

# A Review of the Pros and Cons of Genetically Modified Organisms

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# TABLE OF CONTENTS

<b>I. INTRODUCTION</b> .....	3
<b>II. REVIEW OF LITERATURE</b> .....	4
A. World Controversy.....	4
B. Pros of GMO's.....	4
C. Cons of GMO's.....	5
D. Supporters position.....	6
E. Opponents position.....	6
F. The evidence.....	7
G. Assessments/FDA regulation.....	7
<b>III. CONCLUSIONS</b> .....	9
<b>IV. REFERENCE LIST</b> .....	10

## **INTRODUCTION**

Genetically modifying organisms, the introduction of foreign genes to a genetic code of another organism has become a huge controversial debate in the last decade especially pertaining to foods. These foods have had their DNA modified by the introduction of genes from a different organism for desired traits. This process does not occur naturally even though it has been a process used for decades. The use of GM foods has many pros and cons which will be discussed. Are GMO's safe? Should they be labeled? Do the benefits outweigh the risks? Are GMO's regulated and by whom? What does the evidence say? These are many questions underlying this debate which will be discussed in this paper. This review will discuss the world controversy and the presence of GMO's in the U.S, the pros and cons of GMO's, the arguments on both sides of the debate, the evidence behind the safety of GMO's, and the regulation in the U.S to better understand the safety of GMO's.

## **REVIEW OF LITERATURE**

### **World Controversy**

After the discovery of DNA, foods were genetically modified for desired traits leading to many benefits in the food supply. The first major controversy of genetically engineering foods occurred in Europe in the late 1980's (1). Europe became resistant to using biotechnology and created strict regulations and labeling because farmland and organic food was considered more important. Unlike Europe, the U.S. does not have strict labeling. Nearly 70% of our food supply contains genetically modified foods (2). GMO's are grown in 40 countries and on 6 continents. The most common foods that are genetically modified are soybeans, corn, cotton, canola, potatoes, tomatoes, rice, and dairy products. The U.S. has less regulations than any other country and polls show the public wants stricter regulations (3).

### **Pros of GMO's**

Genetically modifying foods benefits producers and consumers. Consumers often choose to buy foods based on looks, taste, and possibly nutrient content. Genetically modifying ingredients allows scientists to increase the nutrient content and taste of common foods (1). GM foods can resist pests and diseases, so less pesticides are used which decreases the cost (1, 4). Not only are pesticides expensive which raises the cost of foods, but are possibly harmful to health. The greatest benefit of genetically modifying foods is that more people are fed since foods grow faster, harvests are more likely to last, and foods last on the shelf longer (1, 5). This can decrease famine and starvation in many developing countries. For example, Norman Borlaugh saved a million lives by planting GM wheat by increasing the normal yield by 70% (2). Even though genetically modified foods are beneficial, they also have many cons.

## **Cons of GMO's**

Eating genetically modified foods may lead to potential health risks and negatively impacts the environment. Potential health risks include changes that are unexpected and harmful (3). Since scientists change the genetic make-up of an organism, changes one may not expect could occur. Allergens and toxins can be introduced in organisms (4). The consumption of crops with allergens and toxins can cause allergic reactions. In a study conducted by Hi-Bred in the mid 1990's, genetically engineered Brazil nuts caused allergic reactions. Eating foods that are genetically modified could also contain an antibiotic gene. If this gene is passed on to the individual, the individual may become resistant to certain antibiotics. Changing of genes can switch random genes on and cause accidental contamination or toxicity which would lead to negative consequences such as overproduction of a toxin, allergen, or carcinogen. For example, GM maize was found to be toxic because of a random gene that was turned on. Even though nutrient content can be increased, nutrient content can also adversely change. GM foods affect the environment by leading to the extinction of plants, less resistant to some pests and more susceptible to others, loss of genetic diversity, and increasing the occurrence of a genetic catastrophe which is the damage of genes that may lead to tragic consequences from a well-intended effort to improve human life (7). Potential health effects and environmental effects contribute to the concerns of consumers.

## **Supporters of GMO's**

Supporters of GMO's believe genetically modified crops are safe even though more testing is needed. The U.S. government, FDA, WHO, large corporations, and others support the use of GMO's. The U.S. government says "GM crops are safe, resist disease better, and can provide much-needed food in starving nations" (4). The benefits outweigh the risks since crops resist disease better and feed more people. The FDA, who regulates GMO's admits there is no adequate testing, but since no reports of injury and illness are linked specifically to GMO's they regard them as "generally safe" (5). Even though animal studies have shown potential health effects, many have been regarded as faulty, inaccurate, or have no "biological relevance." For example, a Gilles-Eric Seralini conducted a study showing rats that grew tumors after ingesting GM corn feed and was recently retracted after a year-long investigation. The study showed inclusive evidence on the effect of GMO's and cancer since the study did not meet scientific standards (8). GMO's may be regarded as safe from one point of view, but others may disagree.

## **Opponents of GMO's**

Opponents of GMO's regard them as unsafe and could lead to potential health effects. Many countries around the world have decided to ban or regulate GMO's because of a possible health effect and harm on the environment. Then why does the U.S. still use GM foods? Many U.S. consumers and activists believe GMO's are bad and should be labeled. They view that if animal studies show potential health effects even if only short-term, this risk is not worth it. Everyone should know what they are eating. But labeling of GMO's would be difficult because of traceability and liability issues. Opponents could raise the point that supporters may hide or interpret evidence to mean nothing because of problems in the study. Also, scientists may be afraid to lose their credibility if they found something wrong with a GMO food (10). Then if they

don't want to label GMO's, are big companies afraid of causing harm and becoming reliable or do they just not want to lose money? No direct cause could be linked to GMO's, but may in the future. Consumers are becoming more aware of the issue and may stop buying products that are labeled with genetically modified ingredients. Opponents do not believe GMO's are safe and want all foods that contain GMO's labeled for the safety of the public. But what does the evidence show?

### **The Evidence**

According to the evidence, GMO's may cause potential health effects, but the evidence is insufficient and unclear of the long-term health effects on humans. Researchers using rats as subjects found that GM foods can be toxic (8). The following studies resulted in adverse consequences of gene engineering: mice fed GM soy had adverse function on their liver, pancreas, and testes, female rats fed GM soy had changes in their uterus and ovaries, mammals fed GM soy and maize had toxic effects on kidneys and liver, rats fed GM maize grew more slowly and increased levels of triglycerides and affect the liver and kidneys, and rats fed GM potatoes developed pre-cancerous conditions in the gut. Since these studies were only short-term they do not show the effects of GMO's in the long-term. Also, no human studies exist. The evidence suggests GM foods may have potential health risks, but the evidence is unclear and more testing is needed.

### **Safety Assessments/FDA Regulation**

The FDA regulates GM foods and must pass safety assessments in order to be made commercially available. The WHO also recognizes the need for continued safety assessments before being marketed (6). The safety assessments used are substantial equivalence, qualitative

testing, and quantitative testing (10). Substantial equivalence is a starting point to identify similarities and differences between existing foods and the new product (GM product) (11). Qualitative testing is used to identify appropriate use of materials or safety of material and quantitative testing is used to control contractual agreements such as labeling (12). First, the developer produces a safety assessment of the GM crop then FDA scientists review the safety assessment for approval (12). GM crops also adhere to the safety assessments outlined by the Food, Drug, and Cosmetic Act. This process is voluntary, but encouraged by FDA. Even though GM crops are regulated, consumers still want stricter labeling.



## CONCLUSIONS

The production of GM crops is a highly controversial debate worldwide that will most likely continue for many years. To determine the safety of GMO's is very difficult. GM foods are regarded as safe and assessed for safety from the FDA. But what about the evidence from short-term animal studies that shows possible health effects of GMO's? These studies suggest negative consequences, but are considered unclear and insufficient to reach a consensus conclusion. More evidence and safety assessments are needed. Supporters believe the benefits of GMO's outweigh the risks because feeding more people is worth the risk of potential health effects. But on the other side, GMO's pose a potential risk and they should be labeled because people have a right to know what they are eating. Consumers want labeling and opponents raise good points about why large corporations may not want labeling. The government and consumers should consider the concerns of the public because welfare of society is most important.

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