

Awareness of Grade 9 Students in Genetically Modified Organisms (GMO) Food Products: A Survey Study

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Abstract:- There are many modifications and advancements that happen in different fields. Science is not an exemption for it is always partnered with technology. One of the recent innovations in the field of Genetics are the genetically modified organisms (GMOs) which are very controversial for its positive and negative effects to the health of the consumers, existence of stronger pests, and economic effects. This study aims to collect the general awareness and perception of Grade 9 students of a state laboratory high school about the Genetically Modified Organism (GMO) products. This paper displays that the 23 Grade 9 student participants from a state laboratory high school batch 2021-2022. The male is 30.43% of the respondents' sex and the female constitutes 69.57% of the participants. Moreover, the age range of the participants is 13-16 years old. Qualitative research method was utilized through survey questionnaires via Google Forms. The study was conducted on December 22, 2021. In conclusion, there is a lack of awareness of the Genetically Modified Organism (GMO) products in terms of Basic knowledge about GMOs, and GMO products effects on human health.

Keywords:- GMO, awareness, survey, high school students

I. INTRODUCTION

We live on an ever-changing planet Earth which is affected by both the natural processes and the effect of human interventions on their environment. It is our concern to observe and study our planet's behavior [1]. Technology improves almost all aspects of our lives. Now, the existing Industry 4.0 which is also known as the fourth industrial revolution can help to fulfill the needs of humanity. This change has started with the applications of more advanced manufacturing and digital information technologies [2]. Technology inevitably invades these three aspects: social, economic, and environmental aspects. In terms of communication, economics, education, politics, and the agricultural sector can also be improved or degraded by technology [3].

The fast-paced modifications are also affecting the scientific realm. Advancing technology is the permissive source of growth, but it is only a potential, not self-sufficient. If technology will be employed widely and efficiently, if its progress is to be stimulated by such use, institutional and ideological adjustments must be made to take effect by the

advancing stock of human knowledge [4]. The field of Science is not an exemption to the effects of technological innovations because it is the theoretical factor of the technology which is the application of the concepts.

One of the domains of science is genetics. According to Encyclopædia Britannica, Inc., genetics is the investigation of heredity and genes in specific. Genetics composes one of the main pillars of biology and is connected with many other areas, including agriculture, medicine, plant biology, and biotechnology. Genetics, which is the study of heredity, is a field also influenced by technology.

Recently, there is much modernism that happens in the field of genetics. Genetically modified organisms (GMOs) are formed by inserting genetic material, which can be from another species, into a plant so that the new genetic material will induce the plant's ability to display a desirable trait. It enhances the traditional genetic breeding that may produce a variety of food animals and plant crops produce for human consumption. Moreover, the FAO (Food and Agriculture Organization of the United Nations) and the European Commission define a GMO as a product "not occurring naturally by mating and/or natural recombination". GM foods pertain to foods produced from genetically modified plants or animals.

There are positive and negative feedbacks in this innovation. Studies show that GMO- opposers are more focused on the issue by expressing emotions and blunting scientific evidence, while GMO-fanatics stress scientific evidence [5].

Some of the positive effects of genetic modification are agronomic benefits, economic benefits, modification of the chemical composition in food, improvement in food processing, and products for therapeutic purposes.

Under the agronomic benefits is what happened between 1996 to 2012. There was an increase of 370 million tons of food crops. In the United States, one-seventh of the increased yield is credited to GM crops. Approximately, an addition of more than 300 million acres of conventional crops would have been needed to have an equal increase in yield as delivered by GM crops.

Moreover, economic benefits from (GM) crops are also undeniable. Between 2006 and 2012, farm income had a global increase from GM food of \$116 billion which is almost triple that of the previous 10 years. According to the estimations of James and Brookes, 42% of the economic gain was from the increased yield due to advanced genetics and resistance to pests and weeds. While the remaining 58% was contributed to the decreased costs of production including the reduced pesticide and herbicide usage.

The modification of the chemical composition in food includes some genetic modification that is specifically targeted to enhance certain nutrient levels for the foods to have high therapeutic and pro-health value. Some examples are vitamins A, C, E, unsaturated fatty acids, and probiotics. Another example is the “Golden Rice” which reduces malnutrition effectively and economically. In the same way, researchers can also change the amino acid composition of proteins and the carbohydrate content of foods.

Facilitate food processing can also be integrated with genetic modifications. In 1992, the “Flavr Savr” tomatoes were produced by the California company, Calgene. The genetic changes consist of the introduction of an antisense gene, which conceals the enzyme polygalacturonase. It will result in slowing down the ripening of tomatoes and allow longer shelf life. The composition in potatoes has also been changed by gene editing. potatoes display greater stability of brightness factors and a more attractive appearance using a cyclodextrin glycosyltransferases gene from bacteria.

On the other hand, this genetic modification may lead to adverse consequences. Also, the scientific community and nonscientists do not agree with this technological intervention for a variety of reasons. Since the mid-1990s, genetically modified organisms (GMOs) which have huge commercial importance have been at the center of political controversy in the European Union (EU). Moreover, the number of EU member states with a negative stand about GMOs has grown continuously [6]. In August 2013, anti-GMO (Genetically Modified Organisms) activists besieged a research field of Golden Rice administered by the Philippine International Rice Research Institute (IRRI), and other sector partners. In July 2011, an attack happened at an experimental farm of the Commonwealth Scientific and Industrial Research Organization (CSIRO), an Australian federal government agency for scientific research. A group of protesters from Greenpeace, a non-government, environmental organization tried to destroy the entire crop of genetically modified wheat in the experimental farm. As an example, genetically altered pesticide-resistant crops become the reason for the existence of the “pesticide genes to pest species. It then resulted in the development of pesticide-resistant superweeds and increased contamination of the environment with the pesticide chemicals that have adverse effects on useful insects [7].

There is a need to educate consumers about the health benefits and safety of GMO foods, the effective marketing of GMO foods to the consumers' agricultural producers, distributors, and food retailers. This study uses a sample of Grade 9 Junior High School students' awareness about GMO foods in terms of characteristics commonly associated with organic food, namely healthy, safe, environmentally beneficial, and ethical [8]. This research will determine the level of awareness of the students about GMO foods.

II. METHODS

The research instruments used were composed of 10 multiple choice items composed of different aspects of awareness, safety, and the consumers' likelihood to buy a GMO food product from a local market. The respondents voluntarily participated in answering the questionnaire on December 22, 2021. The 23 participants ranging in age from 13 to 16 years old are composed of Grade 9 students in a state university in Bulacan Batch 2021-2022. The primary focus of the paper is to have an overview of the awareness and perception of the Grade 9 students about a trending and relevant topic to science which is the Genetically Modified Organism (GMO) Food Products.

III. RESULTS

Gender	Frequency	Percentage
Male	7	30.43%
Female	16	69.57%
Total	23	100%

Table 1:- Gender of the Participants

Table 1 shows that the seven respondents are male while the remaining 16 participants are female. Male composes 30.43% of the respondents and female constitutes 69.57% of the participants.

Age	Frequency	Percentage
13	1	4.345%
14	16	69.57%
15	5	21.74%
16	1	4.345%
Total	23	100%

Table 2:- Age Distribution of The Participants

The table 2 exhibits the age distribution of the respondents to the survey questionnaire. There are 16 students (60.57%) who are 14 years old. One learner is a 13-year-old participant, and another is a 16-year-old participant who composes 4.345% of learners, each. The five students are 15 years old which composes 21.74% of the participants.

Here are the graphs which show the results from the 10 questions in the survey questionnaire.

A. General Opinion about GMOs

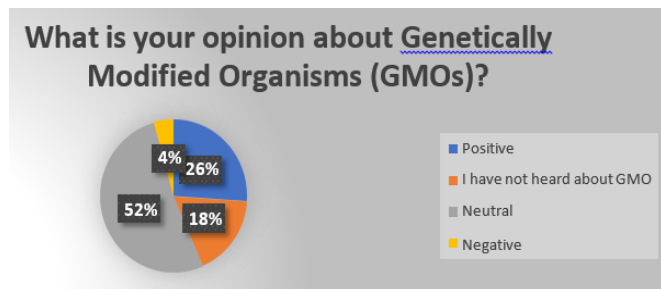


Fig. 1:- Opinion Of Respondents About GMOs

Fig. 1 shows the distribution of answers of the respondents about their general opinion about Genetically Modified Organisms (GMOs). According to fig. 1, the majority (52%) of the answers are neutral about GMOs. 26% of the respondents is composed of the positive opinion about GMOs. Then, negative opinion dominates in 4% of the participants while 18% have not heard about GMOs.



Fig. 2:- Tendency Of Participants To Buy GMO Products

The Fig. 2 illustration exhibits the percentage distribution of the responses regarding their likelihood to buy or purchase a GMO item from a local grocery store. In fig. 2, it was shown that the majority of the respondents are likely to buy GMO products from a local grocery store. 31% of them are unlikely to buy any GMO product from a local store while the remaining 4% of the respondents are very unlikely to purchase a GMO containing product.

B. Information Acquisition about GMOs

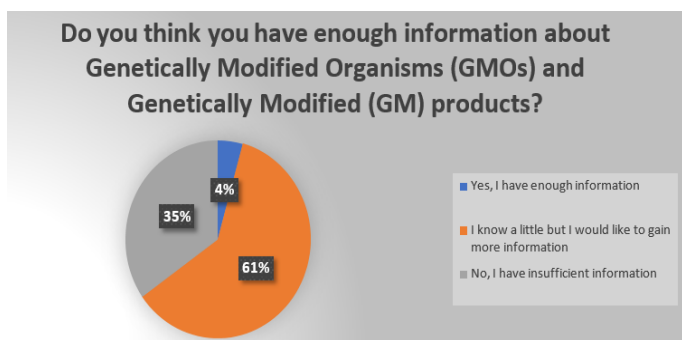


Fig 3:- Awareness Of Respondents About GMOs

Fig. 3 has a pie graph which displays the distribution of the awareness of the respondents to the Genetically Modified Organism (GMO) and Genetically Modified (GM) products. The majority of the respondents (61%) know a little

information but would like to gain more information about Genetically Modified Organisms (GMOs) and Genetically Modified (GM) products. The 35% of the participants do not have sufficient information about GMOs and GM products. While the remaining 4% are constituted by the participants who have enough information about GMOs and GM products.

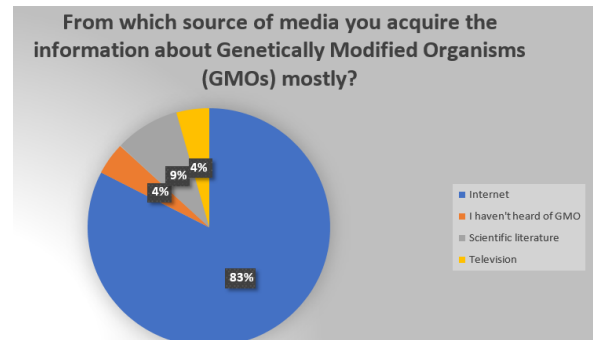


Fig. 4:- Source Of Information Of Respondents

Fig. 4 graph highlights the responses of the participants relevant to their source of media where they mostly acquire information about Genetically Modified Organisms (GMOs). This pie graph clearly illustrates the distribution of the responses regarding the media source where they get information about Genetically Modified Organisms (GMOs). The majority of the Grade 9 students who participated in this study found information about GMOs from the internet. The remaining 9% of the participants were able to garner information about GMOs from the scientific literature. And the 4% of the respondents have gained additional knowledge about GMOs through watching T.V. while the other 4% of the learners have not heard the term GMO before this study.

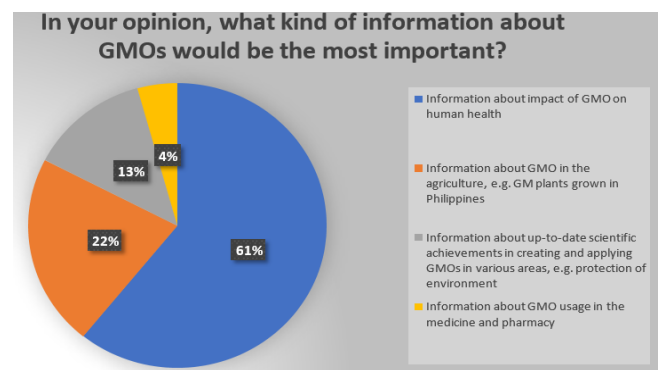


Fig. 5 Participants' Priority Information About GMOs

Fig. 5 graph analyzes the participants' answers regarding the question: "In your opinion, what kind of information about GMOs would be the most important?" Based on the graph in Fig. 5, most of the grade 9 participants are valuing the information about the impact of GMOs on human health. The other 22% are much interested in the information about GMO plants in agriculture e.g., GM plants that are grown in the Philippines. Moreover, 13% or three participants were engaged with the idea of the information about up-to-date scientific achievements in creating and applying GMOs in various areas, e.g. protection of the environment. The 4% of the participants want to know more about GMO usage in medicine and pharmacy.

C. Basic knowledge about GMOs

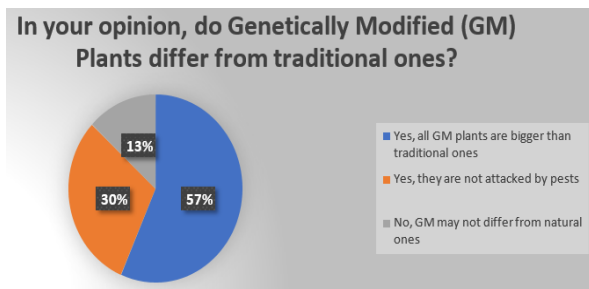


Fig. 6:- Differentiation of GM Plants from Normal Ones

Fig. 6 pie graph calculates the participants’ responses regarding the question: “In your opinion, do Genetically Modified (GM) plants differ from traditional ones?” According to Fig. 6, there is 57% percent of the participants agreed the GM plants are bigger than traditional ones. Out of 23 participants, 7 agreed that GM plants are not attacked by pests. The remaining 13% believe that there is no difference between GM plants and natural ones.

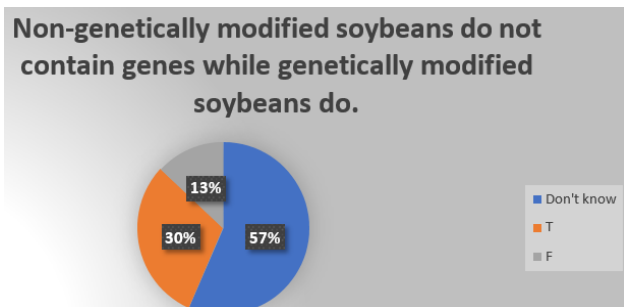


Fig. 7:- Genes of GMOs

Fig. 7 reveals a basic knowledge of the participants about the difference between non-genetically modified soybeans that do not contain genes and genetically modified soybeans. The results from fig. 7 show that 57% of the respondents do not know the difference between non-genetically modified soybeans that do not contain genes and genetically modified soybeans. 30% of the participants have agreed that there is a difference between these two soybeans. While 13% of the participants disagreed with the statement about the difference between the two soybeans.

D. Basic GMO products effect to human health

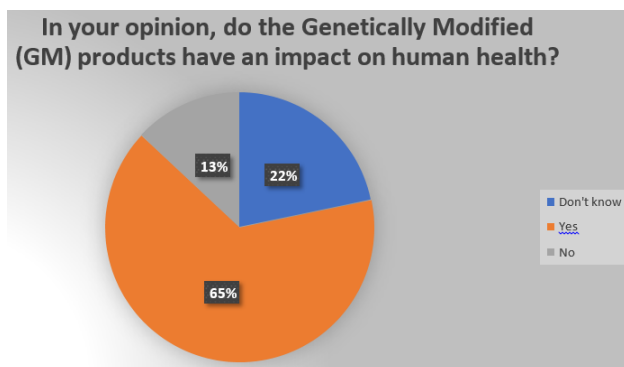


Fig. 8:- Effect Of GMOs To Human Health

Fig. 8 pie graph showcases the perception of the grade 9 level students about the safety of the consumers of GMO food products. Of all the participants, 12 learners of 65% of the participants agreed that Genetically Modified (GM) products have an impact on human health. The remaining 22% do not know if there is any health impact from GMOs. While 13% of the respondents believe that there are no impacts to the health when GMOs were consumed.

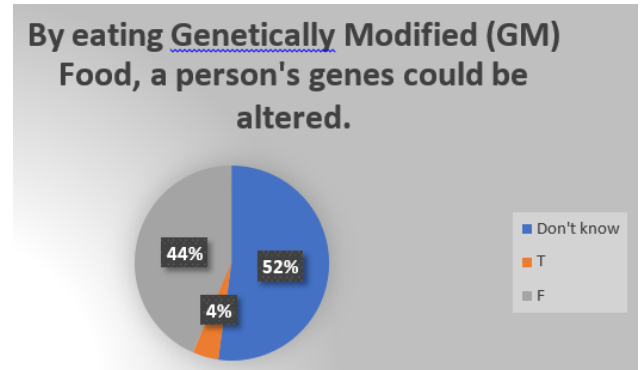


Fig. 9:- GMOs Effect To Genes

Fig. 9 illustration presents the distribution of the responses about the effect of the consumption of Genetically Modified (GM) foods on the consumer’s genes. Fig. 9 showcases the opinion of the students regarding the possibility of the alteration of the genes after consuming Genetically Modified (GM) foods. The majority of the participants responded that they do not know if there are possibilities of gene alteration after consuming GM foods. The 44% of the participants do not agree with the statement of possible gene alteration due to GM food consumption while the remaining 4% of the learners ticked the true answer showing that they agree with the statement.



Fig. 10:- Safeness Of GM Foods

Fig. 10 chart represents the responses about the safety and risk from GM foods usage. Based on Fig. 10, there are 48% of the respondents chose neither as their response to the question: How safe or risky are GM foods to human health? 22% of the participants do not know the answer. According to the remaining 17% of the respondents, GM foods are very safe while 13% of the participants believe that GM foods are very risky to human health.

IV. DISCUSSION

A. Conclusion

As a conclusion, this research shows that the 23 Grade 9 student participants from a state university high school Batch 2021-2022 have a lack of awareness of the Genetically Modified Organism (GMO) products in terms of Basic knowledge about GMOs, and GMO products effects on human health. The male is 30.43% of the respondents' sex and the female constitutes 69.57% of the participants. Moreover, the age range of the participants is 13-16 years old.

B. Recommendations

The future studies will provide additional information which may determine the level of awareness of the students about the Genetically Modified Organism (GMO) products. Interventions and teaching methodologists must also be applied to enhance the awareness of the students regarding these GMO products. These are some of the recommendations:

1. The replication studies are needed to evaluate how the learners perceive the Genetically Modified Organism (GMO) products.
2. More random samples and different kinds of sampling techniques should be executed to gather more data about this topic.
3. Further studies should focus on the integration of the topic of Genetically Modified Organisms (GMO) products in Science subjects.

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