

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

Abstract

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. 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 involves the transfer of genes from one plant to another and in extreme cases, the transfer of genes from animal into plant, for example the Bt corn [1]. 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 genetically modified (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 shelf 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 [2] 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 shelf life. With advent of molecular technologies such as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), scientist are now snipping genes from microbes, plant, and even animals and inserting them into

47 the genome of desired organism in order to create new traits in plants and animals with numerous
48 economic values to mankind. Chronic hunger and malnutrition pose a persistent threat for
49 hundreds of millions of Africans. Modern biotechnology is therefore seen as a form of emerging
50 technology that can potentially reduce hunger and malnutrition, and is anticipated to play a
51 crucial role in advancing socio-economic development.

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53 The numerous merits associated with biotechnology notwithstanding, public attitude and
54 perception on GM products are divided. Some perceive GM products as reducing labour and
55 production cost, increasing productivity, satisfying nutritional needs, and improving economic
56 and environmental conditions. Others perceive GM foods as hazardous to health, ethically
57 unnatural, and possibly leading to a loss of biodiversity [3]. Public perception toward GM
58 products is crucial in understanding of modern biotechnology and agricultural development. This
59 is because public perception of GM products might influence government regulations, consumer
60 acceptance and farmers adoption of agricultural biotechnology. The divided public perception on
61 agricultural biotechnology has led governments to make effort in supporting a number of studies
62 to gauge the proven benefits and risk of GM technology, facilitating greater involvement of stake
63 holders in GM technology such as farmers, the private sector, scientists, consumers, academia
64 and the media to engage in dialogues for greater acceptance of GM products and promoting the
65 understanding of food safety and environmental impact [4].

66
67 Despite effort made by local and international donor organizations for the adoption of GM
68 technology, the technology continues to face low level of acceptance especially in the
69 underdeveloped and developing worlds. Public interest and concerns over genetically modified
70 organisms (GMOs) have been growing in recent times and are now top on national governments
71 and the world agenda where reducing poverty remains one of the major challenges in the region
72 [5].

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74 In Africa, very few countries use commercialized GM crops [6] despite the level of hunger and
75 food insecurity in this part of the world. It will be wise that African leaders take steps in the
76 direction that will save the future generation from perceived hunger, poverty and dependency.
77 GM technology is anticipated to produce food crops that will be cheaper and more readily
78 available because of improved yields and more stable production. The adoption of GM crops has
79 been negatively affected by public opinion and anti-GM lobby groups despite the potential for
80 increased food production in developing countries [7]. Environmental risks such as gene flow,
81 evolution of resistance in the targeted pest populations, impacts on non-target organisms, and
82 food safety are often raised [8]. Several studies have been conducted to assess consumer attitudes
83 and perceptions toward GM crops [9,10,11]. Results revealed that consumers' perceptions
84 toward the potential benefits and risks of GM crops are still mixed and differ within and across
85 countries. Moreover, consumer attitudes toward GM crops change as consumers are exposed to
86 new information [12]. Hence, information has a crucial impact on consumers' references for GM
87 food products. Also, [12] highlighted the general lack of empirical studies integrating
88 consumers' preferences with farmers' adoption of GM crops in developing countries; that is, the
89 propensity to purchase and adopt have rear consideration in a single study. Available scientific
90 knowledge and reviews by national and international science organizations on human health
91 indicate that GM foods are safe and suitable for human consumption [13,14]. Despite these
92 assurances, a number of studies show that consumers in developed countries consistently prefer

93 non-GM foods [15, 16]. It becomes imperative to explore the perception of the people of Calabar
94 in Cross River State, Nigeria on genetically modified products. The findings of this study will
95 provide baseline information to researchers, academia, government and policy makers in the
96 approach to adopt GM products as friendly with great potential to contribute towards mitigating
97 hunger in Nigeria.

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Materials and Methods

100 Study area and population

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

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106 Distribution of Questionnaire

107 Questionnaires were distributed to respondents who were mainly civil servant, business
108 men/women and farmers. Major information included were age, occupation, educational level
109 knowledge of genetically modified products, length of information, source of information, and
110 general knowledge of genetically modified crops.

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112 Statistical analysis

113 Data obtained were presented in simple percentages using charts for ease of comparison. This
114 was performed using SPSS version 20.0.

115 Results

116 Demographics of respondents

117 The results presented in Table 1 show that majority of the respondents were males (51.20%),
118 while the rest (48.80%) were females. The mode age bracket was 25-35 years (46%) for 1840
119 respondents, 36-45 age bracket was 29.25% for 1170 respondents, 46-55 age bracket was 15.5%
120 for 620 respondents and 56 & above was 9.25% for 370 respondents. It was also revealed that
121 48.25% of respondents were single, 34.5% were married, while 17.25% were widows. Also, 27%
122 of the respondents were civil servants, 22.25% were business men and women, 14.5% were
123 farmers, 12.5% were applicants and 23.75% were other occupations not specified in the
124 questionnaire. On educational background of the respondents, 7.75% of respondents stopped at
125 primary education level, 17 % had secondary education, 65.25% had tertiary education, and 10%
126 had no formal education. Thus, most respondents had the benefit of tertiary education.

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Table 1

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	

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Demographic analysis of respondents

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Knowledge and perceptions of respondents on GMPs

140 Respondents were asked if they have heard of GMPs prior to this study and the obtained results

141 are shown in Figure 1. It was found that 63.75% of the population have not heard of GMPs,

142 while 36.25% of the population have heard of GMPs. On the length of information on GMPs,

143 60.5% of the respondents were just hearing of GMPs for the first time, 10% heard of GMPs for

144 (1-2) years, 11.5% have heard of GMPs for (3-4) years, 6% have heard of GMPs for (5-6) years,

145 and 12% have heard of GMPs for 6 years and above (Figure 2). From Figure 3, it can be

146 observed that the main source of information was from other means of communication (63.75%),

147 followed by the television (13%), friends (10.25%), newspaper (7.25%) and radio (5.75%). From

148 the questionnaire, 8% of the respondents strongly agreed that GMFs will modify their genes,

149 27.75% agreed, 46.5% disagreed and 17.75% strongly disagreed (Figure 4). Similarly, 6.25% of

150 the respondents strongly agreed that GM food is better than conventional food, 22.75% agreed,

151 46.5% disagreed and 17.75% strongly disagreed (Figure 5).

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153 It was also revealed that 19.4% of the respondents strongly agreed to have fear for GM products,

154 44.41% agreed to fear, 29.12% disagreed while 7.07 strongly disagreed to having any fear for

155 GM products (Figure 6). Results on ethical acceptability of GMFs revealed that, 15.25% of the

156 respondents strongly agreed that GMFs are not ethically acceptable, 34% agreed, 36% disagreed

157 and 14.75% strongly disagreed (Figure 7). From Figure 8, it is found that 35% of the respondents

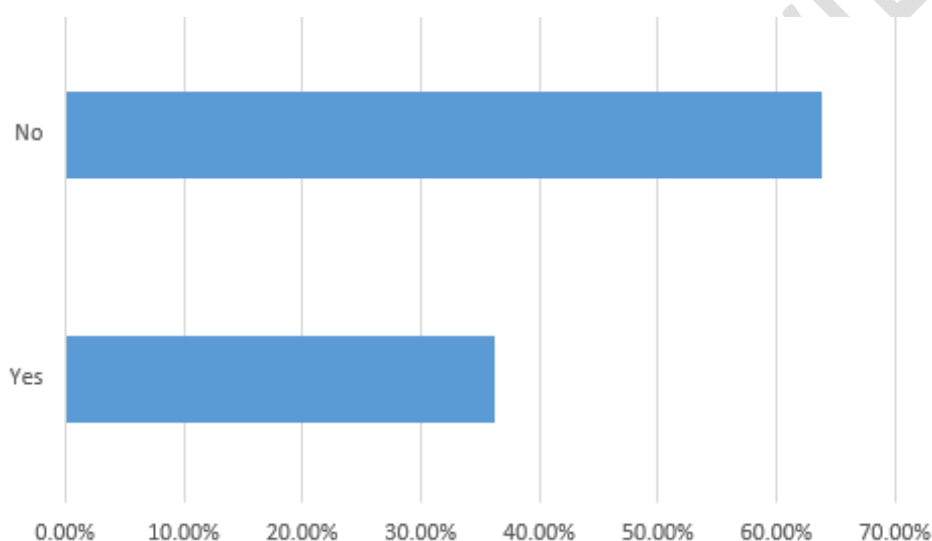
158 strongly agreed that GMPs can cause health damage, 45.5% agreed, 15.5% disagreed and 4%

159 strongly disagreed. 22% of the respondents strongly agreed that GMPs are unnatural and can

160 lead to chronic disease, 57.5% agreed, 16.5% disagreed and 4% strongly disagreed as shown in

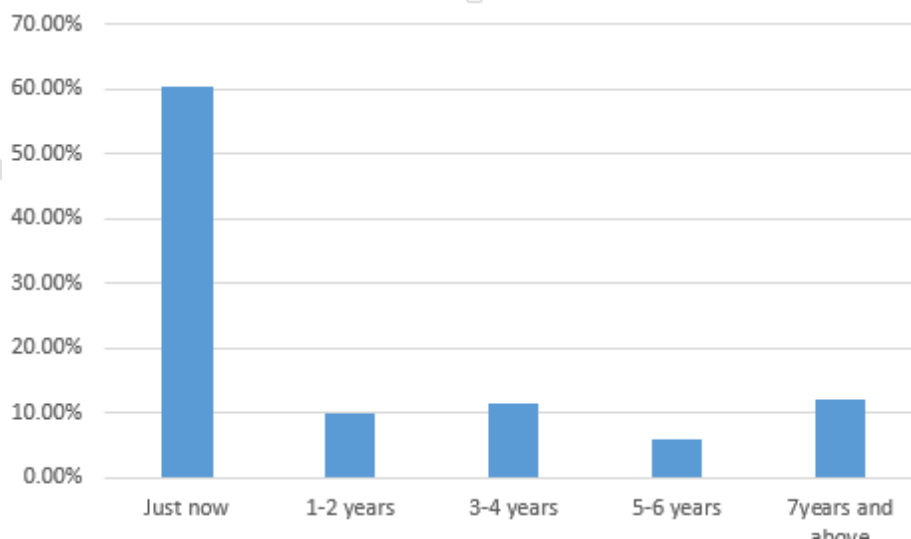
161 Figure 9. While, 25.25% of the respondents strongly agreed that GMPs harm the environment,

162 49.75% agreed, 21.25% disagreed and 3.75% strongly disagreed (Figure 10). Notably, 24% of
 163 the respondents strongly agreed that GM technology in food production will increase
 164 productivity, 58.5% agreed, 14.25% disagreed and 3.25% strongly disagreed (Figure 11). From
 165 the survey, 19% of the respondent strongly agreed that the benefit of GMPs far outweighs the
 166 risk, 43% agreed, 33% disagreed and 5% strongly disagreed as presented in Figure 12. From
 167 Figure 13, it can be noted that 16.75% of the respondents strongly agreed that GM foods are
 168 good for national economy, 57% agreed, 22.25% disagreed and 4% strongly disagreed. The
 169 results in Figure 14 revealed that 16.75% of the respondent strongly agreed that GM technology
 170 improve yield, pest resistance and drought tolerance, 65.5% agreed, 15.25% disagreed and 2.5%
 171 strongly disagreed. From Figure 15 it is revealed that, 33% of the respondent strongly agreed that
 172 the government should fund GM research, 45.25% agreed, 18.25% disagreed and 3% strongly
 173 disagreed.



186 **Figure 1:** Awareness of genetically modified products (GMPs)

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Figure 2: Perception on the length of Information on GMPs

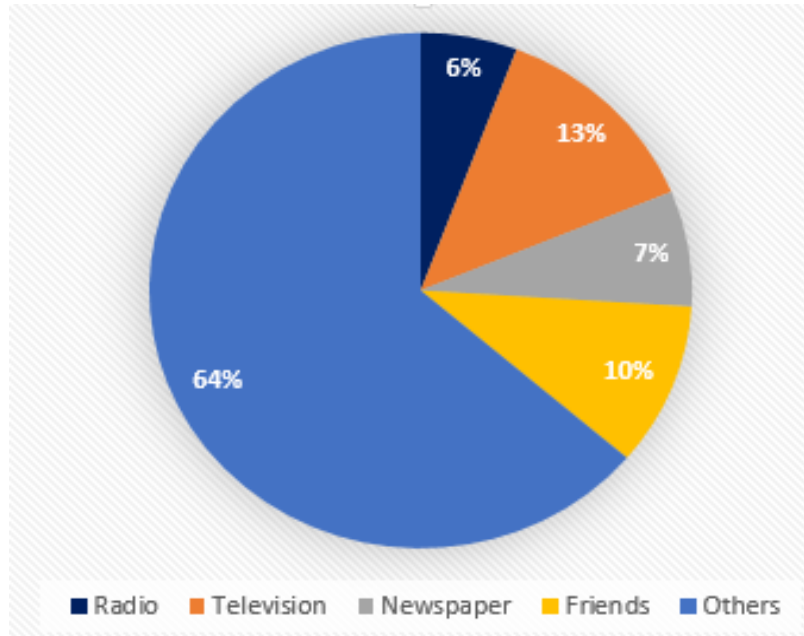
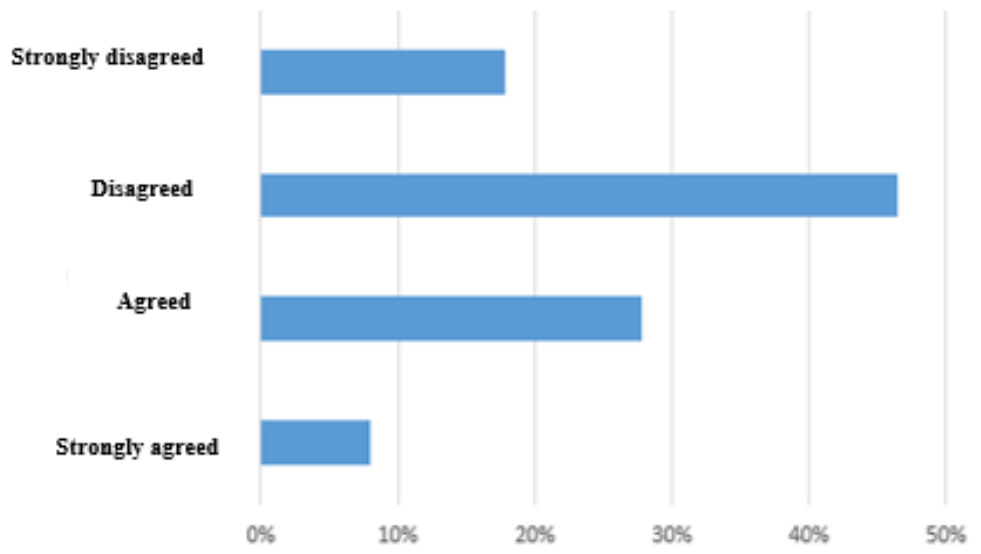


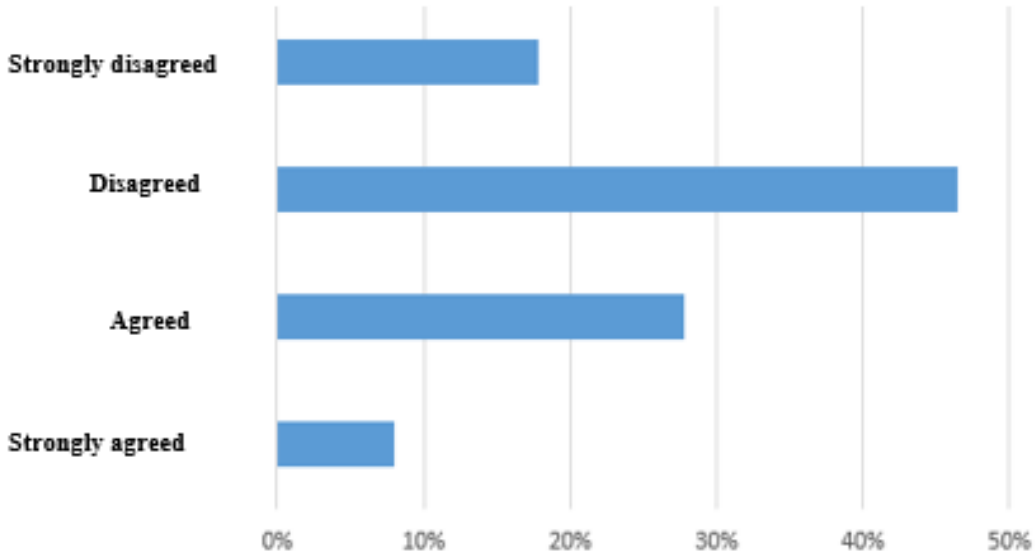
Figure 3: Source of information on GMPs



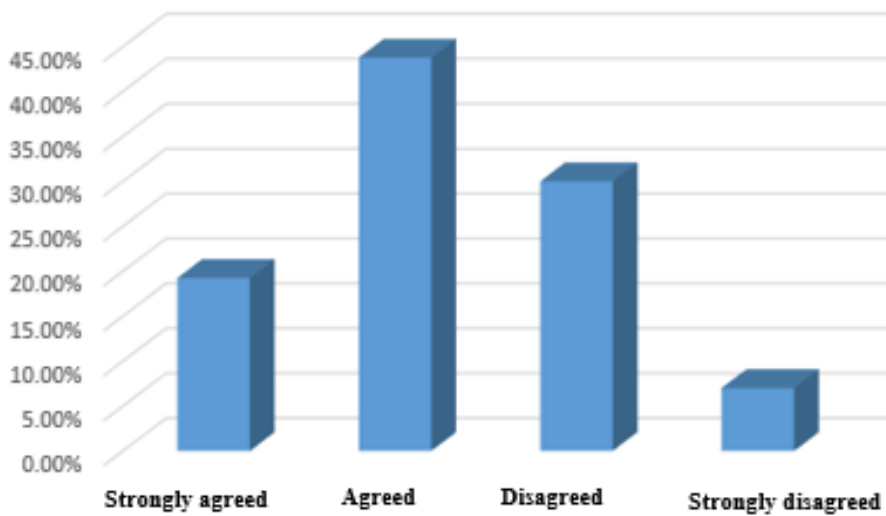
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Figure 4: Perception on GM foods modifying genes

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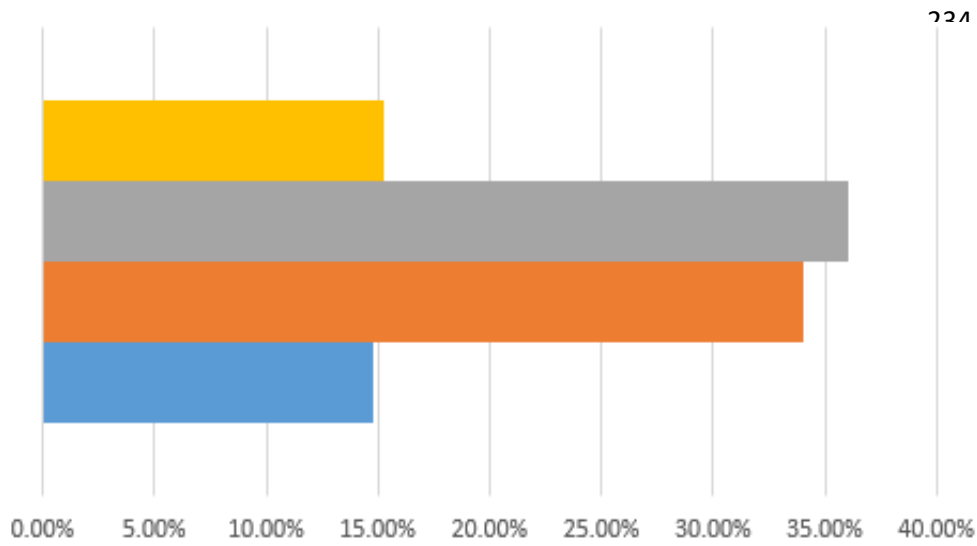
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224 **Figure 5:** Perception on comparing GM foods and conventional foods
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227 **Figure 6:** Perception on fear for GM products

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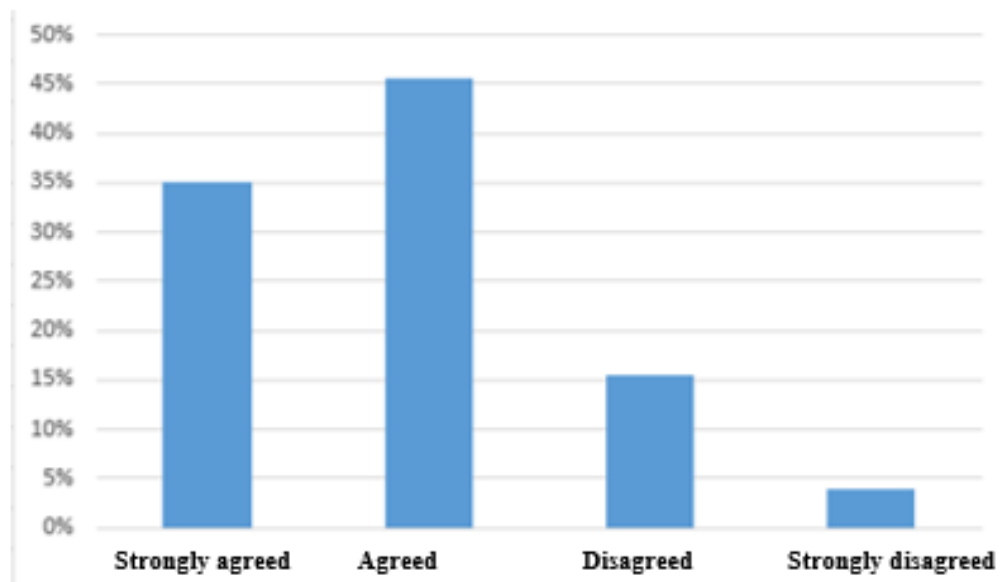
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■ Strongly disagreed ■ Disagreed ■ Agreed ■ Strongly agreed

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Figure 7: Perception on ethical acceptability of GMFs



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Figure 8: Perception on GM products causing health damage

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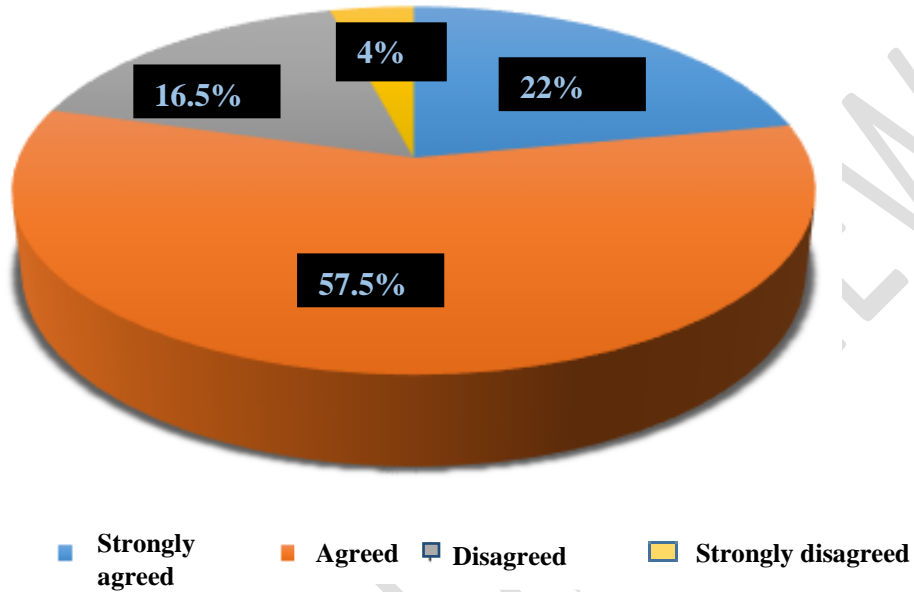
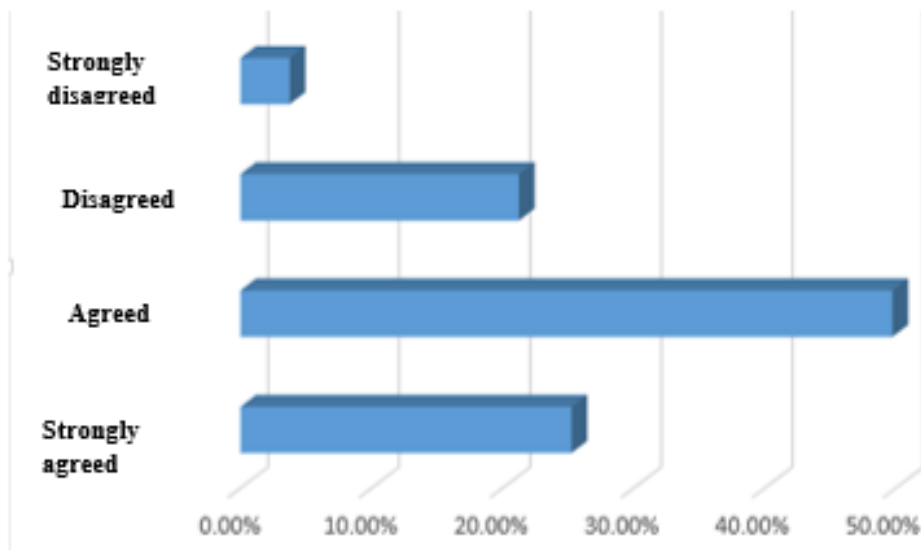


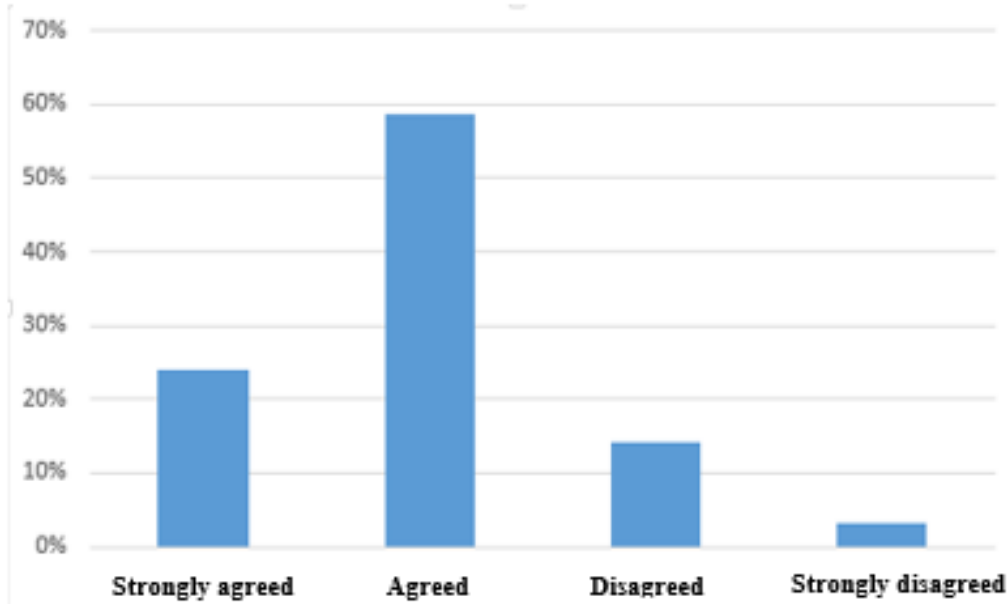
Figure 9: Perception on GM products being unnatural and leads to chronic disease



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Figure 10: Perception on GMPs causing harm to the environment

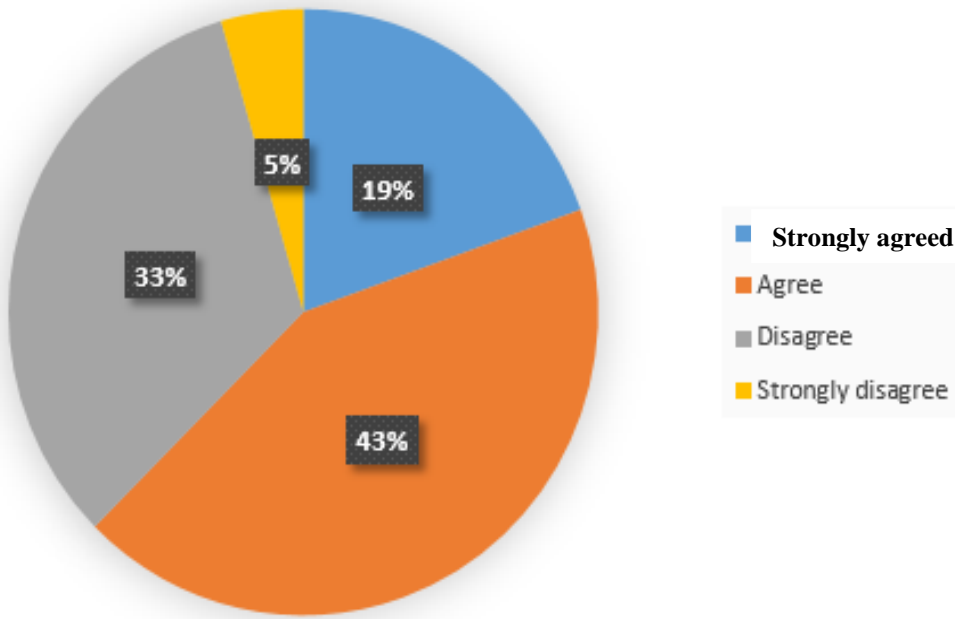
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Figure 11: Perception on increased food production using GM technology

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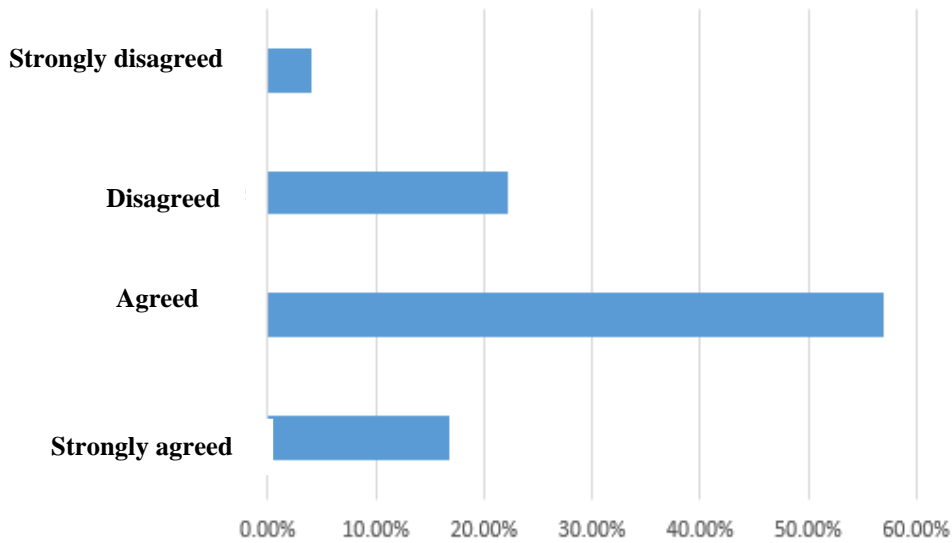
Agreed
Disagreed
Strongly disagreed

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Figure 12: Perception on the benefits of GMPs

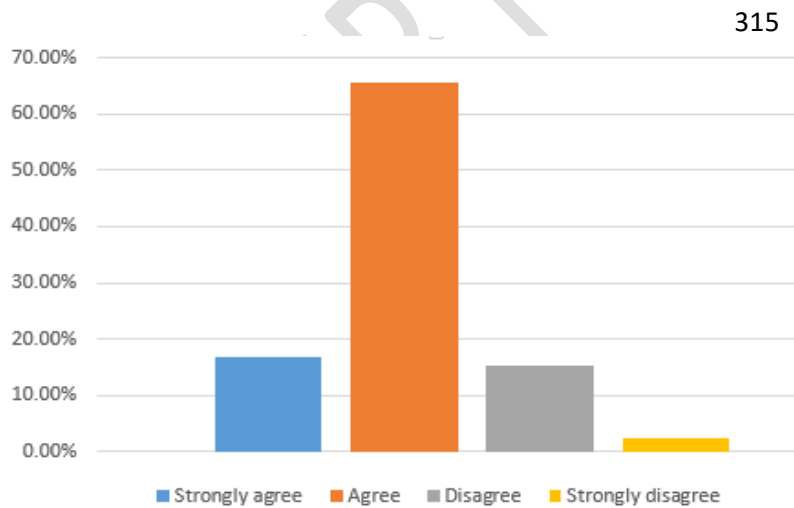
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Figure 13: Perception on GM foods on national economy

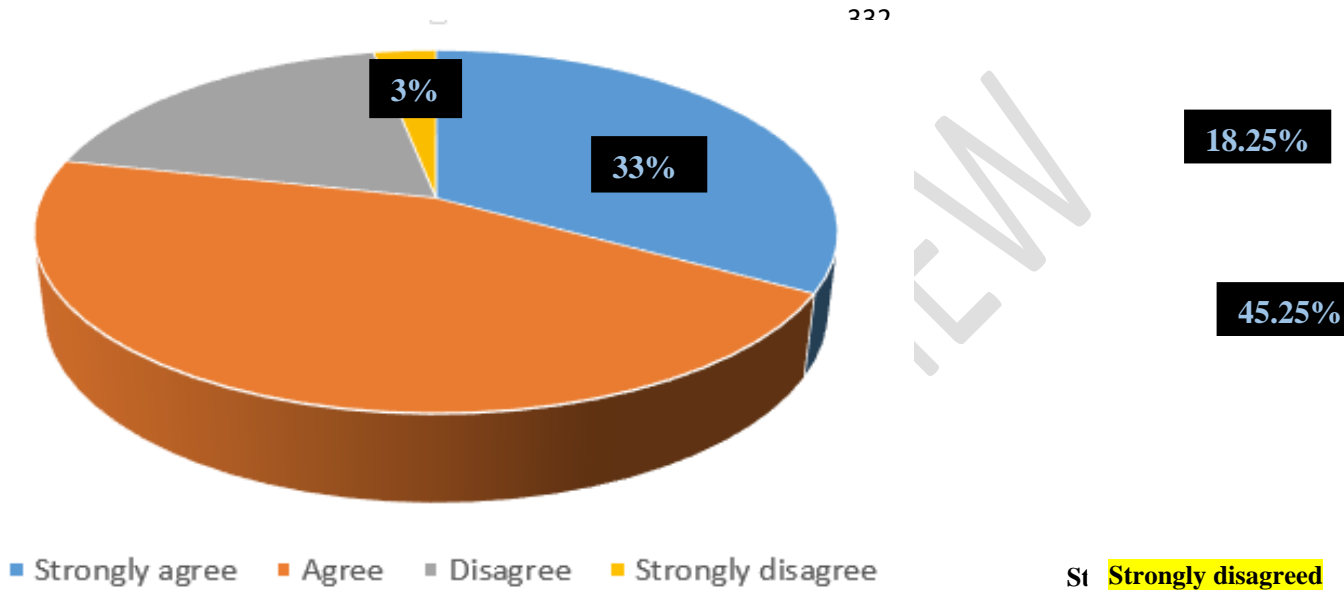


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Figure 14: Perception on GM technology to improve yield, pest resistance and drought tolerance

Strongly agreed
Strongly disagreed

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Figure 15: Perception of government funding Gm research

347 **Discussion**

348 GM products have been in the food system for decades and are becoming even more present, yet
349 consumer knowledge and awareness are not improving especially in the developing world which
350 includes Cross River State in Nigeria. Majority of the respondents who participated in the study
351 were males. A study by [17] on consumer perception and purchase intentions for GM foods in
352 Argentina and found out that GM food was more acceptable by male consumers than by females.
353 Researchers examined consumer attitudinal clusters based on acceptability of genetic
354 modification in Germany and found that GM supporters tended to be older and were more often
355 male than female [18]. Similar studies done in the United States found that women are less
356 supportive of GM crops and foods than their male counterparts [3]. Females, especially from
357 developing countries, are generally less knowledgeable, less interested, and less supportive of
358 science and technology than males [19]. These reports corroborate the submissions of the
359 findings of our study.

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361 Respondents with younger age have higher knowledge of GMFs compared to older age. This
362 shows that old people are not fully aware of GMPs. This may be as a result of their educational
363 background or not having the opportunity to be educated. It is imperative to purport that the
364 move to advocate GMFs is more promising with the younger age brackets that may have more
365 capacity to broadcast the technology through the new emerging platforms. Most of these younger
366 people are single and are free to engage in the activities that will promote wider coverage of
367 GMFs such as consumer education. More participants were in active service which suggests that
368 their level of education must have influenced their knowledge of the GMF. There is a great
369 concern over the low percentage of farmers (14.5%) that participated in this study who in most
370 cases reported that they have no idea about GMFs. This calls for more translation of the science
371 behind GMF to farmers and proper sensitization on the benefits of GM crops to fully engage
372 them in advocating GM products. From the survey, it was clear that the level of education has a
373 positive relationship with the knowledge of participants on GM products as most of the
374 participants reported to have had tertiary education. Department stores, where items are labelled
375 and price-tagged, seem to belong to the learned, who can read and write. Often, to shop with pre-
376 written list of needs. Therefore, one expects them to be knowledgeable of GMFs [20].

377
378 Surveys show that 63.75% of the residence in Cross River State that were captured in the
379 questionnaire were unaware of GMOs or do not fully understand GM products, their traits and
380 they themselves are dissatisfied with their self-rated knowledge, indicating a desire and a need
381 for wide spread consumer education. The low level of awareness of GMPs in Cross River State
382 is a call on the government within and outside as well as biotechnology companies to create
383 platforms to disseminate information to the people of Cross River State and Nigerians by
384 extension. In recent time, the government of Nigeria has recently approved Bt cotton as its first
385 genetically modified crop in 2018 as a pest-resistance variety of cotton, a step to revitalization of
386 its textile industry and boosting economic development [21]. In 2019, National Biosafety
387 Management Agency in Nigeria approved a genetically engineered cowpea variety (pod borer
388 resistant) for utilization by Nigerian farmers [22]. Pod borer insect, *Maruca vitrata* can reduce
389 yield by 80% in cowpea and the cultivation of the resistance variety is a promising approach to
390 yield improvement with the potential to boosting Nigerian economy and contributing to food
391 security. Despite this approaches by the Nigerian government in adopting GM crops, its citizens
392 are still lacking the awareness of the advances, the basic science behind GM crops and the

393 benefits inherent in their utilization. This is evidence in the results of the survey obtained in this
394 study which revealed that 60.5% of the respondents were just hearing of GMPs for the first time.
395 It was revealed that among the respondents who have heard about GMP, greater percentage
396 sourced information from means other than television, newspapers, radio and friends. It is
397 therefore recommended that efforts taken on consumer education and sensitization programmes
398 for the general public should be further increased.

399
400 The low level of awareness and lack of public engagement in biotechnology and genetically
401 modified food is a key premise in acceptability of GMPs over the conventional foods where most
402 of the respondents agreed that conventional food is better than GM food. The public need to be
403 properly guided with special emphasis on the safety of GM food after consumption and should
404 be made to understand that GM crops have been tested through robust trails to be
405 environmentally friendly before their approval and subsequent release. Subjectively, the benefits
406 associated with GM crops as advanced ways to fighting food insecurity far outweighs any
407 perceived controversial demerits. It will be a very unwise decision if this promising science is
408 stamped through the nonchalant and recalcitrant views of the public towards its acceptability.
409 Therefore and most importantly, the government and biotechnology agencies have a very critical
410 role to play in creating a wide coverage of public enlightenment on the benefits of GMPs in
411 Cross River State and Nigeria as a whole.

412 413 **Conclusion**

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

418
419 **Competing interest:** Authors have declared that no competing interest exists.

420 421 **References**

- 422 1. Saxena, D. & Stotzky, G. (2001). Bt Corn has higher lignin content than non-Bt Corn.
423 *American Journal of Botany*, 88, 1704-1706.
- 424
425 2. United Nations Development Programme (UNDP) (2001). Human Development Report.
426 Oxford University press, New York, USA.
- 427
428 3. Hossain, T., Onyango, B., Adelaja, A., Schilling, B & Hallman, W. (2002). Consumer's
429 acceptance of food biotechnology: Willingness to buy genetically modified food product.
430 Food Policy Institute. Retrieved from
431 <http://www.ageconsearch.umn.edu/bitstream/18169/1/wp02ho03.pdf>
- 432
433 4. Gruere, G. P. and Sun, Y. (2012). Measuring the contribution of Bt cotton adoption to
434 India's cotton yields leap. In: *International Food Policy Research Institute* discussion
435 paper (2012).
- 436

- 437 5. United Nations (1992). The convention on biological diversity. Retrieved from
438 <http://www.cbd.int/doc/legal/cbd-en.pdf>
439
- 440 6. Karembu, M., Nguthi, F., & Ismail, H. (2009). Biotech Crops in Africa: The Final
441 Frontier, ISAAA AfriCenter, Nairobi, Kenya. Retrieved from [http://improveagriculture.Com/uploads/files/Biotech_Crops_in_Africa-](http://improveagriculture.Com/uploads/files/Biotech_Crops_in_Africa-The_Final_Frontier.pdf)
442 [The_Final_Frontier.pdf](http://improveagriculture.Com/uploads/files/Biotech_Crops_in_Africa-The_Final_Frontier.pdf), accessed
443
444
- 445 7. Nuffield Council on Bioethics (2003). Genetically Modified Crops: The Ethical and
446 Social Issues. Nuffield Council on Bioethics, London, United Kingdom.
447
- 448 8. Smale, M., & De Groote, H. (2003). Diagnostic research to enable adoption of transgenic
449 crop varieties by smallholder farmers in Sub-Saharan Africa. *African Journal of*
450 *Biotechnology*, 2(12), 586-595.
451
- 452 9. Bett, C., Ouma, J.O. & De Groote, H. (2010). Perspectives of gatekeepers in Kenyan
453 food industry towards genetically modified food. *Food Policy*, 35, 332-3440.
454
- 455 10. Kimenju, S.C., De Groote, H., Bett, C. & Wanyama, J. (2011). Farmers, consumers and
456 gatekeepers and their attitudes towards biotechnology. *African Journal of Biotechnology*
457 *10* (23), 4767-4776.
458
- 459 11. Onyango, B., Govindasamy, R., Hallman, W., Jang, H.M., & Uduri V.S. (2006).
460 Consumer acceptance of genetically modified foods in South Korea. Factor and cluster
461 analysis. *Journal of Agribusiness*, 24(1), 61-78.
462
- 463 12. Smale, M., Zambrano, P., Gruère, G., Falck-Zepeda, J., Matuschke, I., & Horna, D.
464 (2009). Measuring the economic impacts of transgenic crops in developing agriculture
465 during the first decade. Approaches, findings, and future directions. *Food Policy Review*
466 *10*, *International Food Policy Research Institute*, Washington, DC. United State.
467
- 468 13. Food and Agriculture Organization (2004). The State of Food and Agriculture 2003-04.
469 Agricultural biotechnology. Meeting the needs of the poor? Food and Agriculture
470 Organization of the United Nations, Rome. Retrived from
471 <ftp://ftp.fao.org/docrep/FAO/006/Y5160e/>
472
- 473 14. International Council of Scientific Union (ICSU) (2004). New Genetics, Food and
474 Agriculture: Scientific Discoveries-Societal Dilemmas. International Council for Science,
475 Paris. Retrieved from [http://www.argenbio.org/adc/ uploads/pdf/icsu.pdf](http://www.argenbio.org/adc/uploads/pdf/icsu.pdf), accessed
476 November 2011.
477
- 478 15. Costa-Font, M., Gil k. & Trail, Y. (2008). Consumer acceptance, valuation of attitudes
479 towards genetically modified food. *Review and implications for food policy*, *Food Policy*,
480 33, 99-111.

- 481 16. Lusk, J.L., Jamal, M., Kurlander, L., Roucan, M. & Taulman, L. (2005). A meta-analysis
482 of genetically modified food valuation studies. *Journal of Agricultural Resources and*
483 *Economics*, 30, 28-44.
484
- 485 17. Mucci, A. and Hough, G. (2004). Perceptions of genetically modified foods by
486 consumers in Argentina. *Food Quality and Preference*, 15(1): 43-51.
487
- 488 18. Christoph, I. B., Bruhn, M. and Roosen, J. (2008). Knowledge, attitudes towards and
489 acceptability of genetic modification in Germany. *Appetite*, 51(1): 58-68.
490
- 491 19. Anunda, H.N., Njoka, F. & Shauri, S. (2010). Assessment of Kenyan public perception
492 on genetic engineering of food crops and their products. *Journal of Applied Biological*
493 *Science*, 33, 2027-2036.
494
- 495 20. Eneh, O.C., Eneh, C.A., & Chiemela, S. (2016). Genetically modified foods. Food
496 consumer awareness in Enugu, Nigeria. *Jokull Journal*, 66(3).
497
- 498 21. Isaac, N. (2018). Nigeria commercializes Bt cotton, its first GMO crop. Cornell Alliance
499 of Science. [https://allianceforscience.cornell.edu/blog/2018/07/nigeria-commercializes-](https://allianceforscience.cornell.edu/blog/2018/07/nigeria-commercializes-bt-cotton-first-gmo-crop/)
500 [bt-cotton-first-gmo-crop/](https://allianceforscience.cornell.edu/blog/2018/07/nigeria-commercializes-bt-cotton-first-gmo-crop/). June, 04, 2018.
501
- 502 22. Adebowale, N. (2019). Nigeria: Despite controversy, Nigeria approves first genetically
503 modified crop. *Premium times*. <https://allafrica.com/stories/201901300020.html>. October
504 10, 2019.
505