

## CONSUMERS' KNOWLEDGE, ATTITUDE, AND PERCEPTION OF FOOD PRODUCTION SYSTEMS: THE CASE OF THE UNIVERSITY OF NIGERIA NSUKKA, NIGERIA

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### ABSTRACT

Consumers' knowledge and attitude toward food production systems and its potential impact on the environment drive the demand for food, especially from non-conventional systems. This study seeks to advance the literature on consumers' preferences for food, by assessing consumers' knowledge, attitude, and perception of food production systems in the University of Nigeria Nsukka community. Multistage sampling procedure was used in selecting 129 respondents drawn from students, academic, and non-academic staff in the university. Data generated were analyzed using descriptive statistics. The data were collected in-person using a questionnaire. The study revealed that the internet, friends/neighbor, social media, and television were the dominant platforms for sourcing information on the food production systems. The food consumers had little knowledge of genetically modified food products but were quite knowledgeable about organic and conventional food products, respectively. However, they had a positive attitude and perception of food products obtained mainly from organic production system. In addition, the quality of products (M=2.26), income (M=2.14), and cultural beliefs (M=1.54) were some of the factors that affected the intention of consumers to purchase food products obtained from the different food production systems. The study further revealed that packaging of various types of food products (M=1.64) and health implication of consuming food products (M=1.58) were some of information needed by consumers. There is a need for more consumer education in the university community to increase the knowledge of consumers on the health, environmental, and economic benefits of consuming the various food products.

**Keywords:** Consumer knowledge, Conventional food, Food production systems, Genetic modified foods, Organic foods.

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### INTRODUCTION

Food is a basic need of human beings, and meeting the food demand of the teeming population worldwide remains a matter of serious concern. Food systems are critical to the types of foods that are available and accessible to consumers (Fanzo *et al.*, 2022). The food system is a complex web in which human and non-human drivers interact with a system of activities involving production, processing, packaging, distribution, retail, and consumption of foods, resulting in various outcomes (Recordati, 2015; Leeuwis *et al.*, 2021; Fanzo *et al.*, 2022). The food production system has continually changed and developed over the decades to satisfy consumers' needs and behavior (Recordati, 2015; Wlodarska *et al.*, 2019). In many contexts, changes in the food production system are induced by policies, climate change, technology development, urbanization, population growth, health concerns, and shifts in food consumption patterns (Hovhannisyan *et al.*, 2020; Kennedy *et al.*, 2021; Leeuwis *et al.*, 2021; Tetteh *et al.*, 2022). According to Wunderlich and Smoller (2019), food production system exists in three main levels; conventional, organic, and the use of genetically modified organisms (GMO) or genetically engineered food.

Conventional production system uses a variety of cultural practices, methods, tools, and synthetic materials (i.e., synthetic fertilizers, pesticides, herbicides, etc.) to produce crops/animals (Ehn and Fox, 2019) while organic production system is a holistic production management system that promotes and enhances agro-ecosystem health through the use of natural derived products (Mgbenka *et al.*, 2015). The conventional food production system also permits intensive land use, mechanization, and relatively results in high yields per acre (Gunden and Thomas, 2012; Durham and Mizik, 2021) while the organic food production system prohibits the use of synthetic products of any kind (Durham and Mizik, 2021). On the other hand, GMO food is derived from organisms (plants and animals) whose genetic material has been altered from its natural setting (WHO, 2014; Mbadiwe, 2018). This food

production system introduces traits that improve the nutritional value of the products (crops and animals), prevent pest infestation, provide tolerance to pesticides/herbicides, or increase adaptability to weather and growth conditions (Oladipo *et al.*, 2020).

Undoubtedly, the growing presence of all these food production systems has been closely tied to improving food quality and increasing availability; however, consumers are much more concerned about the safety of the food they eat. As a matter of fact, many consumers have become progressively more apprehensive and interested in learning how their foods are sourced and produced (Wunderlich and Smoller, 2019; Vecchione *et al.*, 2015). Kuhar and Juvancic (2010) noted that consumers' concern for the consumption of safe and quality food goes simultaneously with their awareness and knowledge of food production practices. The level of awareness and knowledge about food production practices and its potential impact on the environment drive the demand for food, especially from non-conventional systems as well as increases consumer interest in having a closer relationship with the food producer (Kuhar and Juvancic, 2010).

Besides, consumers' attitudes and knowledge about food production systems provide valuable insight into their perception and purchase intentions of food (Wunderlich *et al.*, 2018). For instance, consumers who perceive that organic food is healthier and more nutritious than non-organically produced food, demand for organic food even with substantial price differences (Fess and Benedito 2018; Ehn and Fox, 2019; Wekeza and Sibanda, 2019). Similarly, consumers tend to make their choice of food based on their moral intuitions (Vega-Rodríguez *et al.*, 2022). Furthermore, their food choices and preference are influenced by nutritional quality, taste, and cost (Vecchione *et al.*, 2015). Furthermore, consumers' perception of environmental, social, and economic impact as well as the safety of a specific food production system is an effective predictor of their purchasing intentions and consumption of the food products (Wunderlich *et al.*, 2018).

Table 1: Sample frame

Faculties	Departments	Total number of students	Total academic staff	Total non-academic staff	Students 3% selected	Staff 5% selected	Number of respondents
Agriculture	Agricultural extension	417	19	11	13	3	16
	Food science and technology.	524	26	12	16	4	20
Arts	English and literary studies	967	28	15	29	5	34
	Archeology and Tourism	266	32	18	8	5	13
Engineering	Mechanical engineering	699	48	35	21	9	30
	Agricultural and Bio-resources Engineering	305	30	35	9	7	16
Total		3178	183	126	96	33	129

A few studies on knowledge, attitude, and perception about food production systems and consumption have focused more on GMO (Iroh *et al.*, 2021; Eneh *et al.*, 2012; Ebuehi and Ailohi, 2012) while others on organic food system (Kajang and Ezekiel, 2020; Rodríguez-Bermúdez *et al.*, 2020; Akinwehinni *et al.*, 2021). So far, no known study has examined consumers' knowledge, perception, and attitude of all the food production systems simultaneously. Meanwhile, comparing the different food production systems will direct producers toward the food preferences of consumers. This study advances the literature on consumers' food preferences given the series of misconceptions about the different food production systems. Furthermore, Rodríguez-Bermúdez *et al.*, (2020) emphasized the need to conduct studies on consumers' behavior in different regions and countries considering differences in perceptions and attitudes across the globe. Thus, this study is designed to provide insight on consumers' knowledge, attitude, and perception about food production systems and perceived factors that affect consumers' choice of food products.

The structure of this paper is as follows. The next section discusses the methodology used for the study. The third section presents the results of the study, while the final section concludes and proposes areas for further research.

## METHODS

### Study area

The study was conducted in University of Nigeria, Nsukka campus located in Enugu State. University of Nigeria Nsukka lies within the latitude 6.8645°N of equator and longitude 7.4083°E of Greenwich meridian. The university was founded in the year 1955 and formally opened on October 7, 1960. Nsukka campus is one out of the four campuses, the university has and it comprises ten faculties, namely; agriculture, arts, biological sciences, engineering, social science, education, veterinary medicine, physical sciences, and pharmaceutical sciences. The university has a population of over 40,000 students and 2500 staff. The Nsukka campus has a land area of 871 ha of hilly savannah.

### Population and sampling procedure

The population for the study comprised all students, academic, and non-academic staff of the University of Nigeria Nsukka (UNN) campus. Multistage sampling procedure was employed in selecting respondents for the study. In the first stage, three faculties (Agriculture, Arts, and Engineering) were randomly selected from the 10 faculties in UNN. In the second stage, two departments each from the selected faculties were randomly selected to give a total number of six departments. The selected departments are Agricultural Extension, Food Science and Technology, English and Literary Studies, Archeology and Tourism, Mechanical Engineering, and Agriculture and Bioresources Engineering. In the third stage, 5% of staff and 3% of students were proportionately selected for the study. Thus, the total sample size for the study was 129 respondents (Table 1).

### Research design and instrument for data collection

The study employed the descriptive research design, using survey to elicit information from the respondents. As a descriptive study, it

examined sources of information, knowledge, attitude, perception, and factors affecting consumers' intention to purchase food from the different food production systems. Data for this study were collected face-to-face through the use of a questionnaire. The questionnaire was self-administered and as such it was designed in a simple and easy-to-understand format. It was written in English and was validated by experts in the Department of Agricultural Extension, University of Nigeria, Nsukka.

### Measurement of variables

Consumers' sources of information on food production systems were ascertained using "Yes" and "No" responses against various information sources: Radio, television, mobile phone, internet, etc. Similarly, the knowledge of consumers about the different food production systems was assessed using a dichotomous response ("Yes" and "No") with every correct response to the knowledge statements Scoring 1, while an incorrect response was scored 0. To eliminate guessing by the respondents, positive and negative knowledge statements were provided to assess their knowledge about the three different food production systems. To determine the respondents' perception of the environmental, health, economic, and social impacts of the different food production systems, they were requested to indicate their responses to each question on a 5-point Likert-type scale of strongly agree (4), agree (3), undecided (2), disagree (1), and strongly disagree (0). The attitude of respondents toward consuming conventional, organic, and genetically modified foods was determined by asking the respondents to indicate their responses to the attitude statements on a 5-point Likert scale of strongly agree (4), agree (3), undecided (2), disagree (1), and strongly disagree (0). Furthermore, perceived factors affecting the purchasing behavior of the respondents on foods derived from the different food production systems were determined through responses on a 4-point Likert type scale of very serious (3), serious (2), not serious (1), and not at all (0). The data generated from the study were analyzed using IBM SPSS software version 25.0. The results were presented in percentages and means.

## RESULTS AND DISCUSSION

### Socioeconomic characteristics of the respondents

Results in Table 2 revealed that slightly more than half (58.9%) of the respondents were males. The average age of the respondents was about 26 years. The average monthly expenditure on conventional, organic, and GM food products are ₦7,290.30, ₦4074.80, and ₦2024.50, respectively. The majority (75.2%) of the respondents purchased food products from the market. Hermaniuk (2015) also found that 61% of consumers purchase organic foods from traditional market. Further implication of this result shows that the majority of consumers prefer purchasing food products from the market due to a large number of sellers who compete among themselves which leads to decrease in the price of food product.

### Sources of information on the various foods production systems

Data in Fig. 1 revealed that 22.9% of consumers got information about organic food products from friends/neighbors, 21.9% got from the internet, 11.5% got from television, 10.4% from social media, 3.1% from social groups and government agencies, and 2.1% of

respondents get their information from the radio, while 1.0% got theirs from an international organization. Friends/neighbors and internet provided consumers with more information on organic products probably because as a community, consumers interact often and share information among themselves. It could be due to the availability of steady internet services in the university community that enables them to search and obtain more information on organic products. The finding is in line with Perić *et al.* (2017) who found that organic food consumers, primarily used chat with friends and relatives as a source of information, followed by the internet.

Besides, 21.9% of consumers obtained information about conventional food products through social media, 18.8% through television, 17.7% through the internet, 12.5% through friends or neighbors, 5.2% through cell phones, 2.1% each through government agencies, social groups, and international organizations and 1.0% through university (Fig. 1). Social media was the most used platform for obtaining information on conventional food products. This is not surprising because consumers are located in university community where use of social media for information dissemination is common. The study is in line with the study by Wunderlich and Gatto (2015) which states that many consumers received information about GMO food products from the media, internet, and other news sources.

Furthermore, a larger proportion (32.3%) of consumers learnt about GM foods from the internet, 14.6% learnt from social media, 10.4% learnt from friends/neighbors, 8.3% learnt from scientific articles, and 5.2% learnt from newspapers/magazines while 1.0% learnt from a social group (Fig. 1). This result indicated that internet was mostly used by consumers for sourcing information about genetically modified food. Internet may have been frequently used because its availability in the community. It could be that consumers are learned and can use the platforms well to access more information about the acclaimed benefits or dangers of eating the GM food products. The study is consistent with Aleksejeva (2014) who found that majority (77.3%) of consumer sourced information about genetic modified food from the internet. On the contrary, Cui and Shoemaker (2018) found that most consumers have been informed about GM foods through television, newspapers, social media, and lectures and suggest that the use of television, newspapers, and public lectures by scientists will be an effective way to disseminate information about GM foods in Nigeria.

#### Respondents' consumption of food products from the various food production systems

The results in Fig. 2 show that the majority (96.1%) of the respondents consumed organic food products, while 94.6% of them consumed conventional food products. The remaining 39.5% of the respondents indicated that they consumed GMO foods. Evidently, the consumers consumed organic food products more than food products from the other two food production systems. This may be attributed to their perception that organic foods are healthier to consume than other food products.

#### Consumers' knowledge about the various food production systems

Entries in Table 3 show the percentage of correct answers of the knowledge statements for the different food production systems. From the results on organic food production system, the majority (92.2%) of the respondents had knowledge over the fact that "organic food products are naturally grown," "organic farming system naturally produces crops and livestock without harming the environment" (85.3%), organic food production system makes use of traditional technology (83.7%), among others. Based on their knowledge of genetically modified food production system, a greater percent (67.4%) of the respondents were knowledgeable that "bioengineering is a modern technique in producing more genetic food products," genetic crops contain genes' (65.9%), "genetic food production systems resist poor environmental conditions" (62.8%), among others. Regarding conventional food production system, the majority (84.5%) of the respondent had knowledge over the fact that "application of synthetic fertilizer enhances the production of conventional crops," "conventional

Table 2: Socioeconomic characteristics of respondents

Socioeconomic variables	Frequency	Percentage	Mean
Sex			
Male	76	58.9	
Female	53	41.1	
Age			
≤20	48	37.2	
21–30	53	41.1	
31–40	18	13.9	25.8
41–50	8	6.2	
≥51	2	1.6	
Amount spent on organic food			
≤15,000	108	97.3	
₦16,000–₦30,000	1	0.9	4074.8
Above ₦ 30,000	2	1.8	
Amount spent on conventional food			
≤₦10,000	94	83.2	
₦11,000–₦20,000	14	12.4	7290.3
Above ₦20,000	5	4.4	
Amount spent on genetic modified food			
≤ ₦5000	58	95.1	
₦6000–₦10,000	1	1.6	2024.5
Above ₦11,000	2	3.3	
*Place of purchase of food product			
On campus restaurant	26	20.2	
Off-campus restaurant	22	17.1	
Market	97	75.2	
Supermarket	22	17.1	
Roadside shops	18	14.0	

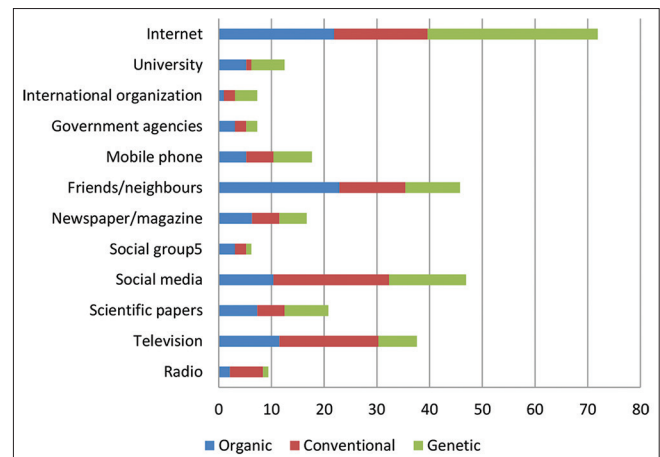


Fig. 1: Major sources of information on the different food products

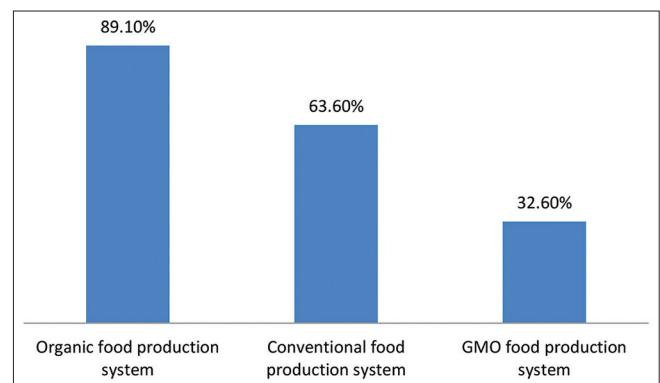


Fig. 2: Respondents' consumption of food products from the different food production systems

farming system depends largely on intensive inputs of synthetic fertilizers" (76.0%), "conventional production system at the long run increases the fertility of the soil" (62.0%), among others.

**Table 3: Knowledge of the consumers on the different food production systems**

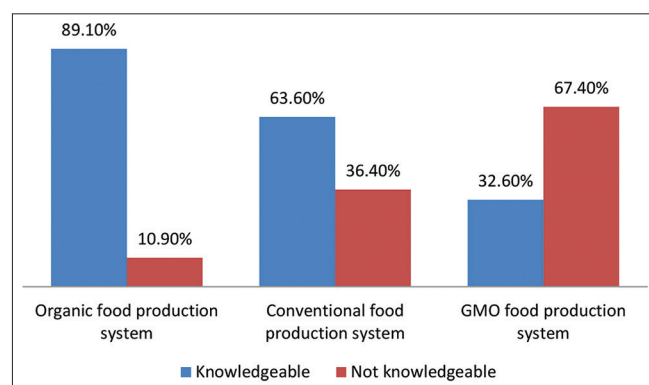
Variables	Percentage
Organic food production system	
Organic food products are naturally grown	92.2
Organic farming system naturally produces crops and livestock without harming the environment	85.3
Organic food production system makes use of traditional technology	83.7
Organic farming system is labor intensive	76.7
Organic livestock are reared without the use of hormone stimulator	75.2
Pest and weed control are the major problems facing organic farming system	75.2
Organic farms have low ammonia emissions and acidification of surrounding lands	62.8
Sophisticated implements are used in organic farming	42.6
Livestock are organically reared with the use of antibiotics	41.1
Pesticides are used in the production of organic food product	29.5
Organic production system produces food products through the use of synthetic fertilizer	28.7
Herbicides are used in the production of organic foods	27.1
Genetically modified food production system	
Bioengineering is a modern technique in producing more genetic food products	67.4
Genetic crops contain genes	65.9
Genetic food production systems resist poor environment conditions	62.8
Genetic foods are not produced under natural conditions	56.6
Soy and corn cotton are the most cultivated GMOs	55.8
Genetically modified food production system offers tolerance to herbicide	54.3
Genetic modified production system does not lead to the generation of herbicide-resistant weed	52.7
The flavr Savr tomato is the first accepted genetic modified food product	48.1
Genetic crops are not safe to produce in the environment	42.6
Genetic modified food production systems do not resist pest attacks on crops	41.9
Conventional food production system	
Application of synthetic fertilizer enhances the production of conventional crops	84.5
Conventional farming system depends largely on intensive inputs of synthetic fertilizers	76.0
Conventional production system at the long run increases the fertility of the soil	62.0
Conventional food production systems mitigate the effect of pest and diseases	62.0
Organic fertilizers are used in conventional production system	58.9
Application of antibiotics in rearing conventional livestock reduces the rate of production	44.2
Conventional farming system entails the production of food products through the transfer of genetic materials	35.7
Conventional food products are produced without the use of herbicides	33.3
Pesticide and herbicide reduces the yield of conventional crops	24.0

Collectively, the results in Fig. 3 reveal that that 89.1% of the respondents had knowledge about organic, conventional (63.6%), and GMO (32.6%) food production systems, respectively. This implies that the majority of the consumers were more knowledgeable about organic and conventional food production systems. Consumers' knowledge about these two food production systems could be attributed to the fact that food products from these systems were readily available in their area. Furthermore, the higher knowledge of organic production system could be due to public sensitization of the perceived health benefits of organic food products by friends/neighbors, internet, social media, or other platforms. This agrees with Wang *et al.* (2019) who found that a high level of knowledge could positively moderate consumers' personal attitude, health consciousness, and intention to purchase organic food. Similarly, Denver and Christensen (2015) reiterated that consumers who prefer organic food often describe both health and environmental concerns as motives behind their choice, but there is also some evidence that an expectation of health gains is the factor most likely to push consumers from a mere preference for organic products to actual purchases of them, overcoming the fact that organic produce is generally more expensive than the conventionally produced alternatives.

On the contrary, 67.4% of the respondents had no knowledge of GMO, conventional (36.4%), and organic (10.9%) food production systems, respectively. This implies that fewer consumers had good knowledge about food products from GMO. The majority of consumers may have had no knowledge of GM food production system because of poor public sensitization of the products. It could also be due to the use of the wrong channel in disseminating information about GMO technology and its products. The study is consistent with Ebuehi and Ailohi (2012) who found that awareness about biotechnology and GM foods/organisms was high but knowledge regarding specific details about GM technology was poor. Similarly, Tanius and Seng (2015) also found that people have a low level of awareness of GM foods.

#### Consumers' perception of the environmental, health, economic, and social impacts of the various food production systems

Table 4 indicated consumers' perception of the environmental, health, economic, and social impacts of the various food production systems. Based on the perceived environmental impacts of the various food production systems, the respondents agree to some extent that organic farming promotes renewed uptake of nutrients from the soil ( $M=2.83$ ), organic farming system is regarded as the solution to environmental pollution ( $M=2.78$ ), both insecticide and fungicide used in conventional food production system have negative effect on biodiversity ( $M=2.71$ ), conventional farming decreases soil organic matter and soil structure ( $M=2.55$ ), use of technology in conventional food production contributes to destruction in the environment ( $M=2.50$ ), and insecticide degrades the biological control potential in conventional farming system ( $M=2.49$ ), among others. It can be deduced from the findings that the respondents perceived that organic food production systems



**Fig. 3: Consumers' knowledge about the various food production systems**

**Table 4: Consumers' perception of the environmental, health, economic, and social impact of the food production systems**

Perception of food production systems	Mean	SD
Conventional		
Conventional food production system increases the rate of income	2.74	0.98
Production of conventional food products is mostly consumed resulting to high GDP	2.74	0.89
Both insecticide and fungicide have negative effect on biodiversity	2.71	1.03
Conventional production system improves means of livelihood	2.64	1.09
Conventional food production has least cost price compared to other food products	2.56	1.03
Conventional farming decreases soil organic matter and soil structure	2.55	1.06
Conventional food product is unconsciously consumed	2.51	0.96
Use of technology in conventional food production contributes to destruction in the environment	2.50	1.02
Difference in income leads to large consumption of conventional food	2.49	0.86
Insecticide degrades the biological control potential in conventional farming system	2.49	0.91
Application of agrochemicals in conventional system leads to contamination of the product	2.43	1.10
Conventional farming is a decline on microbial and faunal biodiversity	2.40	0.95
High health risk is associated with the consumption of conventionally grown produce	2.38	1.01
Nitrate substance contained in agrochemicals are harmful to the health	2.29	1.14
Long-term consumption of conventional food product is hazardous to the health	2.23	1.18
People of lower class are perceived to consume conventional food product	2.15	1.08
Food product produced conventionally is easily identified in the point of purchase	1.98	1.08
Organic food		
Organic food production system produces food which improves one's health status	2.94	0.90
Organic food products are believed to have better taste and high quality	2.92	0.94
Organic food production system increases the rate of income	2.89	0.84
The production of organic food products increases national gross domestic product	2.87	0.90
Organic farming promotes renewed uptake of nutrients from the soil	2.83	0.92
Organic food product are more expensive to purchase than other food products	2.82	0.93
Production of organic food products creates employment	2.81	0.84
Organic farming system is regarded as the solution to environment pollution	2.78	0.95
Organic foods lessen the rate of cancer	2.61	1.10
Fruits and vegetables produced organically protect against cardiovascular diseases	2.59	0.97
Organic production system has contributed to increasing global production of various food products	2.58	0.97
Consumption of organic food reduces the rate of obesity	2.56	1.02
Purchase of organic food product is due to the believe that they are not genetically modified	2.54	1.14
Organically produced food such as fruits and vegetables protects humans to an extent against dementia	2.52	1.14

(Contd...)

**Table 4: (Continued)**

Perception of food production systems	Mean	SD
It is difficult to differentiate between organic and other food product in the point of purchase	2.46	1.11
Non-communicable diseases (e.g., diabetes) are manageable when eating organic food products	2.41	1.24
Exposure of farmers to climate change is reduced by the practice of organic farming	2.23	1.10
Organically grown food products can be identified through physical appearance	2.17	1.16
Identification of organically grown food product is through accreditation stickers	1.99	1.09
Genetically modified food		
Billions of dollars have been actualized through genetic modified method	2.60	0.92
Hormones use in enhancing livestock production is harmful to the health when consumed	2.56	0.98
Production of genetic modified food has helped in increasing the country's GDP	2.55	0.86
Genetically modified farming system leads to food sustenance	2.54	0.97
Consumption of genetically modified food can result to cancer	2.47	1.17
Genetic modified production system reduces the rate of pest and diseases	2.38	1.11
Food product produced genetically causes toxic or allergic reaction	2.34	1.11
Genetic modified product are perceived to be less nutritious	2.34	1.07
Genetic modified farming system reduces cost associated to production	2.32	0.92
Genetic modified production system reduces the rate of soil and air pollution	2.30	1.08
Differentiation of genetically modified food from other food products is tough	2.25	1.05
Human genes could be altered as a result of eating genetic modified foods	2.23	1.13
The transfer of genes in genetic modified system is a threat to biodiversity	2.23	1.12
Purchase of genetic modified foods is preferred to be consumed due to its price tag	2.19	1.10
Adequate availability of food products is as a result of genetic modified food production	2.19	0.99
Genetic modified production system improves the environmental condition of the society	2.16	1.04
Production of genetic food reduces the toxication of the soil	2.07	1.23
GM food genes can get into human generative cells and can be passed to future generation	2.05	1.07

Strongly agree=4; agree=3; undecided=2; disagree=1; strongly disagree=0

provide a more positive environmental impact when compared with the other food production systems. Durham and Mizik (2021) outline the genuine environmental effects of organic food production methods at the farm level including lower carbon emissions, higher weather resilience, and long-term sustainability. Notwithstanding, GM food production systems also offer good environmental benefits due to the use of "no-till" or "reduced-till" farming practices that facilitate carbon sequestration and reduce soil erosion (Brookes and Barfoot, 2018). However, conventional food production systems characterized typically with high use of mineral fertilizers and synthetic pesticides increase greenhouse gas emissions with negative implications on environmental sustainability (Mie *et al.*, 2017).

The results further show that the respondents agreed to some extent the following as perceived health impacts of the various food production systems; organic food production system produces food which improves

one's health status (M=2.94), organic food products are believed to have better taste and high quality (M=2.92), organic foods lessens the rate of cancer (M=2.61), fruits and vegetables produced organically protects against cardiovascular diseases (M=2.59), consumption of organic food reduces the rate of obesity (M=2.56), hormones used in enhancing livestock production for GMOs is harmful to the health when consumed (M=2.56), organically produced food such as fruits and vegetables protects humans to an extent against dementia (M=2.52), consumption of genetically modified food can result to cancer (M=2.47), non-communicable diseases (e.g., diabetes) are manageable when eating organic food products (M=2.41), high health risk is associated with the consumption of conventionally grown produce (M=2.38), among others. The consumers generally perceived that organic farming systems produce healthier food products than other food production systems. In other studies (Baudry *et al.*, 2016; Stolz *et al.*, 2011), consumers perceived that the organic food production system promotes the development of healthy and environmentally sustainable practices. Consumers' positive perception about organic food could be justified by their higher knowledge on the potential benefits of eating organic food products. However, while many consumers are aware that organic foods as more desirable, the relatively higher prices and lower availability of organic products compared to their conventional and GMO counterparts may limit purchase and quality perception (Suciu *et al.*, 2019). Bryla (2016) and Rizzo *et al.*, (2020) also found that organic foods are healthier, environmentally friendly, and tastier than conventional foods and genetically modified food.

Regarding the perceived economic impacts of the various food production systems, the respondents agreed to some extent that the production of organic food product increases National Gross Domestic Product (M=2.87), organic food product is more expensive to purchase than other food products (M=2.82), conventional food production system increases the rate of farmers' income (M=2.74), production of conventional food products is mostly consumed resulting to high GDP (M=2.74), billions of dollars have been actualized through genetic modified method (M=2.60), conventional food production has least cost price compared to other food products (M=2.56), and production of genetic modified food has helped in increasing the country's GDP (M=2.55), among others. In general, organic food products are more expensive than food products from other food production systems. This is because it is characterized by lower yields resulting from reduced pesticide and fertilizer use. Cavigelli *et al.* (2009) found that during a field trial on a study site of 16 ha, organic field crops have higher price premium and greater net returns than the conventional field crops.

The respondents further agreed to some extent that the perceived social impacts of the various food production systems were: Organic products are believed to have better taste and high quality (M=2.92), organic production system increases the rate of farmers' income (M=2.89), production of organic food products creates employment (M=2.81), conventional production system improves means of livelihood (M=2.64), organic production system has contributed to increasing global production of various food produce (M=2.58), purchase of organic food product is due to the believe that they are not genetically modified (M=2.54), conventional food product is unconsciously consumed (M=2.51), difference in income leads to large consumption of conventional food (M=2.49), it is difficult to differentiate between organic and other food product in the point of purchase (M=2.46), and genetic modified food product is perceived to be less nutritious (M=2.34), among others. The results generally show that the respondents considered that both organic and conventional food production systems had more positive social impacts than the GM food production system. In line with this, MacRae *et al.* (2008) agreed that organic food production systems contribute to rural vitality and increase total family income in agriculture-dependent communities because money spent on agrochemicals and fuel could be saved and used for other household needs.

However, some of the perceptions of the respondents (such as consumption of GM food can result to cancer, human gene could be

altered as a result of eating GM food etc.) could be viewed as negative. This is because these views may hinder the acceptance or development of the GM production system. The finding is consistent with Eneh *et al.* (2016) who found that consumers perceived GM food as artificial which can enhance nutritional value but can also cause health damage. Similarly, it is in line with the finding of Wunderlich and Gatto (2015) which states that due to limited knowledge on genetics, understanding of the impacts of eating GE food was muddled, with almost one-half of respondents believing that a person's genes could be altered as a result of eating GMOs and more than two-thirds believing that modified genes from GMOs could enter human reproductive cells and be passed to offspring. This means that these respondents need adequate information on genetic modified food product.

#### Food consumption attitude of the consumers

Results in Table 5 reveal the attitude of consumers toward consuming food products from the various production systems. The consumers had the following favorable attitude toward conventional food products: Regular check-up is required due to consumption of conventional food product (M=2.62), beliefs on the negative impacts of pesticide and herbicide reduces the rate of conventional food consumption (M=2.40), and herbicide and pesticide application during conventional farming system has little or no determination in choice of such food product (M=2.27), among others. The result implies that consumers had a positive attitude to most of the statements on conventional food products. Attitude can significantly influence consumer choice of food products. This agrees with Stolz *et al.* (2011) who found that consumers who were significantly more price-sensitive preferred conventional-plus and conventional products rather than organic products.

The respondents further agreed to some extent that practices in organic farming are labor intensive (M=2.96), satisfaction is gotten from the consumption of organic food product (M=2.95), organic food products are better consumed than genetically manufactured food (M=2.87), substances used in organic food production should be properly indicated in the label to sway my purchasing intension (M=2.85), etc. were some of the attitude shown by consumers on organically produced foods. Consumers had favorable attitude toward organic food products and this could be linked to their positive perception and knowledge about the organic food production system. Their knowledge of organic food production system could positively moderate the consumers' personal attitude and perception as well as intention to purchase organic food products. This is consistent with Teng and Wang (2015) who found that consumers' perceived knowledge has critical effects on their confidence in organic food, which in turn will influence their attitudes and intentions to purchase organic food.

Furthermore, Table 5 revealed that consumers' attitude toward genetically modified food includes: Health impacts of genetically modified food production system negatively affect my purchasing choice of food type (M=2.71), genetic modified product is unreliable because of harmful substances used in production (M=2.62), and information based on genetically modified food tends to reduce its consumption (M=2.41) among others. This implies that consumers also had positive attitude about genetically food products irrespective of their low knowledge on the product. Attitude has a significant influence on the choice of food product especially if the prices are the same or different but quality is the same (Ebuehi and Ailohi, 2012). This agrees with Eneh *et al.* (2016) who found that consumers had favorable attitude to GM food products. On the contrary, Ebuehi and Ailohi (2012) found that undergraduate students of medical and dental students of Lagos university had a negative attitude toward GM products.

#### Perceived factors affecting consumers' intention to purchase food derived from the different food production systems

Entries in Table 6 reveal that the consumers perceived the following as serious factors affecting consumers intention to purchase organic, conventional, and genetic modified food products; quality of food product (M=2.26), potential health benefits of the food product

(M=2.25), income (M=2.14), knowledge about food product (M=2.11), and price of food product (M=2.07). The quality of food products is a serious determinant of consumers' intention to purchase food products. A high-quality food product is likely to be purchased more than less-quality food products. Besides quality, educational level and cultural beliefs significantly affect consumers' purchasing intention of any food products. While education enables consumers to learn about the benefits and dangers of the products, cultural beliefs may prohibit them from eating all sorts of food products. Furthermore, income affects the purchasing intention. A higher income-earning consumer will purchase more food products of choice than the low-income-earning consumers. On the other hand, consumers that are conscious of price of food product may prefer not to buy costly food products. This finding is line

**Table 5: Consumers attitude toward consuming organic, conventional, and genetic modified food products**

Attitude statements	Mean	SD
Conventional food products		
I consume more of conventional and genetic modified food because it is cheaper	2.05	1.05
I believe my negative perception about conventional food product is due to lack of information	2.23	1.07
Herbicide and pesticide application in conventional farming system has little or no determination in the choice of such food product	2.27	1.13
Beliefs on negative impacts of pesticide and herbicide reduces the rate of conventional food consumption	2.40	1.01
Due to consumption of conventional food product regular check-up is required	2.62	0.95
Organic food products		
Inadequate product produced organically makes me purchase other product produced under different production system	2.20	0.98
I demand for organic foods before purchasing and consuming them	2.30	1.28
Lack of sustainable produce in organic farming system makes other production system vital	2.51	1.10
Differentiation between organic food and other alternatives is difficult to achieve	2.57	1.06
Discomfort in practices of organic farming system brought about introduction of other food production	2.66	1.00
Substances used in organic food production should be properly indicated in the label to sway my purchasing intension	2.85	0.87
Organic food products are better consumed than genetically manufactured food	2.87	0.95
Satisfaction is gotten from the consumption of organic food product	2.95	0.94
Practices in organic farming are labor intensive	2.96	0.78
Genetically Modified food products		
I see value in spending money on genetic modified free foods	1.87	1.23
Good health records make me consume more genetic modified food product	2.00	1.10
The production of genetically modified food is risky for all living things	2.30	1.05
Inadequate information by genetically modified food producers reduces the rate of consumption	2.38	1.08
Information based on genetically modified food tends to reduce its consumption	2.41	0.97
Genetic modified product is unreliable because of harmful substances used in production	2.62	0.93
Health impacts of genetically modified food production system negatively affect my purchasing choice of food type	2.71	0.91

Cutoff mean  $\geq 2.0$  indicating favorable attitude; Source: Field survey, 2019

with Van Doorn and Verhoef (2015) who found that consumers with price consciousness would avoid organic foods.

#### Areas of information needed by consumer about different food products

Table 7 revealed various areas of information needed by the consumers on the different food products. The respondents considered the following as important information needs: Adequate packaging of various types of food product (M=1.64), health implication of consuming food products (M=1.58), health consequences of additives added to food product (M=1.49), benefits of consuming food products (M=1.49), how to detect additives in various types of food (M=1.47), procedures in production in respect to conventional production system (M=1.37), effects of producing the different food products (M=1.37), procedures in the production aspect of organic production system (M=1.36), labeling of food products (M=1.22), procedures in the production aspect of genetic modified production system (M=1.19),

**Table 6: Perceived factors affecting consumers' food purchasing behavior**

Factors	Mean (M)	SD
Health hazard	0.02	0.18
Country of origin	1.33	1.04
Level of advertisement made about the product	1.39	0.99
Roles and status in the society	1.43	0.89
Reputation of the brand	1.47	0.87
Social class	1.50	0.99
Cultural beliefs and norm	1.54	1.04
Labeling of food product	1.55	0.89
Brand name of the food product	1.61	0.93
Educational level	1.80	0.91
Size of the family	1.92	0.91
Price of food product	2.07	0.85
Knowledge about food product	2.11	0.90
Income	2.14	0.78
Potential health benefits of the food product	2.25	0.83
Quality of food product	2.26	0.88

Very serious=3, serious=2, not serious=1, not at all=0

**Table 7: Information needs of the various food products**

Information needs	Mean (M)	SD
Purchase of various types of food product due to their differences	0.02	0.18
Conditions that can warrant purchasing them in their types	0.02	0.18
Area of production	0.02	0.18
Use of sophisticated machine in conventional food production system	1.12	0.76
Where to purchase different food products	1.17	0.66
Procedures in production aspect of genetic modified system	1.19	0.77
Labeling of food products	1.22	0.74
Procedures in production aspect of organic production system	1.36	0.65
Procedures in production in respect to conventional production system	1.37	0.64
Effects of producing the different food products	1.37	0.69
How to detect additives in various type of food	1.47	0.67
Health consequences of additives added to food product	1.49	0.69
Benefits of consuming food products	1.49	0.56
Health implication of consuming food products	1.58	0.60
Adequate packaging of various types of food product	1.64	0.53

Very important=2, important=1, not important=0

where to purchase the food products ( $M=1.17$ ), and use of sophisticated machine in conventional food production system ( $M=1.12$ ). Consumers may have needed information on adequate packaging of various food products because it could help them to understand the composition of the products. Proper understanding of the product packaging would increase the chances of purchasing the products. In a similar way, provision of information on the health implication of consuming food products is ideal because it will clear the doubts consumers had about the products. Furthermore, consumers may have needed information on labeling of food products to enable them to distinguish the different food products. Labeling gives information about the quality, quantity, and other features of the products. The finding agrees with Nitzko (2019) who found that the spectrum of information required by consumers on food products ranges from origin and the constituents of food products, processing and production methods, declaration of additives, nutrition value, price, shelf life, food quality to health, and safety of the food.

### CONCLUSION AND POLICY IMPLICATIONS

Food consumers in the University of Nigeria Nsukka community mostly consumed organic food products possibly due to their knowledge and positive perception about organic food production system. The respondents mostly sought information on organic, conventional, and GM food production systems from friends/neighbors, social media, and internet, respectively. The consumers were quite knowledgeable about the organic and conventional food production systems; however, they had the least knowledge about GM food production system. In general, these consumers had a positive attitude toward the three different food products irrespective of their knowledge level. Most of the consumers have a positive perception about the consumption of organic food citing its positive health, economic, and environmental impacts. The perception of the respondents about the environmental, health, economic, and social impacts of the different food production systems may have likely affected their attitude toward the consumption of the different food products.

In addition, the intention of consumers to purchase different food products is mostly driven by multiple factors such as quality of products, perceived health benefits of consuming the products, and income. Furthermore, the consumers mostly needed information about adequate packaging of various types of food products. Therefore, there is a need for more consumer education in the university community to increase the knowledge of consumers and encourage the consumption of various food products. Awareness program would increase the consumers' knowledge on health, environmental, and economic benefits of GM food and other different food products. In addition, the government should make policies to tackle the issues of exorbitant price on some food products so as to enable the consumers to purchase any food product of choice at ease. Finally, information about consumers' perception and attitude toward the different food products is important to enable the development of marketing policies that would attract consumers to purchase different food products.

Although this study advances research about consumer's knowledge, attitude, and perception as well as information needs about the different food production systems simultaneously, it is not without some limitations. First, the study employed descriptive research, which is a starting point that illuminates consumers' knowledge, attitude, and perception of the different food production systems. Future studies could examine the relationship between consumers' attitude and perception of the food production systems. Second, Likert scales with different number of points were used in the analysis. For instance, the knowledge, attitude, and perception of the consumers on the impacts of the food production systems utilized a 5-point Likert scale with a neutral response as well as equal positive and negative responses. However, the information needs of the consumers on the different food products and the factors affecting consumers' purchasing intentions were measured using scales with three and four levels, respectively, that did not provide

a neutral response or the positive response predominate over negative responses. The results emanating from this analysis should however be taken with caution. Further studies should consider the influence of consumers' knowledge, attitude, and perception of the food production systems on their food purchase behavior and decisions.

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