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A Study on Threats from Genetically Modified Food

Pavneet Kaur Khera

Abstract – Genetically modified foods have the potential to eliminate hunger and starvation in millions of people, especially in developing countries because the genetic modification can produce large amounts of foods that are more nutritious. Large quantities are produced because genetically modified crops are more resistant to pests and drought. They also contain greater amounts of nutrients, such as proteins and vitamins. However, there are concerns about the safety of genetically modified crops. The concerns are that they may contain allergenic substances due to introduction of new genes into crops. Another concern is that genetic engineering often involves the use of antibiotic-resistance genes as "selectable markers" and this could lead to production of antibiotic-resistant bacterial strains that are resistant to available antibiotics. This would create a serious public health problem. The genetically modified crops might contain other toxic substances such as enhanced amounts of heavy metals and the crops might not be "substantially equivalent" in genome, proteome, and metabolism compared with unmodified crops. Another concern is that genetically modified crops may be less nutritious; for example, they might contain lower amounts of phyto-estrogens, which protect against heart disease and cancer.

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INTRODUCTION

The term genetically-modified foods is most commonly used to refer to crop plants created for human or animal consumption using the latest molecular biology techniques. These plants have been modified in the laboratory to enhance desired traits such as increased resistance to herbicides or improved nutritional content. The enhancement of desired traits has traditionally been undertaken through breeding, but conventional plant breeding methods can be very time consuming and are often not very accurate. Genetic engineering, on the other hand, can create plants with the exact desired trait very rapidly and with great accuracy. For example, plant geneticists can isolate a gene responsible for drought tolerance and insert that gene into a different plant. The new genetically-modified plant will gain drought tolerance as well. Not only can genes be transferred from one plant to another, but genes from non-plant organisms also can be used. The best known example of this is the use of Bacillus thuringiens in corn and other crops. Bacillus thuringiens, is a naturally occurring bacterium that produces crystal proteins that are lethal to insect larvae. Bacillus thuringiens crystal protein gens have been transferred into corn, enabling the corn to produce its own pesticides against insects such as the European corn borer.

REVIEW OF LITERATURE:

The review of available literature indicates that the genetically modified crops available in the market that are intended for human consumption are generally not safe; their consumption is not associated with serious health problems. However, because of potential for exposure of a large segment of human population to genetically modified foods, more research is needed to ensure that the genetically modified foods are safe for human consumption.

According to the FDA and the United States Department of Agriculture (USDA), there are over 40 plant varieties that have completed all of the federal requirements for commercialization. Some examples of these plants include tomatoes and cantaloupes that have modified ripening characteristics, soybeans and sugar-beets that are resistant to herbicides, and corn and cotton plants with increased resistance to insect pests. Not all these products are available in supermarkets yet; however, the prevalence of genetically-modified foods in U.S. grocery stores is more widespread than is commonly thought. While there are very, very few genetically-modified whole fruits and vegetables available on produce stands, highly processed foods, such as vegetable oils or breakfast cereals, most likely contain some tiny percentage of genetically-modified ingredients because the raw ingredients have been pooled into one processing stream from many different sources. Also, the ubiquity of soybean derivatives as food additives in the modern American diet virtually ensures that all U.S. consumers have been exposed to genetically-modified food products.

Thirteen countries grew genetically-engineered crops commercially in 2000, and of these, the U.S. produced the majority. In 2000, 68% of all GM crops

were grown by U.S. farmers. In comparison, Argentina, Canada and China produced only 23%, 7% and 1%, respectively. Other countries that grew commercial genetically-modified crops in 2000 are Australia, Bulgaria, France, Germany, Mexico, Romania, South Africa, Spain, and Uruguay.

Soybeans and corn are the top two most widely grown crops (82% of all GM crops harvested in 2000), with cotton, rapeseed (or canola) and potatoes trailing behind. 74% of these genetically-modified crops were modified for herbicide tolerance, 19% were modified for insect pest resistance, and 7% were modified for both herbicide tolerance and pest tolerance. Globally, acreage of genetically-modified crops has increased 25-fold in just 5 years, from approximately 4.3 million acres in 1996 to 109 million acres in 2000 - almost twice the area of the United Kingdom. Approximately 99 million acres were devoted to genetically-modified crops in the U.S. and Argentina alone.

In the U.S., approximately 54% of all soybeans cultivated in 2000 were genetically-modified, up from 42% in 1998 and only 7% in 1996. In 2000, genetically-modified cotton varieties accounted for 61% of the total cotton crop, up from 42% in 1998, and 15% in 1996. genetically-modified corn and also experienced a similar but less dramatic increase. Corn production increased to 25% of all corn grown in 2000, about the same as 1998 (26%), but up from 1.5% in 1996. As anticipated, pesticide and herbicide use on these genetically-modified varieties was slashed and, for the most part, yields were increased.

THREATS FROM GENETICALLY MODIFIED FOOD

Environmental activists, religious organizations, public interest groups, professional associations and other scientists and government officials have all raised concerns about GM foods, and criticized agribusiness for pursuing profit without concern for potential hazards, and the government for failing to exercise adequate regulatory oversight. It seems that everyone has a strong opinion about genetically-modified foods. Even the Vatican and the Prince of Wales have expressed their opinions. Most concerns about genetically-modified foods fall into three categories: environmental hazards, human health risks, and economic concerns.

ENVIRONMENTAL HAZARDS

 Unintended harm to other organisms Last year a laboratory study was published in Nature showing that pollen from Bacillus thuringiens corn caused high mortality rates in monarch butterfly caterpillars. Monarch caterpillars consume milkweed plants, not corn, but the fear is that if pollen from Bacillus thuringiens corn is blown by the wind onto milkweed plants in neighboring fields, the caterpillars could eat the pollen and perish. Although the Nature study was not conducted under natural field conditions, the results seemed to support this viewpoint. Unfortunately, Bacillus thuringiens toxins kill many species of insect larvae indiscriminately; it is not possible to design a Bacillus thuringiens toxin that would only kill crop-damaging pests and remain harmless to all other insects. This study is being reexamined by the USDA, the U.S. Environmental Protection Agency (EPA) and other non-government research groups, and preliminary data from new studies suggests that the original study may have been flawed. This topic is the subject of acrimonious debate, and both sides of the argument are defending their data vigorously. Currently, there is no agreement about the results of these studies, and the potential risk of harm to non-target organisms will need to be evaluated further.

 Reduced effectiveness of pesticides Just as some populations of mosquitoes developed resistance to the now-banned pesticide DDT, many people are concerned that insects will become resistant to Bacillus thuringiens or other crops that have been genetically-modified to produce their own pesticides.

 Gene transfer to non-target species Another concern is that crop plants engineered for herbicide tolerance and weeds will cross-breed, resulting in the transfer of the herbicide resistance genes from the crops into the weeds. These "super-weeds" would then be herbicide tolerant as well. Other introduced genes may cross over into non-modified crops planted next to genetically-modified crops. The possibility of interbreeding is shown by the defense of farmers against lawsuits filed by Monsanto. The company has filed patent infringement lawsuits against farmers who may have harvested genetically-modified crops. Monsanto claims that the farmers obtained Monsanto-licensed genetically-modified seeds from an unknown source and did not pay royalties to Monsanto. The farmers claim that their unmodified crops were cross-pollinated from someone else's genetically-modified crops planted a field or two away. More investigation is needed to resolve this issue.

There are several possible solutions to the three problems mentioned above. Genes are exchanged between plants via pollen. Two ways to ensure that non-target species will not receive introduced genes from genetically-modified plants are to create genetically-modified plants that are male sterile (do not produce pollen) or to modify the genetically-modified plant so that the pollen does not contain the introduced gene. Cross-pollination would not occur, and if harmless insects such as monarch caterpillars were to eat pollen from genetically-modified plants, the caterpillars would survive.

Another possible solution is to create buffer zones around fields of genetically-modified crops. For example, non- genetically-modified corn would be planted to surround a field of Bacillus thuringiens genetically-modified corn, and the non- genetically-modified corn would not be harvested. Beneficial or

harmless insects would have a refuge in the non-genetically-modified corn, and insect pests could be allowed to destroy the non- genetically-modified corn and would not develop resistance to pesticides. Gene transfer to weeds and other crops would not occur because the wind-blown pollen would not travel beyond the buffer zone.

HUMAN HEALTH RISKS

 Allergenicity Many children in the US and Europe have developed life-threatening allergies to peanuts and other foods. There is a possibility that introducing a gene into a plant may create a new allergen or cause an allergic reaction in susceptible individuals. A proposal to incorporate a gene from Brazil nuts into soybeans was abandoned because of the fear of causing unexpected allergic reactions. Extensive testing of genetically-modified foods may be required to avoid the possibility of harm to consumers with food allergies.

 Unknown effects on human health: There is a growing concern that introducing foreign genes into food plants may have an unexpected and negative impact on human health. A recent article published in Lancet examined the effects of genetically-modified potatoes on the digestive tract in rats. This study claimed that there were appreciable differences in the intestines of rats fed genetically-modified potatoes and rats fed unmodified potatoes. Yet critics say that this paper, like the monarch butterfly data, is flawed and does not hold up to scientific scrutiny. Moreover, the gene introduced into the potatoes was a snowdrop flower lectin, a substance known to be toxic to mammals. The scientists who created this variety of potato chose to use the lectin gene simply to test the methodology, and these potatoes were never intended for human or animal consumption. On the whole, with the exception of possible allergen city, scientists believe that GM foods do not present a risk to human health.

ECONOMIC CONCERNS

Bringing a genetically-modified food to market is a lengthy and costly process, and of course agri-biotech companies wish to ensure a profitable return on their investment. Many new plant genetic engineering technologies and genetically-modified plants have been patented, and patent infringement is a big concern of agribusiness. Yet consumer advocates are worried that patenting these new plant varieties will raise the price of seeds so high that small farmers and third world countries will not be able to afford seeds for genetically-modified crops, thus widening the gap between the wealthy and the poor. It is hoped that in a humanitarian gesture, more companies and non-profits will follow the lead of the Rockefeller Foundation and offer their products at reduced cost to impoverished nations.

Patent enforcement may also be difficult, as the contention of the farmers that they involuntarily grew Monsanto-engineered strains when their crops were cross-pollinated shows. One way to combat possible patent infringement is to introduce a "suicide gene" into genetically-modified plants. These plants would be viable for only one growing season and would produce sterile seeds that do not germinate. Farmers would need to buy a fresh supply of seeds each year. However, this would be financially disastrous for farmers in third world countries who cannot afford to buy seed each year and traditionally set aside a portion of their harvest to plant in the next growing season.

CONCLUSION:

Genetically modified food pose a threat to the environment. They exists and take valuable natural resources from native and unaltered organisms. They can decimate certain insect and animal populations, leading to a damaging shift in the environment.

The idea of producing food with desirable qualities paved the way for the development of genetically modified food worldwide. Scientists were able to isolate genes with favorable traits and insert them in crops to produce food that can resist drought, insects, pesticides and even is more nutritious. But then, it was found that consumption of this engineered tomato caused stomach lesions in rats, thus, raising issues about the safety of genetically modified food in general. Since then, the debate raise on the disadvantages of consumption of genetically modified food. Below are just some examples of the long list of disadvantages of such practice;

. The safety of such products is not verified yet, in fact, we are the lab rats to test the safety of such technology.

This is sad but true. In fact, genetically engineered food is being consumed daily with no thorough research of its potential threats on human health.

- Genetically modified ingredients can cause cancer.
- It could raise new allergy outbreaks in humans.
- Adverse effects on the immune system.
- Health concerns - Since genetically modified foods have not been around for a long time, some

researchers are concerned that ingesting these foods may cause harm to the human and animal body.

- Environmental issues - The plants that are genetically modified may become more prevalent, choking out other plants and causing native plants to die off.

- Intellectual property concerns - Since the genetically modified foods are tagged by their genetic markers, some farmers can be sued for growing the seeds, even though they may have simply blown into a neighboring field.

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