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HOW IS SAFE GENETICALLY MODIFIED FOOD?

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Abstract
Genetically modified food is a kind of food that has been genetically enhanced through genetic engineering. Genetically modified food exists because people are too far from their food sources. Scientists and regulators point out that genetically modified food is not more risky than conventional plant breeding technology. This paper will investigate the potential risks of genetically modified food and provide a number of specific solutions to those disadvantages. It will then argue that consuming genetically modified food is generally safe.
genetically modified food has to meet the same safety requirements as food grown from non-genetically-modified seeds. While genetically modified food has its pros and cons, genetically modified food is generally safe and healthy to eat, although research on its health effects is still limited. Despite these concerns, genetically modified food can help government find sustainable ways to feed people, specifically in countries that lack access to nutrient-rich food.
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1. INTRODUCTION

Genetically modified food or GM food, alias genetically engineered food or bioengineered food, is a kind of food – soy, corn, or other crops grown from seeds – that has been genetically enhanced through genetic engineering. Genetic engineering is engineering science in the branch of biology related to the principle of heredity and variations in animals and plants of the same type. Genetically modified seeds are used to plant more than 90% of corn, soybeans, and cotton grown in the United States. Genetically modified food exists because people are too far from their food sources. In addition, some corporations have intellectual property rights for several genetically modified seeds. Public members are much less likely to discern genetically modified food as safe than scientists. The legal and regulatory status of genetically modified food differs by country. Most countries allow it, but several countries restrict or prohibit it. However, scientific findings show that genetically modified food does not have probability to risk on human health, although it must be tested before released it to the public. The potential implications motivate an analysis on whether people should be encouraged to consume genetically modified food.

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2. HEALTH AND ECONOMIC IMPLICATIONS OF GENETICALLY MODIFIED FOOD

Introducing an allergen is a well-known risk of genetic modification. Over the last decade, the percentage of allergies has almost doubled among young people under 18 (Centers for Disease Control and Prevention, 2013b). Genetically modified food is believed to increase allergies. It is believed that the transfer of specific proteins from one plant to another using genetic engineering causes allergy symptoms. To prove it, some researchers from the United States found that "an allergen from a food known to be allergenic can be transferred into another food by genetic engineering" (Nordlee et al, 1996).

However, the probability of a link between genetically modified food and allergies is low. Genetically modified food is less likely to trigger allergic reactions than non-genetically modified food (Xu, 2015). Furthermore, genetically modified food that is currently on the market has not been found to have allergenic effects (Zeratsky, 2016). In addition, the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) have created protocols for genetically modified food that are designed to prevent allergic reactions from the food. These international bodies obligate genetically modified food to be tested for their ability to cause allergic reactions. Hence, no allergens have been found in genetically modified products approved for human consumption. In addition, cultivating plant species with new allergens poses less risk than the process of traditional crossing of plants. In other words, genetic engineering has less effect on protein levels than crossing of plants.

Another problem is that genes that are resistant to antibiotics can be planted into harmful germs, and thus ultra-resistant germs can be created. According to a report published by the Centers for Disease Control and Prevention (CDC), antibiotic-resistant threats can resist antibiotics, making them hard to kill. The report said that two million people were infected by threats – bacteria and fungi – and almost an eighth of them died (Centers for Disease Control and Prevention, 2013a).

However, antibiotics do not experience gene transfer. Netherwood investigates whether genes from modified soybean will move to bacteria that live in the human intestine (Netherwood et al, 2004). The result was that gene transfer did not occur after consuming modified soybeans in volunteers with the intact digestive tract. Gene transfer was only detected in three volunteers who removed their large intestines because of medical grounds. In addition, antibiotic-resistant genes were found in many germs (Käppeli & Auberson, 1998), and in the environment particularly in the human gut (Hollingworth et al, 2003).

Another problem to adopt genetically modified food is the link between the food and the raise of cancer. After feeding mice with modified corn, and a mixture of ordinary-modified corns, the experiment demonstrates that there will be long-term effects of raising cancer (Séralini et al, 2014). Séralini's experiment found that genetically modified maize had the ability to increase health problems on the rats because the rats had liver and kidney damage and large tumors. In addition, herbicides produced by Roundup and genetically modified maize that is tolerant to Roundup are suspected to be linked to cancer (Séralini et al, 2014).

However, more research is needed to assess the potential long-term health effects of genetically modified food. Séralini's research was criticized for several reasons. Firstly, the statistics used are not enough (Hirschler, 2012). Secondly, Sprague-Dawley rats tend to get cancer (Suzuki et al, 1979). Thirdly, Séralini only

used 20 rats (Butler, 2012). Finally, the data on the amount of food, rat growth level, and dose-response relationship are very lacking (Hirschler, 2012).

In the United States, no federal mandate exists for labeling genetically modified food. The U.S. Federal Government based their attitude on suggestions from the American Medical Association (AMA) and the American Association for the Advancement of Science (AAAS). AMA supports science-based labeling policies, believes shifting of safety assessment, and notes purchasing of organic foods (American Medical Association, 2012). Mandatory labeling is very misleading to consumers according to the AAAS (American Association for the Advancement of Science, 2012). As a result, it can be hard for people to know if they are buying and eating genetically modified food.

However, some products still contain genetically modified food, even though the labeling law has been applied (European Commission, 2013). As in the EU, products that contain or consist of genetically modified food or are produced from it must be clearly labeled as such. The reason for labeling is to facilitate tracking, allow information selection, avoid consumer misdirection, and facilitate product withdrawal if and only if adverse effects on health or the environment are found (European Commission, 2003).

In developing countries, the main benefit of modified food is its economic value, particularly for farmers. The International Assessment of Agricultural Science and Technology for Development has recognized the potential for modified food to help developing countries (Kiers et al, 2008). The potentials are reducing post-harvest loss and damage, reducing the risk of crop failure, saving on the usage of agricultural land, reducing the need for pesticides and chemical fertilizers, increasing nutritional value, and resistant to certain diseases and pests, particularly caused by viruses. Furthermore, genetic engineering can produce new types of plants that are resistant to harsh environmental conditions, for instance, dry land, highly salted land, and extreme ambient temperature. In addition, genetic engineering can improve desired functional properties, for instance, reducing allergic, inhibiting fruit ripening, increasing starch levels, and shelf life much longer.

Moreover, monoculture, irrigation, use of herbicides, pesticides, and equipment play key roles for genetically modified crops. For instance, this is the case for cotton plants, or Bt cotton in short. Bt cotton has been widespread in Asia. In India, more than 17 million people depend on cotton farming. Majority of them are small farmers who support their families from land with an area less than 2 hectares. In addition, the farming itself suffered from some pests. The main types of the pests on cotton plants are Helicoverpa armigera, Helicoverpa punctigera, Helicoverpa zea, Agrotis spp., Spodoptera literoralis, Pectinophora gossypiella, Earias spp., and Heliothis virescens (James, 2002). More than 55% of insecticides are used for eradicating those pests in order to increase cotton production. On the other hand, the long-lasting varieties of cotton, particularly using conventional plant breeding, can be used to control the pests. However, this technology was experiencing a difficult problem to solve. The problem is scarcity of resistance genes in the collection of cotton germplasm, for instance resistance gene to the order Lepidoptera, particularly Helicoverpa armigera. Therefore, cotton is one of the first genetically engineered plants in order to reduce pesticide usage, and to create new varieties that are resistant to pests. In 1996, Bt cotton was planted in only 0.72 million hectares in the USA, 30,000 hectares in Australia, and 2000 hectares in Mexico. Four years later, it was estimated that 5.3 million hectares of Bt cotton were

planted in 7 countries. In the USA, it is estimated that 60% of the total farmland were planted by Bt cotton. The consequence is the USA gets an annual economic profit between 200-250 million USD which is distributed over 35% for industries, 46% for farmers, and 19% for consumers. In India, cotton produced in non-GMO plants only reaches 292 kg/hectare, while using genetically modified organism is capable to reach 531 kg/hectare with an ±82% increase (Kranthi, 2012). In general, genetic engineering is similar to plant breeding, so genetically modified crops have better quality than conventional plants. Moreover, genetic engineering is not new, because it has been done for a long time but is not realized by the community.

The presence of genetically modified food products is not always profitable. Some cases show that genetically modified food products cause adverse effects on the environment. The flow of genes from transgenic organisms to other creatures has consequences. The consequences are accelerating invasive species, escalate persistent evolution, and cause extinction to other creatures. Transfer of pest-resistant genes, for instance Bt gene, will cause genetically modified food more adaptive to environment, and tolerant to pests, but has the potential to disrupt the balance of the ecosystem (Jaramillo, 2009). Treatment using pollen from cotton plants containing Cry1Ac and CpTI genes for seven days changed the bee diet (Han et al, 2010). Transgenic corn containing the Bt gene causes the death of monarch larvae (Losey, 1999).

3. CONCLUSION

In conclusion, genetically modified food has to meet the same safety requirements as food grown from non-genetically-modified seeds. While genetically modified food has its pros and cons, genetically modified food is generally safe and healthy to eat, although research on its health effects is still limited. Despite these concerns, genetically modified food can help government find sustainable ways to feed people, specifically in countries that lack access to nutrient-rich food.

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