Genetically modified foods: pathway to food security

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Abstract. Currently, the demand of food far exceeds agricultural production in most developing countries including Nigeria as a result of unsustainable agricultural practices and environmental degradation. Increase in agricultural importation has subsequently increased the government’s expenditure and yearly budget, while also influencing the price of food in the nation. Therefore, a look into other sustainable food options to fight hunger and poverty in Nigeria is imperative. This study attempts to investigate how genetically modified food can help solve the numerous challenges of food security. The study revealed the shortfall in domestically produced food in Nigeria for instance, which is as a result of rapid population growth rate of 3.2% as opposed to food production rate of less than 1%. Advancement in genetic modification technologies has ensured the production of virus, stress-resistant crops and also disease resistant animals. Although these technologies are predominantly employed on plant than animals. Genetically modified foods employ biotechnological processes to alter inherent features of living organisms by replacing the natural gene sequence. Across the globe, several products modified and regenerated by genetic alteration have already been patented and certified by health institutes to be consumable. Foods such as rice, potato, corn, wheat, and soya ranks top in the list of products derived from Genetic Modified species. As research deepens in biotechnology, more uncertainties and controversies surround the consumption of GM products through cutting edge scientific research checked in legal framework, consumers will no longer react negatively towards GM foods.

1. Introduction

Food is one of the basic needs and is essential in order to provide opportunities for the full physical, mental, and social development of individuals. Food is also an essential component of life required for the growth and development of all living things. Without food, human beings stand the risk of starvation and subsequently extinction, hence, it is important that all humans have access to adequate food. According to World Bank [1], Nigeria is the most populated nation in Africa with over 180 million persons. This ever-increasing population accounts for just slightly below 50% of the total population of West Africa and has resulted in increased food demand, thus, triggering erosion, desertification of
farmlands and other food security threats. Despite boasting tremendous natural and human resources, Nigeria still has a great percentage of its population living down the poverty line. World Food Programme [2] estimated that over 55% of Nigerians live with less than US $1.25 on a daily basis. Hunger and malnutrition have therefore characterized various regions of the nation as poverty continues to be on the rise. The living wage model of International labour Organization ILO, [3] aimed at ensuring that every worker and their family have access to basic life needs such as food is still not sufficient to fight poverty in Nigeria. Therefore, it has become imperative for the government to readdress policies and structures that will alleviate poverty in the nation. Among the 109 countries assessed by Global Food Security Index (GFSI) [4], Nigeria ranked 91st with an index of 37.1. This implies a significant percentage of the population still lacks access to affordable, quality and safe food. Moreover, the recommended daily energy intake which falls between 2500 – 3400 Kcal and an average of 64 grams of protein per day are still not been met. The current energy intake estimated to be 1730 Kcal is therefore not sufficient to curb the present food deficiency symptoms. Since Nigeria’s domestic agricultural production cannot cater for the increasing food demand of the populace, the nation has had to rely on agricultural importation in recent years. The rise in importation has subsequently increased the government’s expenditure and yearly budget, while also influencing the price of food in the nation. World Development Indicator,[5] showed that food importation in Nigeria increased from 19.9% in 2000 to 30.6% and 22.7% in 2011 and 2012 respectively while food export barely increased. Therefore, a look into other sustainable food options to fight hunger in Nigeria is most imperative.

Genetically Modified Organism (GMO) is proving to be a potential sustainable option for food production in some developed nations. Through biotechnological processes, inherent features of living organisms are altered by replacing the natural gene sequence to develop these GMO’s [6]. Currently, a number of foods sold in both local and international markets are either partially or totally genetically modified food. Thus, the technology and concept of GMO is rapidly on the rise in several nations of the world and already been adopted by some developing nations. As research become more intensive in an incomprehensive pace in biotechnology, more and more of the products being manufactured or developed ranging from nutritional to medical products depend on bioprocesses for sustainability. Hence, GMO, which is arguably the most publicized discovery of biotechnology, has continued to gain widespread interest due to its tremendous benefits as well as the health risk involved in its consumption. Although, it is still widely consumed all over the globe, despite the controversies surrounding it.

GMO offers a wide range of benefits as it improves the nutritive quality of foods and minimizes waste by saving soil, water and energy for food production. More so, it ensures new planting methods and the growth of disease, virus, stress-resistant crops. However, the probable risk involved in the consumption of GMO’s has also raised some serious health concerns in various nations. Other downside of GMO includes changes in the natural quality of food, threat to genetic diversity, biopiracy and inordinate competition between traditional and organic suppliers of food [7]. Foods such as rice, potato, corn, wheat, and soya ranks top in the list of products derived from Genetic Modified species. Across the globe, several products modified and regenerated by genetic alteration have already been patented and certified by health institutes to be consumable by both animals and humans. These products possess very similar characteristics with their natural samples, only that they have superior basic characteristics such as appearance, smell and colour. Generally, GMO process has been applied mostly to soya than any other commonly known foods such as corn, cotton, soya and canola. Recently, a study was conducted in Turkey involving the screening of local foodstuffs and seeds as well as imported soy and maize seeds. Results from the study showed that local food products did not contain genetically modified organisms, however, GMO’s were present in the imported seeds as they were transgenic [6]. It has also been shown that genetic alteration or modification studies are carried out on animals as well. Genetic modification studies conducted on animals is aimed at controlling the growth and producing disease resistant animals. For diary animals such as cow and sheep, the studies are geared towards changing the milk component and the wool quality respectively [8]. Research is still ongoing to study gene transfer that will give resistance against cold weather conditions and increase growth of living organisms. A study has been conducted on 20 different carp, salmon, tilefish and catfish related to the
Advancement in genetic modification technologies has ensured tremendous increase in milk production through the use of Recombinant Bovine Growth Hormone (RBGH) on milk cows. Animals with modified genes can be utilized to produce low-fat milk and lactose-free milk [10, 11]. Animals are also beneficial for the production of high-quality milk and meat with special protein. Furthermore, GMO technology has also been utilized on microorganisms, which are useful for enzyme secretion and other preservative purposes. Organisms such as bacteria, fungi and moulds, when modified are useful as food additives in the food industry for the production of cheese, bread, cheese etc. These organisms are utilized in secreting amino acids during the production processes [12]. During fermentation of foods such as yoghurt, cheese, meats, lactic acid bacteria are employed as starter culture during the process. These cultures give the food type specific flavour and smell by enabling maturation of the fermented food [13, 14].

2. Importance of Genetic Modified Foods

Genetically modified (GM) foods are increasingly becoming common in many developed and a few developing countries. These foods are developed via genetic engineering technology, in which genes of other food species are inserted into the DNA of the modified food. Although this technology is applied to both plant and animals, it is predominantly employed on plant than animals. They offer the following advantages that make them a very good solution to the problem of food security in developing countries.

i. Prevention of Allergy and Diseases: A major benefit of genetically modified foods is that they help forestall the occurrence of allergies that may come with consuming natural foods. Apart from this, some foods that have been genetically modified possess the ability to treat and cure certain diseases. Foods modified genetically such as potatoes, tomatoes, carrots and soybean, to improve nutritional and health benefits are currently available in both local and international markets [13]. However, producers and manufacturers must ensure that there are no side effects after consuming these foods.

ii. High Yield/ Crop Production: Crops that have been genetically modified have been proven to grow faster than their traditional counterparts. Hence, productivity is enhanced and adequate food is provided for the populace when these crops are grown in the stead of traditional seeds [15].

iii. Climate adaptability: Genetically modified (GM) crops tend to be adaptive and tolerant to different climatic conditions. It has been proven that they can withstand harsh environmental conditions such as drought seasons when it is difficult to grow normal crops [13]. More so, they can be grown in soils and climatic conditions where it is infeasible and unfavourable to grow traditional crops [15].

iv. Low Cost of Production: Production cost of GM foods are relatively cheaper than their traditional counterparts, only that acquisition cost are relatively higher. Cost of production is greatly minimized as the need for insecticides and pesticides are eliminated since such crops are already pest and insect resistant [13]. Moreover, GM crops eliminate the risk involved after spraying hazardous insecticides and pesticides during planting, thus, ensuring the foods consumed are free from harmful chemicals and are environmentally friendly [15].

v. High Nutritional Content: These foods have been engineered to possess high nutritional, mineral and vitamins. Hence, they are generally more nutritious than their traditional counterparts and have better taste and appearance [12].

vi. Increased Shelf Life: Another major benefit of GM foods is that they last longer than traditional ones, that is, they have an improved shelf life. When compared to traditional foods, these foods can be stored for a longer period of time without any fear of quality deterioration and spoilage [15].

3. Consumers attitude toward GM Products
Despite uncertainties and controversies that surrounds GM foods, people from different nations possess varying information about the concept of GMO, which in turn influences their behavior and attitude towards the foods. This determines the acceptance or rejection of foods in various regions across the globe. Factors such as knowledge and level of education, socioeconomic status, risk perception, media, occupation and income etc has been proven to influence the attitude of consumers towards acceptance and consumption of GMF.

Education and knowledge level have been observed to be a major factor that influences decision about GM products. [Christoph et al., [16] explained in his study that 40% of consumers were reluctant to consume GMO’s despite the health and environmental benefits of the foods. Christoph et al. [16] also showed that consumers in European nations such as Spain, England, Italy and France disdained the consumption of GMO products. It was observed in a recent study, Literature support that attitude of consumers towards GMO is “positive” in the US, while it is “negative” in some other top countries. While populace perception of GMO in Turkey and other countries showed that a larger percentage disapproved of the foods, research shows that the US supports biotechnologies for agricultural purposes [16;17;18] Risk perception toward GMO technology also changes among people.

Bilen and Ozel [19] indicated that nearly 90% of the students in their case study had right information about genetically modified (GM) products. It was also shown that the students were not ignorant about the risk involved in the consumption of the products. Generally, there was positive perception towards the concept of genetic modification as the students believed the products can be beneficial to people and technology. Findings from the study helped to reveal the importance of rightly educating the populace on the concept of biotechnology [19]. According to Kaya et al., [20], attitude of consumers in Turkey towards GMO’s and GM foods had negative perception as a result of information about consumers' health, environment and biological diversity and natural resources.

Urban consumers in Turkey believe that foods that have been genetically modified are allergenic, carcinogenic and unhealthy, making them unfit for consumption. More so, they also believe their consumption can lead to organ damage, infertility, intoxication and biological pollution [20]. Although these risk perceptions cannot be established. It has been proven that by altering the DNA structure of foods, properties that causes allergy can be successfully eliminated [12].

4. Conclusion

The probable health risk involved in the consumption of GM foods have been a major topic across the globe despite its widespread use and consumption. GM foods possess tremendous benefits and potentials that will address the food security challenges in many countries, hence, more research should be conducted and adequate information about the foods should be released.

Generally, experts in the field of biotechnology are furthering research in the genetic modification technologies to ensure consumers utilize only safe products. Therefore, these foods can be sold in both local and international markets after enough scientific studies have been conducted and the legal framework thoroughly checked. Thus, consumers will no longer react against modified foods because of limited or biased knowledge.

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