology Laboratory,
Faculty of Medicine in Buenos Aires, decided to investigate. He exposed amphibian embryos to a tiny concentration of glyphosate (diluted 5000 fold). According to an excellent summary of glyphosate-related effects by the Pesticide Action Network,

"Effects included reduced head size, genetic alterations in the central nervous system, increased death of cells that help form the skull, deformed cartilage, eye defects, and undeveloped kidneys. Carrasco also stated that the glyphosate was not breaking down in the cells, but was accumulating. The findings lend weight to claims that abnormally high levels of cancer, birth defects, neonatal mortality, lupus, kidney disease, and skin and respiratory problems in populations near Argentina's soybean fields may be linked to the aerial spraying of Roundup."

Although human embryos are not directly treated with glyphosate in the same way that Carrasco treated his amphibian embryos, it is known that glyphosate does cross the placenta and enters the fetal circulation.

In his article, Dr. Carrasco describes some disturbing findings in Argentina, where more than 50 million gallons of glyphosate-based herbicide is used on more than 45 million acres of GM soy.

In Argentina, an increase in the incidence of congenital malformations began to be reported in the last few years. In Córdoba, several cases of malformations together with repeated spontaneous abortions were detected in the village of Ituzaingo", which is surrounded by GMO-based agriculture. These findings were concentrated in families living a few meters from where the herbicides are regularly sprayed.

Glyphosate may also cause reproductive disorders in the offspring of those exposed. When pregnant rats, for example, were exposed to glyphosate, their male offspring suffered reduced sperm production, increased abnormal sperm, and decrease in testosterone, in puberty and/or adulthood.

Other evidence of reproductive problems from GMOs

The changes in the rat uterus and ovulation cycle are by no means a smoking gun. But they are now part of a pattern of multiple reproductive disorders found in GMO feeding studies. Professor Vyvyan Howard, a toxico-pathologist of the University of Ulster, says, "Several new hazards can now be identified." The growing body or research showing problems, he says, "provides ample evidence that the producers of GMO crops are not performing risk assessments for some of the hazards that independent scientists are identifying and testing." Dr. Howard, who specializes in the effects of toxins on the fetus and infants, asks, "What will be the effect on the fetus in the womb of women eating these foods? This needs to be tested."

The few tests that have been done on animals are more than sobering. In April 2010, researchers at Russia's Institute of Ecology and Evolution of the Russian Academy of Sciences and the National Association for Gene Security found that after feeding hamsters GM soy for two years over three generations, by the third generation most lost the ability to have babies. They also suffered slower growth, a high mortality rate among the pups, and a high incidence of a rare phenomenon of hair growing inside their mouths.

When I reported the results of the hamster study, I included the following review of other GMO-related reports of reproductive disorders:

In 2005, Irina Ermakova, also with the Russian National Academy of Sciences, reported that more than half the babies from mother rats fed GM soy died within three weeks. This was also five times higher than the 10% death rate of the non-GMO soy group. The babies in the GM group were also smaller (see photo) and could not reproduce.

In a telling coincidence, after Ermakova's feeding trials, her laboratory started feeding all the rats in the facility a commercial rat chow using GM soy. Within two months, the infant mortality facility-wide reached 55%.

When Ermakova fed male rats GM soy, their testicles changed from the normal pink to dark blue! Italian scientists similarly found changes in mice testes (PDF), including damaged young sperm cells.
Furthermore, the DNA of embryos from parent mice fed GM soy functioned differently.

An Austrian government study published in November 2008 showed that the more GM corn was fed to mice, the fewer the babies they had (PDF), and the smaller the babies were. Central Iowa Farmer Jerry Rosman also had trouble with pigs and cows becoming sterile. Some of his pigs even had false pregnancies or gave birth to bags of water. After months of investigations and testing, he finally traced the problem to GM corn feed. Every time a newspaper, magazine, or TV show reported Jerry's problems, he would receive calls from more farmers complaining of livestock sterility on their farm, linked to GM corn.

Researchers at Baylor College of Medicine accidentally discovered that rats raised on corncob bedding "neither breed nor exhibit reproductive behavior." Tests on the corn material revealed two compounds that stopped the sexual cycle in females "at concentrations approximately two-hundredfold lower than classical phytoestrogens." One compound also curtailed male sexual behavior and both substances contributed to the growth of breast and prostate cancer cell cultures. Researchers found that the amount of the substances varied with GM corn varieties. The crushed corncob used at Baylor was likely shipped from central Iowa, near the farm of Jerry Rosman and others complaining of sterile livestock.

In Haryana, India, a team of investigating veterinarians report that buffalo consuming GM cottonseed suffer from infertility, as well as frequent abortions, premature deliveries, and prolapsed uteruses. Many adult and young buffalo have also died mysteriously.

Biotech advocates usually deny or try to discredit the evidence, and often attack scientists who discover it. But they rarely call for follow-up studies. With little or no money to follow up on these findings, we won't know for sure if GMOs are the cause, or if it is glyphosate, or something else. But numerous medical doctors aren't waiting for more research. They are telling their patients, especially those pregnant or planning to have kids, just say no to GMOs.

So if you were still eating GMOs before you read this, perhaps it's time to take the doctors' advice.

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Jeffrey Smith

The world's leading consumer advocate promoting healthier non-GMO foods

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