Original Research Article

Public perception on genetically modified products: a case study of three local government areas in Cross River State, Nigeria

Abstract

Genetically modified products are important asset in modern agriculture with great potential to improve performance and yield of crops and farm animals. This survey was carried out to evaluate the perception of the people of Cross River State on genetically modified products (GMPs). The survey was carried out in four local government areas of Cross River State (Odukpani, Calabar Municipality, Calabar South and Akpabuyo) with 1000 respondents in each local government area giving a total of 4000 respondents. Data obtained from the questionnaire shared to the respondents were carefully collated and presented in simple percentages for ease of understanding. The demographic data showed that there were more males in the study (51.2%) than females (48.80%). Majority of the respondents were aged 25-35 years (46%). Most respondents had tertiary education (65.25%) and were majorly civil servants (27%) and businessmen (22.25%). A greater percentage of the respondents (63.75%) never heard of GMPs prior to this research. Majority of the respondents (63.7%) heard about GMPs from sources other than television (13%), friends (10.25%), newspaper (7.25%) and radio (7.25%). It was grossly observed that most of the respondents had various fears and concerns about GMPs, however, 58.5% agreed that the adoption of biotechnological principles in agriculture will increase productivity. In clear terms, we are still far behind in consumer knowledge of GMPs and there is need for more robust efforts in bringing this great technology to the minds of the consumers.

Keywords: GMPs, GMOs, GMFs, respondents, perception, Cross River State

Introduction

Genetically modified product is most commonly used to refer to plants and animals that are created for human consumption using the latest molecular biology techniques. It usually involve the transfer of genes from one plant to another and in extreme cases, the transfer of animal genes into plants, for example the Bt corn (Saxena and Stotky, 2001). This aspect of biotechnology has over the years generated debates and arguments and a good number of people including the better informed section of the public seem to be confused about the benefits and possible dangers of the use of GM foods.

It is widely recognized that biotechnology is one of the most innovative technologies developed in the 20th century with even more promising future in the 21st century. Many GM products such as rice with enhanced vitamin A, fruits and vegetables with extended shell life have already entered the world's food distribution networks. These products have the potential to not only meet our basic need, but also bring a wide range of economic, environmental and health benefits to humanity. Biotechnology advocates emphasize the potential benefits of this great technology to the society through reduction of hunger, malnutrition, cure of diseases promotion of health and general wellbeing. United Nations Development Programme (UNDP, 2001) reported that many GM crop varieties have shown superiority over conventionally grown crops in terms of yield,

pest and disease resistance, nutritional improvement and longer shell life. With advent of molecular technologies such as CRISPR, scientist are now snipping genes from microbes, plant, and even animals and inserting them into the genome of desired organism in order to create new traits in plant and animals with numerous economic values to mankind. Chronic hunger and malnutrition pose a persistent threat for hundreds of millions of Africans. Modern biotechnology is therefore seen as a form of emerging technology that can potentially reduce hunger and malnutrition, and is anticipated to play a crucial role in advancing socio-economic development.

The numerous merits associated with biotechnology notwithstanding, public attitude and perception on GM products are divided. Some perceive GM products as reducing labour and production cost, increasing productivity, satisfying nutritional needs, and improving economic and environmental conditions. Others perceive GM foods as hazardous to health, ethically unnatural, and possibly leading to a loss of biodiversity (Hossain *et al*., 2002). Public perception toward genetically modified (GM) products is crucial in understanding of modern biotechnology and agricultural development. This is because public perception of GM products might influence government regulations, consumer acceptance and farmers adoption of agricultural biotechnology. The divided public perception on agricultural biotechnology has led governments to make effort in supporting a number of studies to gauge the proven benefits and risk of GM technology, facilitating greater involvement of stake holders in GM technology such as farmers, the private sector, scientists, consumers, academia and the media to engage in dialogues for greater acceptance of GM products and promoting the understanding of food safety and environmental impact (Gruere and Sun, 2012).

Despite effort made by local and international donor organizations for the adoption of GM technology, the technology continues to face low level of acceptance especially in the underdeveloped and developing worlds. Public interest and concerns over GMOs have been growing in recent times and are now top on national governments and the world agenda where reducing poverty remains one of the major challenge in the region (United Nations, 1992).

In Africa, very few countries use commercialized GM crops (Karembu *et al*., 2009) despite the level of hunger and food insecurity in this part of the world. It will be wise that African leaders take steps in the direction that will save the future generation from perceived hunger, poverty and dependency. GM technology is anticipated to produce food crops that will be cheaper and more readily available because of improved yields and more stable production. The adoption of GM crops has been negatively affected by public opinion and anti-GM lobby groups despite the potential for increased food production in developing countries (Nuffield Council on Bioethics, 2003). Environmental risks such as gene flow, evolution of resistance in the targeted pest populations, impacts on non-target organisms, and food safety are often raised (Smale and DeGroote, 2003). Several studies have been conducted to assess consumer attitudes and perceptions toward GM crops (Bett *et al*, 2010; Kimenju and De Groote, 2008; Onyango *et al*, 2006). Results revealed that consumers' perceptions toward the potential benefits and risks of GM crops are still mixed and differ within and across countries. Moreover, consumer attitudes toward GM crops change as consumers are exposed to new information (Smale *et al*., 2009). Hence, information has a crucial impact on consumers' references for GM food products. Smale *et al*. (2009) also highlighted the general lack of empirical studies integrating consumers' preferences with farmers' adoption of GM crops in developing countries; that is, the propensity

to purchase and ~~the propensity to~~ adopt have rear consideration in a single study. Available scientific knowledge and reviews by national and international science organizations on human health indicate that GM foods are safe and suitable for human consumption (FAO, 2004; ICSU, 2004). Despite these assurances, a number of studies show that consumers in developed countries consistently prefer non-GM foods (Costa-Font *et al*., 2008; Lusk *et al*., 2005). It becomes imperative to explore the perception of the people of Calabar in Cross River State, Nigeria on genetically modified products. The findings of this study will provide a baseline information to researchers, academia, government and policy makers in the approach to adopt GM products as friendly with great potential to contribute towards mitigating hunger in Nigeria.

Materials and Methods

Study area and population

This study was carried out in four local government areas in Cross River State namely; Odukpani, Calabar Municipality, Calabar South and Akpabuyo all in Southern Senatorial Zone of Cross River State. Questionnaires were distributed to 1000 respondents in each of the four local government areas giving a total of 4000 participants.

Distribution of Questionnaire

Questionnaires were distributed to respondents who were mainly civil servants, business men/women and famers. Major information included were age, occupation, educational level knowledge of genetically modified products, length of information, source of information, and general knowledge of genetically modified crops.

Statistical analysis

Data obtained from the respondents were analyzed using SPSS version 20.0. The results obtained were presented in simple percentages using charts for ease of comparison.

Results

Demographics of respondents

The results presented in Table 1 showed that majority of the respondents were males (51.20%), while the rest (48.80%) were females. The mode age bracket was 25-35 years (46%) for 1840 respondents, 36-45 age bracket was 29.25% for 1170 respondents, 46-55 age bracket was 15.5% for 620 respondents and 56 & above was 9.25% for 370 respondents. It was also revealed that 48.25% of respondents were single, 34.5% were married while 17.25% were widows. Also, 27% of the respondents were civil servants, 22.25% were business men and women, 14.5% were farmers, 12.5% were applicants and 23.75% were other occupations not specified in the questionnaire. On educational background of the respondents, 7.75% of respondents stopped at primary education level, 17 % had secondary education, 65.25% had tertiary education, and 10% had no formal education. Thus, most respondents had the benefit of tertiary education.

Table 1

Table 1 Demographic analysis of respondents

Knowledge and perceptions of respondents on GMPs

~~In Figure 1, respondents were asked if they have heard of GMPs prior to this study and it was~~

Gender	Male (%) 51.20	Female (%) 48.80			
Age	25-35 years (%) 1840 (46)	36-45 years (%) 1170 (29.25)	46-55 years (%) 620 (15.5)	56- above (%) 370 (9.25)	
Marital status	Single (%) 48.25	Married (%) 34.5	Widows (%) 17.25		
Occupation	Civil servants (%) 27	Businessmen/women (%) 22.25	Farmers (%) 14.5	Applicants (%) 12.5	Others (%) 23.75
Education	Primary (%) 7.75	Secondary (%) 17	Tertiary (%) 65.25	None (%) 10	

In Figure 1, respondents were asked if they have heard of GMPs prior to this study and it was found that 63.75% of the population have not heard of GMPs while 36.25% of the population have heard of GMPs. On the length of information on GMPs, 60.5% of the respondents were just hearing of GMPs for the first time, 10% heard of GMPs for (1-2) years, 11.5% have heard of GMPs for (3-4) years, 6% have heard of GMPs for (5-6) years, and 12% have heard of GMPs for 6 years and above (figure 2). From Figure 3, the main source of information was from other means of communication (63.75%), followed by the television (13%), friends (10.25%), newspaper (7.25%) and radio (5.75%). From the questionnaire, 8% of the respondents strongly agreed that GMFs will modify their genes, 27.75% agreed, 46.5% disagreed and 17.75% strongly disagreed (~~f~~Figure 4). ~~In s~~Similarly, ~~fashion,~~ 6.25% of the respondents strongly agreed that GM food is better than conventional food, 22.75% agreed, 46.5% disagreed and 17.75% strongly disagreed (~~f~~Figure 5).

It was also revealed that 23.4% of the respondents strongly agreed to have fear for GM products, 47.41% agreed to fear, 34.12% disagreed while 10.12 strongly disagreed to having any fear for GM products (~~f~~Figure 6totalling does not add to 100%). Results on ethical acceptability of GMFs revealed that, 15.25% of the respondents strongly agreed that GMFs are not ethically acceptable, 34% agreed, 36% disagreed and 14.75% strongly disagreed (~~f~~Figure 7). From Figure 8, 35% of the respondents strongly agreed that GMPs can cause health damage, 45.5% agreed, 15.5% disagreed and 4% strongly disagreed. 22% of the respondents strongly agreed that GMPs are unnatural and can lead to chronic disease, 57.5% agreed, 16.5% disagreed and 4% strongly disagreed as shown in ~~f~~Figure 9. While, 25.25% of the respondents strongly agreed that GMPs harm the environment, 49.75% agreed, 21.25% disagreed and 3.75% strongly disagreed (~~f~~Figure

10). Notably, 24% of the respondents strongly agreed that GM technology in food production will increase productivity, 58.5% agreed, 14.25% disagreed and 3.25% strongly disagreed (Figure 11). From the survey, 19% of the respondent strongly agreed that the benefit of GMPs far outweighs the risk, 43% agreed, 33% disagreed and 5% strongly disagreed as presented in Figure 12. From Figure 13, 16.75% of the respondents strongly agreed that GM foods are good for national economy, 57% agreed, 22.25% disagreed and 4% strongly disagreed. The results in Figure 14 revealed that 16.75% of the respondent strongly agreed that GM technology improve yield, pest resistance and drought tolerance, 65.5% agreed, 15.25% disagreed and 2.5% strongly disagreed. From Figure 15 it was revealed that, 33% of the respondent strongly agreed that the government should fund GM research, 45.25% agreed, 18.25% disagreed and 3% disagreed.

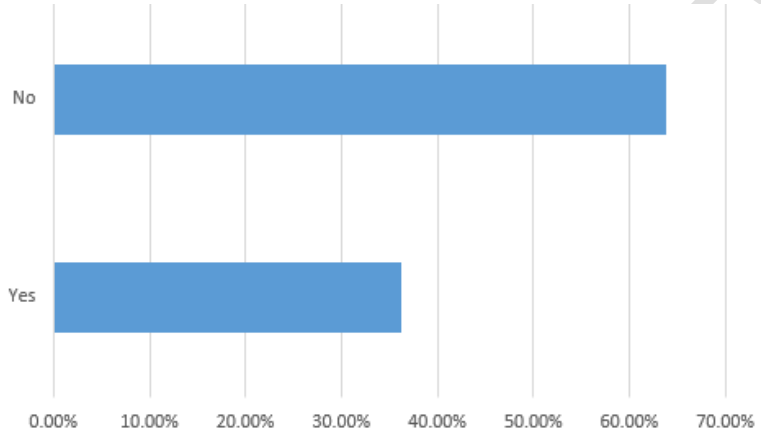


Figure 1: Awareness of genetically modified products (GMPs)

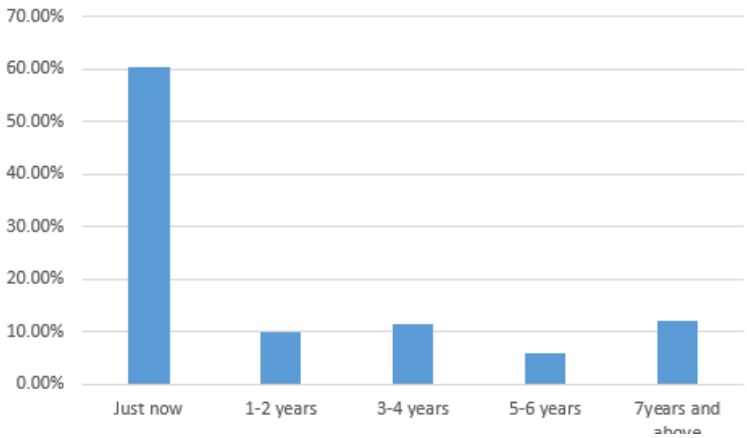


Figure 2: Perception on the length of Information on GMPs

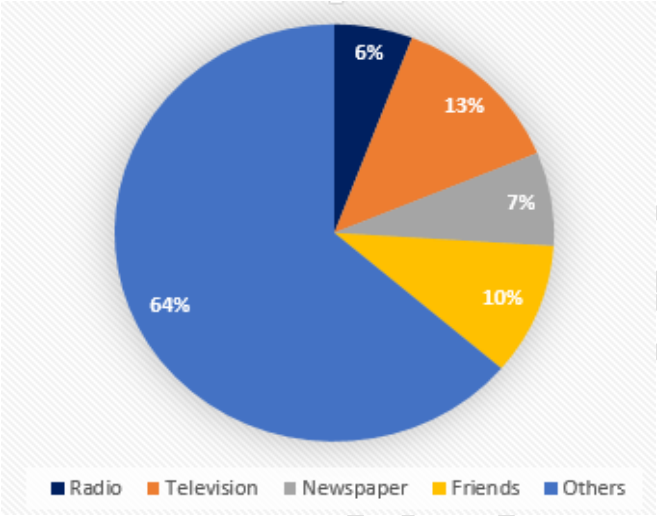


Figure 3: source of information on GMPs

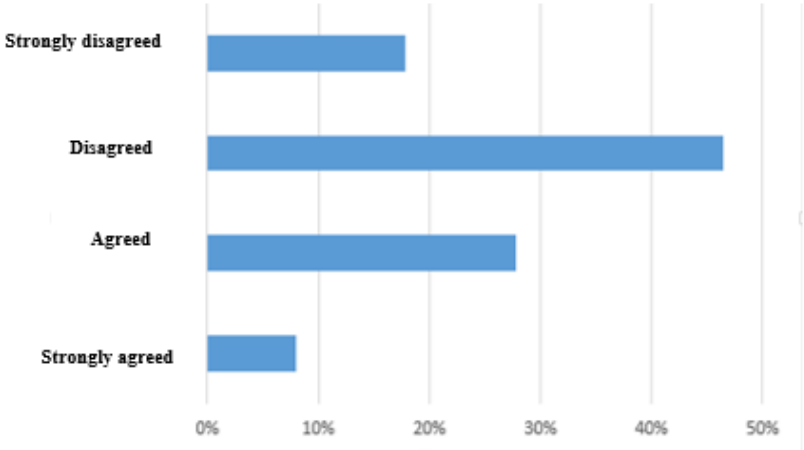


Figure 4: Perception on GM foods modifying genes

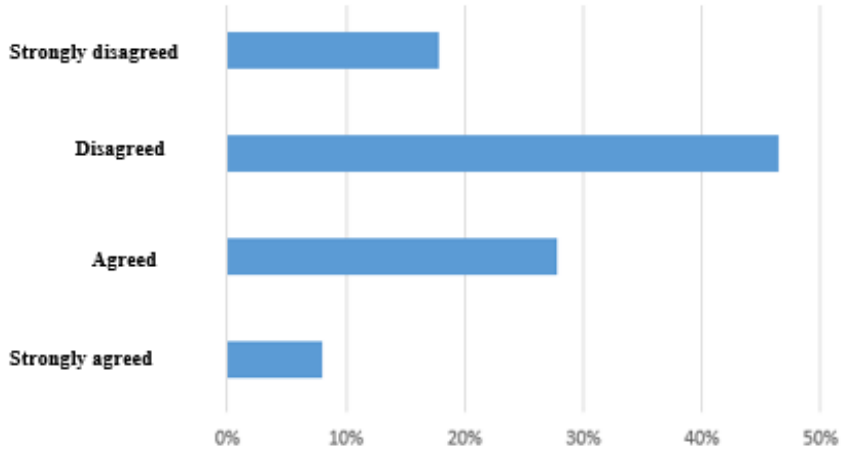


Figure 5: Perception on comparing GM foods and conventional foods

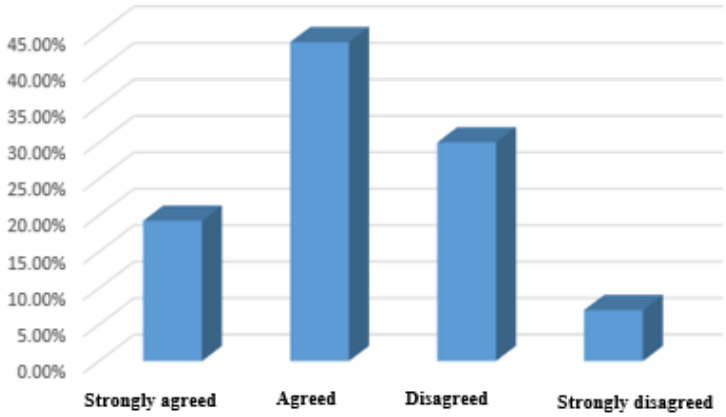


Figure 6: Perception on fear for GM products

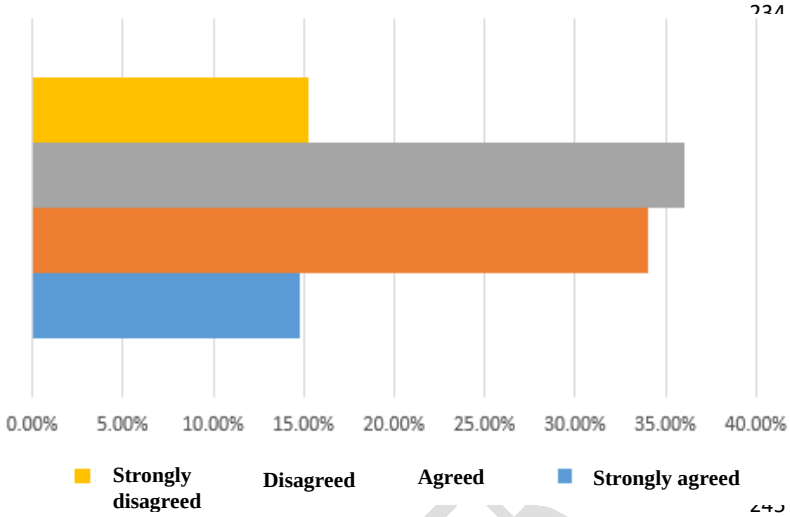


Figure 7: Perception on ethical acceptability of GMFs

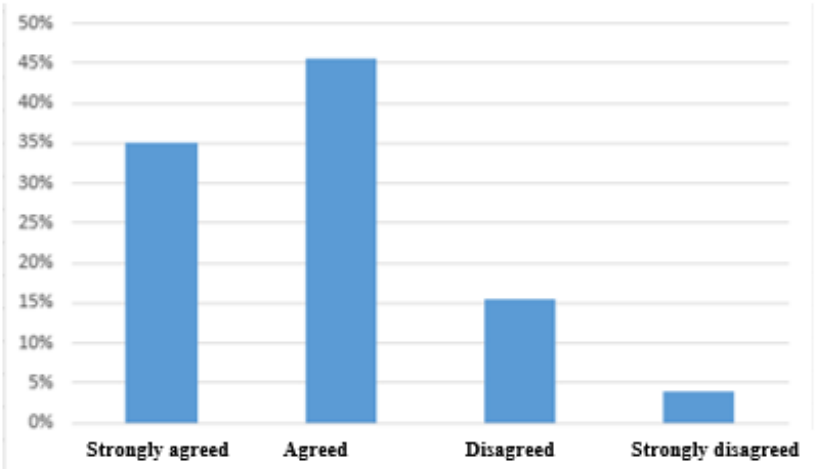


Figure 8: Perception on GM products causing health damage

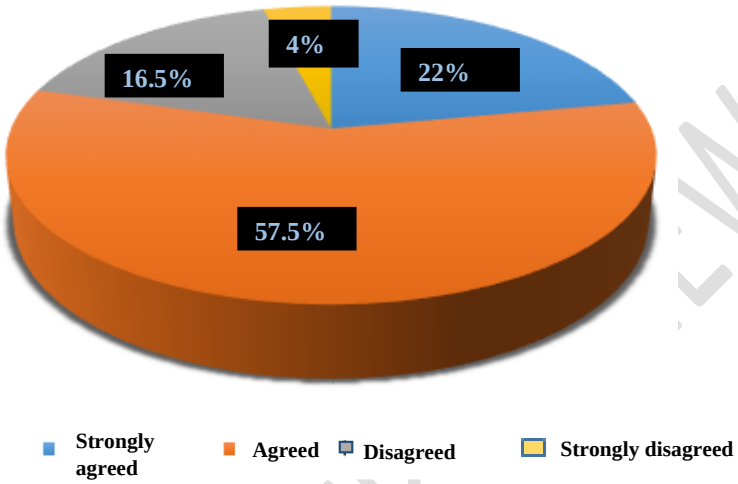


Figure 9: Perception on GM products being unnatural and leads to chronic disease

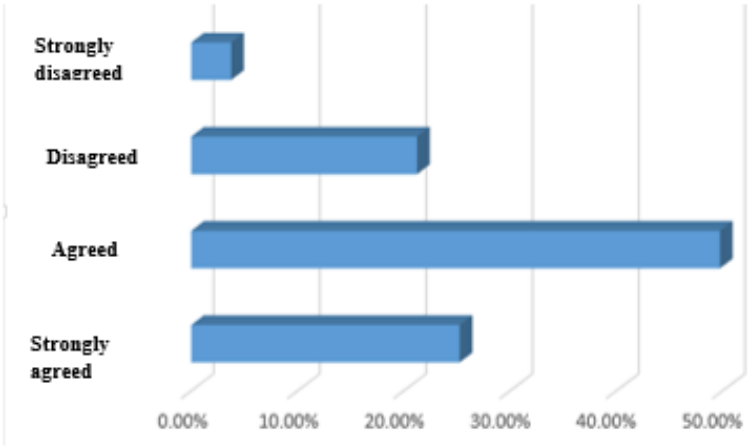


Figure 10: Perception on GMPs causing harm to the environment

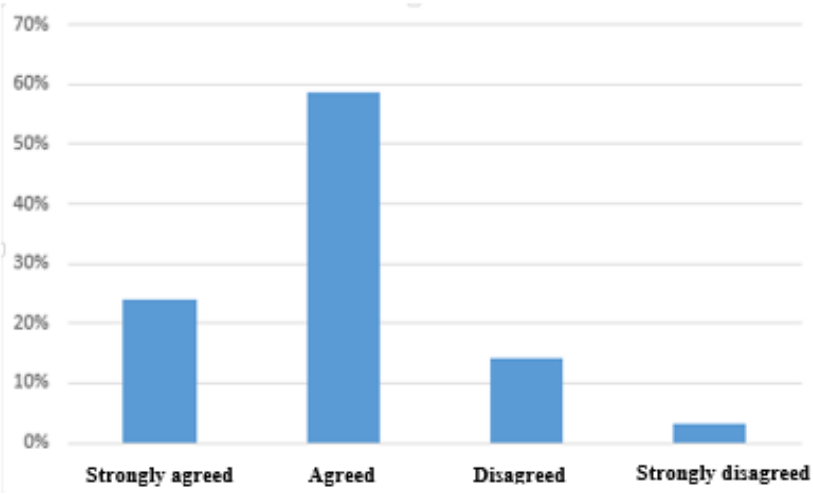


Figure 11: Perception on increased food production using GM technology

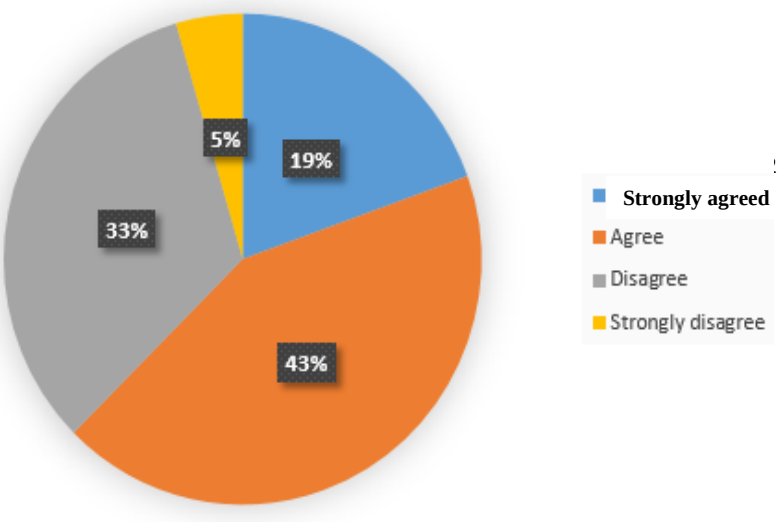


Figure 12: Perception on the benefits of GMPs

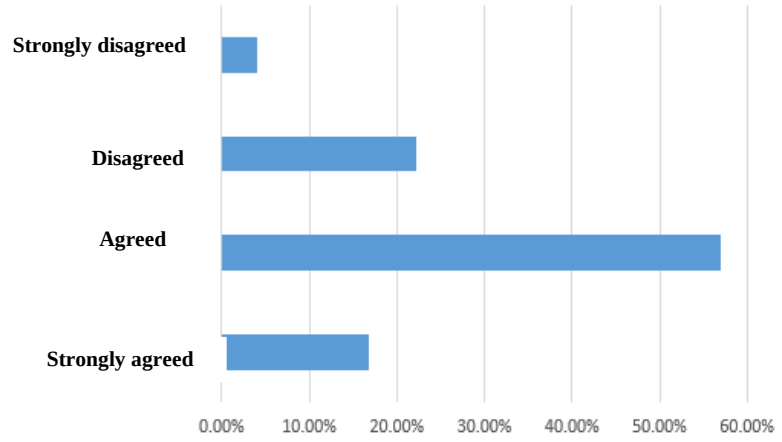


Figure 13: Perception on GM foods on national economy

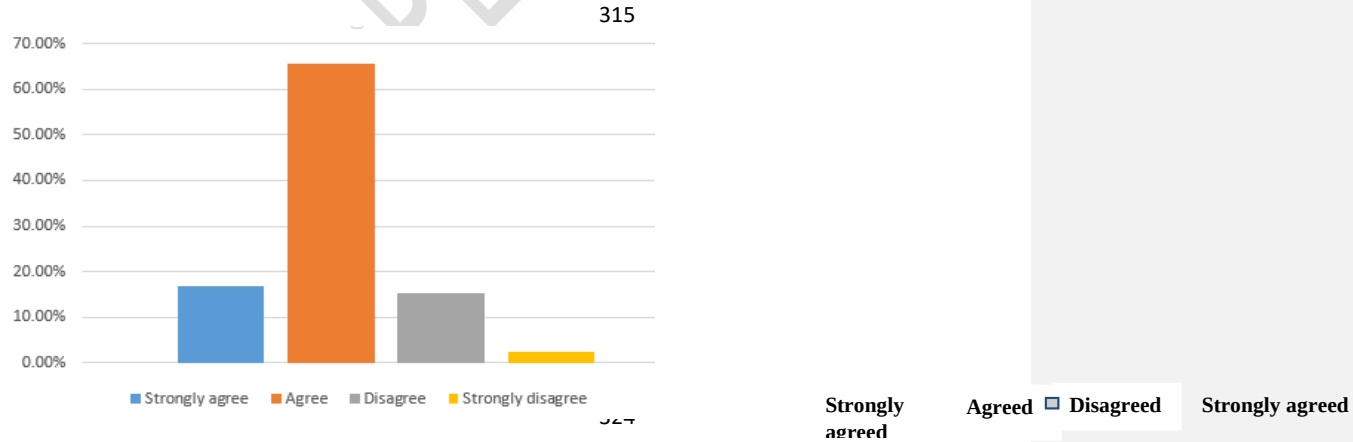
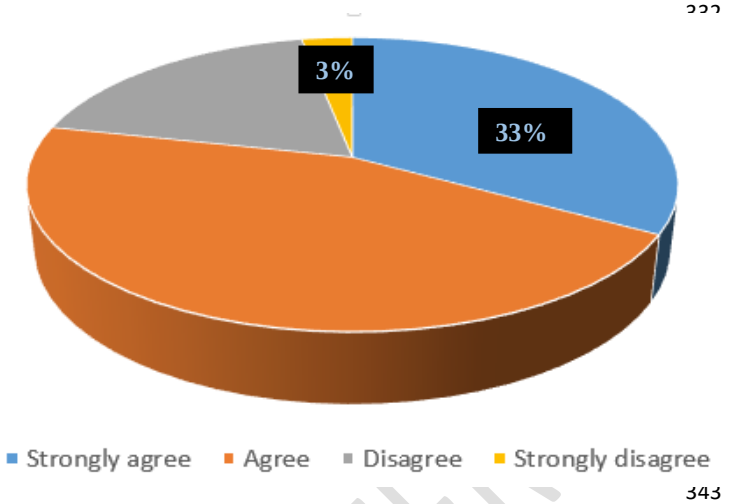


Figure 14: Perception on GM technology to improve yield, pest resistance and drought tolerance



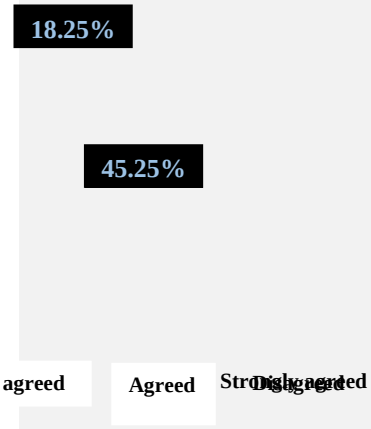


Figure 15: Perception of government funding Gm research

Discussion

GM products have been in the food system for decades and are becoming even more present, yet consumer knowledge and awareness are not improving especially in the developing world which include Cross River State in Nigeria. Majority of the respondents who participated in the study were males. Mucci and Hough (2004) studied consumer perception and purchase intentions for GM foods in Argentina and found out that GM food was more acceptable by male consumers than to females. Christoph *et al*. (2008) examined consumer attitudinal clusters based on acceptability of genetic modification in Germany and found that GM supporters tended to be older and were more often male than female. Similar studies done in the United States found that women are less supportive of GM crops and foods than their male counterparts (Hossain *et al*., 2002). Females, especially from developing countries, are generally less knowledgeable, less interested, and less supportive of science and technology than males (Anunda *et al*., 2010). These reports corroborate the submissions of the finding of our study.

Respondents with younger age have higher knowledge of GMFs compared to older age. This shows that old people are not fully aware of GMPs. This may be as a result of their educational background or not having the opportunity to be educated. It is imperative to purport that the move to advocate GMFs is more promising with the younger age brackets who may have more capacity to broadcast the technology through the new emerging platforms. Most of these younger people are single and are free to engage in the activities that will promote wider coverage of GMFs such as consumer education. More participants were in active service which suggest that their level of education must have influenced their knowledge of the GMF. There is a great concern over the low percentage of farmers (14.5%) that participated in this study who in most cases reported that they have no idea about GMFs. This calls for more translation of the science behind GMF to farmers and proper sensitization on the benefits of GM crops to fully engage them in advocating GM products. From the survey, it was clear that the level of education has a positive relationship with the knowledge of participants on GM products as most of the participants reported to have had tertiary education. Department stores, where items are labelled and price-tagged, seem to belong to the learned, who can read and write. Often, to shop with pre-written list of needs. Therefore, one expects them to be knowledgeable of GMFs (Eneh *et al*., 2016).

Surveys show that 63.75% of the residence in Cross River State that were captured in the questionnaire were unaware of GMOs or do not fully understand GM products, their traits and they themselves are dissatisfied with their self-rated knowledge, indicating a desire and a need for wide spread consumer education. The low level of awareness of GMPs in Cross River State is a call on the government within and outside as well as biotechnology companies to create platforms to disseminate information to the people of Cross River State and Nigerians by extension. In recent time, the government of Nigeria has recently approved Bt cotton as its first genetically modified crop in 2018 as a pest-resistance variety of cotton, a step to revitalization of its textile industry and boosting economic development (Isaac, 2018). In 2019, National Biosafety Management Agency in Nigeria approved a genetically engineered cowpea variety (pod borer resistant) for utilization by Nigerian farmers (Adebowale, 2019). Pod borer insect, *Maruca vitrata* can reduce yield by 80% in cowpea and the cultivation of the resistance variety is a promising approach to yield improvement with the potential to boosting Nigerian economy and contributing to food security. Despite this approaches by the Nigerian government in adopting

GM crops, her citizens are still lacking the awareness of the advances, the basic science behind GM crops and the benefits inherent in their utilization. This is evidence in the results of the survey obtained in this study which revealed that 60.5% of the respondents were just hearing of GMPs for the first time~~., 10% know of GMPs for 1-2 years, 11.5% for 3-4 years, 6% for 5-6 years, and 12% for 7 years and above.~~ It was revealed that among the respondents who have heard about GMP, greater percentage sourced information from means other than television, newspapers, radio and friends. It is therefore recommended that efforts taken on consumer education and sensitization programmes for the general public should be further increased.

The low level of awareness and lack of public engagement in biotechnology and genetically modified food is a key premise in acceptability of GMPs over the conventional foods where most of the respondents agreed that conventional food is better than GM food. The public need to be properly guided with special emphasis on the safety of GM food after consumption and should be made to understand that GM crops have been tested through robust trails to be environmentally friendly before their approval and subsequent release. Subjectively, the benefits associated with GM crops as advanced ways to fighting food insecurity far outweighs any perceived controversial demerits. It will be a very unwise decision if this promising science is stamped through the nonchalant and recalcitrant views of the public towards its acceptability. Therefore and most importantly, the government and biotechnology agencies have a very critical role to play in creating a wide coverage of public enlightenment on the benefits of GMPs in Cross River State and Nigeria as a whole.

Conclusion

Explicitly, the knowledge of the respondents on genetically modified product was quite low and by implication, this maybe the general knowledge status of other Nigerians on GMPs. It is therefore very urgent that the respective advocates of GMPs doubled their effort in consumer education and more public enlightenment on the many benefits inherent in the use GMPs.

Competing interest: Authors have declared that no competing interest exist.

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