

Why Genetically Modified Food Need Reconsideration Before Consumption?

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Introduction

With the advent of introducing genetic engineering in agricultural sciences and food production, food safety has become a major issue.^[1] The genetic content of the organisms is altered using these techniques that result into genetically engineered organism (plants/animals) also known as genetically modified organisms.

Human beings mainly depend upon plants for their food requirements therefore health issues related to genetically modified (GM) crops have become a major concern. The first GM plant or transgenic crop produced was tobacco in 1983, followed by the transgenic Flavr Savr tomato, which opened arenas in the field of crop biotechnology. Transgenic crops cater to the need of ever expanding human population as these have a variety of characteristics required for the purpose as these crops are resistant to diseases, environmental stresses, and increased nutritional value like golden rice as well as increased shelf life to name a few. Scientists are on the way of developing edible vaccines using bananas, potatoes, soybean, rice and legumes, etc. These vaccines are cost effective as well as easy to administer and store.^[2] However, what remains of main concern is the debate over the safety and ethical issues concerning such a crop plants. The safety assessment of GM food generally involves:

1. Direct health effects.
2. Tendency to provoke allergic reactions.
3. Specific component thought to have nutritional/toxic properties.
4. Stability of inserted genes.
5. Nutritional affects associated with genetic modifications.
6. Unintentional effect caused due to gene insertion.^[3]

List of risks is very long, but some major issues are discussed below:

Risk of genetically modified crops on fetus

It has been observed that GM crops, that produce *Bacillus thuringiensis* (Bt) toxin has an adverse effect on pregnant mice. Previously, a study has been carried out that showed the presence of orally ingested foreign deoxyribonucleic acid (DNA) in the rat fetus.^[4] The baby rat pups which were fed with GM crops appeared to be smaller in size when compared to control pups.^[5] Studies have shown that Cry1ab unmistakably seem to cross the placenta to the fetus that is dangerous, given the potential harmfulness of these natural contaminations and the delicacy of the fetus.^[6] It has been demonstrated in a study that Bt poisons are not dormant on nontarget human cells, and that they can cause symptoms with different buildups of pesticides particular to GM plants.^[7] Hence, screening methods for GM crops should be stringent and cover all the aspects of developmental stages of the fetus whether it is immunological response or development of internal as well as external organs.

Toxin producing plants

With the hope to protect the plants from pests, Bt crops were introduced which produces built in pesticide. Bt which is the organism from which it is extracted, though have a safe history, but the levels of toxin produced in the plants is predicted to have many side effects on human population. Before the advent of Bt crops, Bt spray was being used which in itself was considered to have toxin levels beyond the scope; which for the record was less toxic than the varieties now available with built in qualities.^[8] Studies in the past have confirmed that Bt toxin was sprayed over an area to kill gypsy moth, the people in the vicinity had severe allergic reaction induced, and few had to take medical aid in order to overcome it.^[9] Considerable increase in the concentration of Bt toxins in the environment has been noticed and caused some adverse effects on nontarget organisms.

There are reports showing some hematological risks to vertebrates through expression of the genes Cry1Aa, Cry1Ab,

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Cry1Ac or Cry2A and their toxic effects increase with long-term exposure.^[10] A study on four delta-endotoxins cry 1Aa, cry 1Ab, cry 1Ac, and cry 2A from Bt on zebrafish *Danio rerio* showed embryotoxicity and developmental delay after exposure to variable concentrations.^[11] Therefore, these microbiological control agents can't be considered to be safe for mammals without further studies.

Horizontal gene transfer to the microorganisms of the intestinal tract and antibiotic resistance

Horizontal gene transfer is the exchange of genes between living organisms in a way other than conventional multiplication. The extensive scale development of GM-plants, that is, on about 170 million hectares around the world,^[12] results in innumerable open doors for bacterial population to recombinant DNA and consequently, open doors for unintended level spread of transgenes.^[13] The phenomenon of horizontal gene transfer has been demonstrated both in the laboratory^[14,15] as well as natural conditions.^[16] There is a fear that the antibiotic resistance genes used as markers in GM crops could be transferred to microorganisms of the gastrointestinal tract (GIT)^[17] and microbial population of GIT can become resistant to antibiotics. A lot of studies have shown that risk of horizontal gene transfer and it may have risk to human health.^[18]

Allergic responses by genetically modified crops

The introduction of novel proteins into foods may elicit harmful allergic response in the body including hypersensitivity. For example Cry9C, a protein isolated from a common soil bacteria; *Bacillus thuringiensis* sp. *Tobworthi*, into StarLink corn, has been approved only for animal feed but not for human feed. The cry9C protein is not easily digestible indicating that it may trigger allergy in human beings.^[19] People with food allergies have fair chances to be affected by exposure to foreign proteins that are introduced into food through genetic engineering. GM foods can supply novel proteins into the food chain, from the organisms that are never part of food. Symptoms of these allergies might range from mild to fatal. There is a need for the rigorous evaluation of new GM crops depending upon cases, and more stringent screening methodologies are required.

Conclusion

Though GM crops promises to meet the world's food need and eliminate the world hunger and starvation, the potent harmful effects cannot be overlooked and these need to be taken seriously. The long term impact on the society cannot be overruled as it includes the health risk of all the people involved be it producers (farmers) or the consumers along with the scientists who are working in the laboratory. Hence, it is the need of the hour to reach and try for sustainable development that meets the needs of humans and the balance of nature maintained.

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