ASEAN Journal of Science and Engineering Education

Journal homepage: http://ejournal.upi.edu/index.php/AJSEE/

Perception and Acceptability of Laboratory-Cultured Meat

Oluwatoyin Hannah Owokoniran [1,2,], Gabriel Oluwole Owokoniran[2], Femi Peter Adesina[2], Imoleayo Sarah Olateju [3]*

[1]Division of Environmental Health, Graduate School of Global Environmental Studies, Kyoto University, Kyoto, Japan

[2]Department of Biology, Federal University of Technology, Akure, Ondo State, Nigeria.

[3]Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria.

*Correspondence: E-mail: owokoniran.hannah.65t@st.kyoto-u.ac.jp

ABSTRACT

This study aimed to determine the perception and acceptability of cultured meat in the Nigerian market. The investigation was conducted with the aid of a cross-sectional survey study using the online Google survey questionnaire platform. A total of 233 Nigerians responded to this research survey. The majority, 108 (46.4%), of the respondents were between 18–30 years old, and 150 (64.4%) were male. Almost half of the respondents (47.6%) have not heard or read about cultured meat before, and 208 (89.3%) have never tasted it. Gender ($p = 0.003$, $\chi^2 = 9.00$) and whether respondents had tasted cultured meat before ($p = 0.001$, $\chi^2 = 13.45$) were significant determinants of accepting cultured meat in Nigeria. Females were 2.31 times more likely (OR = 2.31, Cl = 1.33-4.01) to accept cultured meat than males, and those who had previously tasted cultured meat were 0.16 times less likely (OR = - 0.16, Cl = 0.05-0.47) to accept cultured meat. Component 1 of the principal components analysis (PCA) contains perceptions that cultured meat is unnatural, disgusting, unhealthy, or can lead to health complications in the future and a loss of balance in the ecosystem. Nigerians would be interested in consuming cultured meat if growing concerns about the resulting side effects on human health can be addressed.

ARTICLE INFO

Article History:
Submitted/Received 23 Jan 2023
First Revised 20 Mar 2023
Accepted 08 May 2023
First Available online 10 May 2023
Publication Date 01 Mar 2024

Keyword:
Acceptance rate,
Alternative protein source,
Biodiversity preservation,
Cultured meat,
Public health.

1. INTRODUCTION

Meat is a concentrated source of protein, vitamin A, B-complex vitamins, iron, zinc, phosphorus, and selenium humans need for optimum growth and development (Higgs, 2000; Pereira and Vicente, 2013; Ahmad *et al*., 2018). Despite its established nutritional and economic significance to society, the manufacture and products of meat have nonetheless been a highly controversial topic due to their reported negative contributions to global warming, waste management, animal welfare, and public health (Van Loo *et al*., 2020). In recent years, livestock production has been reported to contribute about 7.1 million tonnes of carbon dioxide (CO_2) annually to greenhouse gas emissions globally and constitutes 14.5% of anthropogenic-related emissions. It contributes substantially to global warming through emissions of nitrous oxide (N_2O) and methane (CH_4) emissions, which significantly contribute to global warming (Grossi *et al*., 2019). Besides the effect of livestock on climate change, many studies have linked meat consumption to adverse health and safety challenges (McAfee *et al*., 2010; Verbeke *et al*., 2010; Pan *et al*., 2012; Domingo and Nadal, 2016; Domingo and Nadal, 2017).

In 2020 alone, 324 million metric tonnes of meat were consumed globally. It is predicted that by 2030 and 2050, 453 and 455 million metric tonnes of meat, respectively, would have been consumed worldwide. The Food and Agriculture Organization, a key agency of the United Nations, predicted that by 2050, Africa's current meat consumption of 10.5 million tonnes will have increased by about 150% to 35 million tonnes. Presently in Nigeria, 360,000 metric tonnes of beef are consumed annually. However, this demand is currently met by pastoralists from the Fulani ethnic group, whose activities have been a significant concern in the nation (Ajibefun, 2018; Duke and Agbaji, 2020; Ugwueze *et al*., 2022). As a result, a prospective alternate source of protein may reduce the heavy reliance on this group for meat supply.

Lab-grown meat otherwise called cultured meat, as the name implies is meat produced in the laboratory as opposed to the conventional breeding and killing of animals (Treich, 2021). The terms "in vitro," "clean," "cell-based," "artificial," "synthetic," or "lab-grown" are also used to describe cultured meat. By utilizing stem cell-based technologies, tissue is grown artificially to imitate real animal flesh for ingestion by humans. It is projected that this type of meat can serve in place of animal flesh as an alternate source of protein. Since the first hamburger made from lab-grown meat was introduced in August 2013, several studies have evaluated consumers' acceptance of lab-grown meat in different parts of the world (O'Riordan *et al.*, 2017; Bryant and Barnett, 2018; Gómez -Luciano *et al.,* 2019; Mancini and Antonioli, 2019; Van Loo *et al*., 2020; Weinrich *et al*., 2020). However, there is currently a dearth of information regarding Nigerians' awareness of and acceptance of cultured meat (Falowo *et al*., 2022). Even though cultured meat has not yet been made available in Nigerian markets, it is imperative to investigate the level of awareness and acceptability of lab-grown meat for consumption by Nigerians. Therefore, this study is focused on assessing the attitude and perceptions of Nigerians towards lab-grown meat as an alternative source of meat.

2. METHODS

2.1. Description of Study Area

Nigeria is the most populous country in West Africa. It is located at latitude 9.0820°N and longitude 8.6753°E, surrounded by Niger at the north, Chad and Cameroon at the east, the Gulf of Guinea at the south, and Benin at the west. The estimated population is over 200 million, with more than 250 ethnic groups and 36 states.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

2.2. Study Design and Population

This is a cross-sectional survey that was conducted for 5 months, from October 2021 to February 2022, through an online Google survey form. The study population consists of citizens of Nigeria residing in the country at the time of the study, and their perceptions and acceptability were obtained via an online Google form. A total of 233 Nigerians participated in the online questionnaire. Permission was requested through phone calls, emails, social media platforms, and in-person discussions. A brief introduction about cultured meat was attached at the beginning of the Google survey form so that the participants would have an idea about the topic. The online questionnaire contains participants' socio-demographic data and their acceptance and perceptions of cultured meat. Our research questions broadly sought insights into the opinions and positions of Nigerians toward cultured meat concerning general acceptance, willingness to purchase, environmental conservation and management, resolution of current ongoing crises over land, and perceived health implications. These issues will be discussed accordingly in this paper.

2.3. Statistical Analysis

The collected data were subjected to statistical analysis using the Statistics Package for Social Science (SPSS) version 21. Descriptive tests were carried out on the socio-demographic data of the respondents, and a Chi-square analysis was done to determine the factors that influence the acceptance of cultured meat among Nigerians. Similarly, respondents' perceptions were subjected to principal component analysis. The KMO and Bartlett's test is 0.857, with $p<0.01$ which was considered good. Extraction was made because one of the variables was less than 0.4. Following the removal, the KMO and Bartlett's test became 0.860, with $p<0.01$. Three components had eigenvalues greater than 1, with a cumulative value of 56.28%. When compared with parallel analysis, there were only two components whose eigenvalues were larger than the corresponding random eigenvalues. Three variables were removed as the extraction values were less than 0.4. Later, the number of factors was reduced to two, and varimax rotation was performed. The final KMO and Bartlett's test was 0.86, with a cumulative value of 55.16%. The two components had acceptable Cronbach's alpha (Item > 0.6) and acceptable eigenvalue sizes.

3. RESULTS AND DISCUSSION

Table 1 shows that a total of 233 Nigerians responded to this research survey. Almost half (108 (46.4%)) of the respondents were between 18 - 30 years old, and 150 (64.4%) were male. The educational level and religious group of most of the respondents were tertiary 226 (97.0%) and Christianity 207 (88.8%) respectively. Meanwhile, only 17 (7.3%) of the respondents work in the meat industry, and most of the respondents 229 (98.3%) eat meat. **Figure 1** shows that 52.4% (122) of the respondents have heard or read about cultured meat before.

Acceptance of cultured meat by the respondents is presented in **Table 2**. A significant percentage 208 (89.3%) of Nigerians observed had never tasted cultured meat before, and for those that have tasted it, few 8 (3.4%) stated that it tasted better than real meat, and 10 (4.3%) opined that it was not like real meat. More than half 150 (64.4%) of the respondents expressed willingness to taste cultured meat if given. A little more than half 118 (50.6%) of the respondents declared unwillingness to purchase cultured meat if it is released into the Nigerian market, and 113 (57.1%) said they will discourage their family and friends from eating cultured meat.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

Table 1. Socio-demographic data of the respondents.

Variables		Frequency	%
Region	South-East	11	4.7
	South-West	181	77.7
	South-South	20	8.6
	North-central	15	6.4
	North-East	4	1.7
	North-West	2	.9
Age	< 18	1	.4
	18 - 30	108	46.4
	31 - 40	87	37.3
	41 - 50	19	8.2
	> 50	18	7.7
Gender	Male	150	64.4
	Female	83	35.6
Level of Education	Elementary	1	.4
	Secondary	6	2.6
	Tertiary	226	97.0
Religion	Christian	207	88.8
	Islam	24	10.3
	Eckist	1	.4
	No religion	1	.4
Do you work in the meat industry?	No	216	92.7
	Yes	17	7.3
Do you eat meat?	No	4	1.7
	Yes	229	98.3

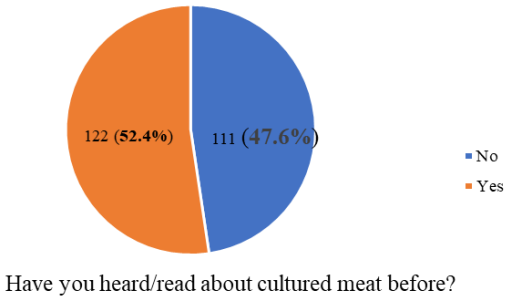

Figure 1: Response from respondents that have heard/read about cultured meat before.

Table 2. Acceptance of cultured meat by the respondents.

Variables		Frequency	%
Have you tasted cultured meat before?	No	208	89.3
	Yes	25	10.7
If 'Yes', how does it taste?	Better than real meat	8	3.4
	Like real meat	10	4.3
	Not like real meat	10	4.3
	Do not know	205	88.0
If 'No', would you be willing to taste it if given?	No	83	35.6
	Yes	150	64.4
Would you buy cultured meat when released into the Nigerian market?	No	118	50.6
	Yes	115	49.4
Would you encourage your family and friends to eat it?	No	133	57.1
	Yes	100	42.9

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

In **Table 3**, the regions of the respondents (p = 0.35, χ^2 = 5.59), age (p = 0.339, χ^2 = 4.53), level of education (p = 0.428, χ^2 = 1.70), religion (p = 0.538, χ^2 = 2.17), if respondents worked in the meat industry (p = 0.760, χ^2 = 0.09) or whether they eat meat (p = 0.326, χ^2 = 0.96) were not significant determinants of the acceptance of cultured meat. Meanwhile, respondents' gender (p = 0.003, χ^2 = 9.00) and whether they had previously tasted cultured meat (p = 0.001, χ^2 = 13.45) were the significant determinants of the acceptance of cultured meat in Nigeria. Females were 2.31 times more likely (OR = 2.31, Cl = 1.33 – 4.01) to accept cultured meat compared to males and those who have previously tasted cultured meat were 0.16 times less likely (OR = 0.16, Cl = 0.05 – 0.47) to accept cultured meat.

Table 3. Socio-demographic of respondents against acceptance of cultured meat.

		Would you buy cultured meat when released into the Nigerian market?				
		No	**Yes**	**α**	**χ^2**	**OR(Cl)**
Region	South-East	4 (36.4)	7 (63.6)	0.350	5.59	
	South-West	93 (51.4)	88 (48.6)			
	South-South	10 (50.0)	10 (50.0)			
	North-central	10 (66.7)	5 (33.3)			
	North-East	1 (25.0)	3 (75.0)			
	North-West	0 (0.0)	2 (100.0)			
Age	< 18	0 (0.0)	1 (100.0)	0.339	4.53	
	18 – 30	52 (48.1)	56 (51.9)			
	31 – 40	42 (48.3)	45 (51.7)			
	41 – 50	12 (63.2)	7 (36.8)			
	> 50	12 (66.7)	6 (33.3)			
Gender	Male	65 (43.3)	85 (56.7)	0.003	9.00	2.31 (1.33-4.01)
	Female	53 (63.9)	30 (36.1)			
Level of Education	Elementary	1 (100.0)	0 (0.0)	0.428	1.70	
	Secondary	2 (33.3)	4 (66.7)			
	Tertiary	115 (50.9)	111 (49.1)			
Religion	Christian	105 (50.7)	102 (49.3)	0.538	2.17	
	Islam	11 (45.8)	13 (54.2)			
	Eckist	1 (100.0)	0 (0.0)			
	No religion	1	0 (0.0)			
Do you work in the meat industry?	Yes	8 (47.1)	9 (52.9)	0.760	0.09	
	No	110 (50.9)	106 (49.1)			
Do you eat meat?	Yes	115 (50.2)	114 (49.8)	0.326	0.96	
	No	3 (75.0)	1 (25.0)			
Have you tasted cultured meat before?	Yes	4 (16.0)	21 (84.0)	0.001	13.45	-0.16 (0.05-0.47)
	No	114 (54.8)	94 (45.2)			

Table 4 shows the respondents' perceptions of cultured meat. 90 (38.6%) and 78 (33.5%) out of the total sample size could not visualize cultured meat as an alternative to solving protein shortages/ deficiencies in meals. In total, 164 (70.4 %) of Nigerians agreed that cultured meat is unnatural and almost half of the respondents 105 (45.1%) agreed that cultured meat will reduce the farmer/herder's crisis in Nigeria.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

Table 4. Perception of respondents to cultured meat.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Mean	SD
Cultured meat will reduce hunger levels in Nigeria	48 (20.6)	39 (16.7)	90 (38.6)	41 (17.6)	15 (6.4)	2.73	1.16
The Nigerian government should prevent the production/importation of cultured meat	11 (4.7)	52 (22.3)	78 (33.5)	45 (19.3)	47 (20.2)	3.28	1.16
Its production will contribute to the mitigation of the loss of biodiversity	18 (7.7)	29 (12.4)	101 (43.3)	65 (27.9)	20 (8.6)	3.17	1.02
It will be more nutritious and make protein more available	37 (15.9)	47 (20.2)	62 (26.6)	76 (32.6)	11 (4.7)	2.90	1.16
It is animal welfare-friendly	15 (6.4)	29 (12.4)	81 (34.8)	88 (37.8)	20 (8.6)	3.30	1.01
Cultured meat is safe and environmentally friendly	18 (7.7)	37 (15.9)	92 (39.5)	73 (31.3)	13 (5.6)	3.11	0.99
It will reduce food-borne or zoonotic diseases	20 (8.6)	34 (14.6)	81 (34.8)	83 (35.6)	15 (6.4)	3.17	1.04
Its production can make animal breeders lose their jobs	13 (5.6)	50 (21.5)	68 (29.2)	70 (30.0)	32 (13.7)	3.25	1.11
It is unnatural	7 (3.0)	20 (8.6)	42 (18.0)	93 (39.9)	71 (30.5)	3.86	1.04
It will be unhealthy or lead to health complications in the future	11 (4.7)	32 (13.7)	93 (39.9)	49 (21.0)	48 (20.6)	3.39	1.1
It will lead to loss of balance in the ecosystem	12 (5.2)	48 (20.6)	89 (38.2)	64 (27.5)	20 (8.6)	3.14	1.01
It will be disgusting	21 (9.0)	53 (22.7)	100 (42.9)	41 (17.6)	18 (7.7)	2.92	1.04
It will be costlier than natural meat	8 (3.4)	33 (14.2)	82 (35.2)	78 (33.5)	32 (13.7)	3.40	1
It will reduce farmers/herder's crisis in Nigeria	30 (12.9)	41 (17.6)	57 (24.5)	79 (33.9)	26 (11.2)	3.13	1.21

Component 1 from the principal components analysis (**Table 5**) contains perceptions that cultured meat will be disgusting, unhealthy or lead to health complications in the future, resulting in a loss of balance in the ecosystem, which is unnatural. Component 2 contains the perceptions that culture meat is animal welfare-friendly, will reduce farmers/herder's crisis in Nigeria, will reduce food-borne or zoonotic diseases, and will be more nutritious and make protein more available.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

Table 5. Principal components analysis of the respondents' perception.

	Component	
	1	2
Cultured meat will reduce hunger levels in Nigeria		0.639
It will be more nutritious and make protein more available		0.593
It is animal welfare-friendly		0.720
Cultured meat is safe and environmentally friendly		0.614
It will reduce the farmers/herders crisis in Nigeria		0.718
It will reduce food-borne or zoonotic diseases		0.643
It is unnatural	0.714	
It will be unhealthy or lead to health complications in the future	0.763	
It will lead to a loss of balance in the ecosystem	0.750	
It will be disgusting	0.770	
Eigenvalue	4.095	1.421
Cronbach's alpha	0.782	0.784

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

The current study provides empirical insights into the reactions and acceptance of cultured meat among Nigerians. This is important both for the potential meat companies, who may see the Nigerian market as having good potential for patronage and for the citizens, who should see the potential an alternative meat source holds for the nation. To the best of our knowledge, this is the first study to examine the perceptions of Nigerians on the knowledge, perception, and acceptance of cultured meat.

This study's level of awareness (52.4%) is higher than the 14% of Dutch respondents who claimed to have heard and know about cultured meat (Bekker *et al*. 2017), the 0% awareness reported by Verbeke *et al*. (2015) from the UK, Portugal, and Belgium, the 29% hearing of it in the US (Wilks and Phillips, 2017), the 11.45% of consumers who know about it from three cities in China (Zhang *et al*., 2020), and the 63% of South African respondents who have not heard about it. Higher awareness recorded in this study could be attributed to the fact that the news of cultured meat has become more widespread than in preceding years and most of our respondents have tertiary education and have access to novel information (Falowo *et al*., 2022). Moreover, some were PhD holders and professors who had obtained education outside Nigeria.

Almost all (98.3%) of the respondents were meat eaters, while 7.3% worked in the meat industry. Falowo *et al*. (2022) equally reported that the majority (89%) of their respondents in South Africa were beef eaters. Interestingly, the average Nigerian believes that eating food without adding meat or an alternative to meat (such as boiled egg or animal skin) is a sign of being poor or not meeting the standard of living. Similarly, to this, in several developed countries, eating meat is seen as an integral component of social identities and customs. As a result, many individuals today consume far more meat than is necessary for health (Willett *et al*., 2019; Bryant *et al*., 2020).

Therefore, the small number of respondents who indicated they did not consume meat in this study may be vegetarians, or because of a belief in a particular religion, health issues, or a meat allergy. The study by Valente *et al*. (2019) found that respondents' main motivations for giving up meat included concerns for animal welfare, the environment, and human health. Furthermore, consuming meat has been linked to a variety of health problems. According to Papier *et al*. (2021), higher consumption of poultry meat was linked to higher risks of gastroesophageal reflux disease (GERD), gastritis and duodenitis, diverticular disease,

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

gallbladder disease, and diabetes. Higher consumption of unprocessed red and processed meat alone was linked to higher risks of ischemic heart disease (IHD), pneumonia, diverticular disease, colon polyps, and diabetes. Thus, if cultured meat is determined to be safe for healthy consumption, its acceptability may improve. In addition, this may draw the attention of people to the potential health risks of consuming conventional meat while avoiding the demands of animal killing.

The majority (89.3%) of the respondents have never tasted cultured meat, and where the remaining respondents tasted cultured meat is not well known because cultured meat is not yet produced or imported into the Nigerian market. Some of them may have travelled to countries where cultured meat is already available or mistook packaged canned meat for cultured meat. Countries like Singapore, the UK, the US, Switzerland, Germany, Italy, Belgium, Japan, China, and Israel have started funding the sale of cultured meat in their food markets. Even though the number of respondents responding to the taste of cultured meat is slightly higher than the number who confirmed having eaten cultured meat previously, 35.7% of them claimed that its taste is not similar to that of real meat. Meanwhile, when Mark Post, who was the first scientist to produce a cultured beef burger, presented it to panel members for evaluation. The panellists raved about the flavour, saying that it tasted remarkably like real meat. Rolland et al. (2020) served "cultured" hamburgers to 193 participants from the Limburg region of the Netherlands in 2017; despite the lack of an objective difference, all the participants stated the "cultured" hamburgers were superior to the regular ones.

It was interestingly discovered through this study that even though 64.4% of individuals were willing to taste cultured meat if given, more than half of the respondents were neither willing to commit financially to buying the meat nor ready to endorse it to friends and family for consumption. The high level of willingness is consistent with the findings of Bryant *et al*. (2020) and Falowo *et al*. (2022). Heightened curiosity and willingness to test new grounds as observed among most of the participants were also corroborated by Mancini and Antonioli (2020). A survey has shown that there is a high willingness and acceptance of cultured meat in some European countries such as Italy, Spain, the UK, Finland, Poland, and the Netherlands (Bryant *et al*., 2020). In Pakistan, the general population's willingness to consume cultured meat was 27.6% (Ahsan *et al.,* 2022).

The willingness to taste meat may have stemmed from the fact that many of the respondents in this study were educated and had no reservations about any form of meat preparation and likely wanted to know how the taste might be. Apart from the fact that most respondents were meat eaters, the reluctance of the remaining 35.6 % of respondents to consume cultured meat may be related to worries about its flavour, safety, ethical implications, religious implications, naturalness, and knowledge. Also, with this level of awareness and willingness, it is probable that with more campaigns and the satisfaction of several factors, the acceptance level would improve significantly.

Gender and "whether respondents have tasted cultured meat before" were the major determinants of acceptance and willingness to buy cultured meat if it would be released into the Nigerian market. Just like the study by Falowo *et al*. (2022), which identified gender among others as an important influencing factor regarding acceptance of cultured meat. It was discovered that females were 2.31 times more likely than males to purchase cultured meat. Females are thought to be more accepting than males due to their familiarity with conventional meat, as this is the group that has mastered the culinary skill in Nigeria (Obayelu *et al*., 2020) and they may want to explore its taste in delicacy. Although, studies have found that men consume more meat than women do (Graca *et al*., 2015; Valente *et al*., 2019), and Mancini and Antonioli's study in 2019 found that men were readier to sample cultured meat

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

than women. In addition, compared to those who have not tasted it, people who said they have eaten cultured meat in this study were less likely to purchase it. This may be connected to 35.7% of them who felt that the taste was not authentically meat-like. Meanwhile, Bekker *et al*. (2017) and Wilks and Phillips (2017) contended that greater acceptability of cultured meat would be linked to greater familiarity with it.

Many people were uncertain if cultured meat will reduce hunger in Nigeria, mitigate biodiversity, be more expensive than natural meat, be safe, and environmentally friendly, or if the government should prevent its production or importation into the Nigerian market. In contrast to the study of Verbeke *et al*. (2015), many Nigerians do not hold the opinion that cultured meat would be disgusting. This may be because there are many varieties of processed meat already available on the market, such as "Asun," -"Suya," and "Kundi" (Jegede *et al*., 2018). Although many agree that it is unnatural and that its production could make animal breeders lose their jobs, many also agreed that it will help reduce food-borne or zoonotic diseases, farmers/herder's crisis in Nigeria, and that it will be more nutritious and make protein more available. Many of the respondents equally agreed that cultured meat production is animal welfare friendly. Eaters and non-eaters of meat may find this alternative to obtaining protein appealing from the perspective of animal welfare since some scientists already view this new (cultured) meat as a vegetarian product (Chauvet, 2018; Hopkins, 2015).

Moreover, Chriki and Hocquette (2020) reviewed that the major goal of lobbying for cultured meat innovation is to provide an alternative to confining animals, often in small places, and slaughtered inhumanely. Nevertheless, cell collection or biopsies using animals might raise some concerns about their well-being too. The positive opinions about whether the introduction of cultured meat would ease the herders/farmers crisis in Nigeria were also not unexpected given that the feared crisis was caused by cattle herders' unwelcome trespassing into farmers' lands, which frequently resulted in clashes, fatalities, and the destruction of valuable farm products.

The principal component analysis from this study showed that the studied population prioritized their concerns about cultured meat over its advantages, as revealed in component 1. Their concerns were about its naturalness, health complications, loss of balance in the ecosystem, and being disgusting (less than 25%). This could be because Nigerians are familiar with either naturally self-cultivated crops or agricultural produce devoid of technological involvement. Thus, the thought of ingesting something unnatural like cultured meat might be unsettling and cause many people to develop a fear of cultured meat. According to studies by Bryant *et al.* (2019) and Wilks *et al.* (2019), food neophobia is a predictor of rejection of cultured meat. Unwillingness to attempt foods that are seen as technical appeared to be motivated by disgust and a perception of unnaturalness (Bekker *et al*., 2017). In fact, revulsion and a sense of naturalness seemed to contribute to people's rejection of cultured meat (Siegrist *et al*., 2018).

4. CONCLUSION

Even though many Nigerians were uncertain of the taste and agreed with the unnatural production of cultured meat, a larger percentage were willing to purchase it when it is released into the market. This suggested that cultured meat would likely be received with mixed reactions based on the expected taste. Due to the essentiality of gaining the trust of potential customers, stakeholders should be informed clearly about the origin, benefits, safety, cost, and ethics of cultured meat.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

5. ACKNOWLEDGMENT

We thank Mrs Temilade Adesina for her contribution in sharing the survey Goggle link on her social media platforms. This study did not receive any specific financial assistance from any public, commercial, or not-for-profit funding source.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

7. REFERENCES

Ahmad, R. S., Imran A. and Hussain, M. B. (2018). Nutritional composition of meat. *Meat Science and Nutrition*, *61*(10.5772), 61-75.

Ahsan, M., Uzair, M. and Ali, M. (2021). Attitudes and perceptions towards cultured meat among general population in Pakistan. *ASEAN Journal of Science and Engineering Education*, *2*(1), 111-122.

Ajibefun, M. B. (2018). Social and economic effects of the menace of Fulani herdsmen crises in Nigeria. *Journal of Educational and Social Research*, *8*(2), 133.

Bekker, G.A., Fischer, A.R.H., Tobi, H., and van Trijp H.C.M. (2017). Explicit and implicit attitude toward an emerging food technology: The case of cultured meat. *Appetite, 108*, 245–54.

Bryant, C. and Barnett, J. (2018). Consumer acceptance of cultured meat: A systematic review. *Meat Science, 143*, 8-17.

Bryant, C., Szejda, K., Parekh, N., Desphande, V. and Tse, B. (2019). A survey of consumer perceptions of plant-based and clean meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, *3*, 11.

Bryant, C., van Nek, L. and Rolland, N.C. (2020). European markets for cultured meat: A comparison of Germany and France, *Foods, 9*(9), 1152.

Chauvet, D.J. (2018). Should cultured meat be refused in the name of animal dignity? *Ethical Theory and Moral Practice*, *21*, 387–411.

Chriki, S. and Hocquette, J.F. (2020). The myth of cultured meat: A review. *Frontiers in Nutrition, 7*(7), 1-9.

Domingo, J.L. and Nadal, M. (2016). Carcinogenicity of consumption of red and processed meat: What about environmental contaminants? *Environmental Research*, *145*, 109–115.

Domingo, J.L. and Nadal, M. (2017). Carcinogenicity of consumption of red meat and processed meat: A review of scientific news since the IARC decision. *Food and Chemical Toxicology*, *105*, 256-261.

Duke, O., and Agbaji, D.D. (2020). Fulani herdsmen crisis and the socioeconomic development of Benue State, Nigeria. *International Journal of Scientific and Research Publications*, *10*(8), 343-357.

Falowo, B. A., Hosu, Y. S. and Idamokoro, E. M. (2022). Perspectives of meat eaters on the consumption of cultured beef (in vitro production) from the Eastern Cape of South Africa. *Frontiers in Sustainable Food Systems*, *6*, 924396.

Gómez-Luciano, C.A., de Aguiar, L.K., Vriesekoop, F., and Urbano, B. (2019). Consumers' willingness to purchase three alternatives to meat proteins in the United Kingdom, Spain, Brazil, and the Dominican Republic. *Food Quality and Preference, 78*, 103732.

Graca, J., Oliveira, A. and Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, *90*, 80-90.

Grossi, G., Goglio, P., Vitali, A. and Williams, A. G. (2019). Livestock and climate change: Impact of livestock on climate and mitigation strategies. *Animal Frontier*, *9*(1), 69-76.

Higgs, J. D. (2000). The changing nature of red meat: 20 years of improving nutritional quality. *Trends in Food Science and Technology*, *11*(3), 85-95.

Hopkins, P.D. (2015). Cultured meat in western media: The disproportionate coverage of vegetarian reactions, demographic realities, and implications for cultured meat marketing. *Journal of Integrative Agriculture, 14*(2), 264-272.

Jegede, O. B., Ogunwole, O. A., and Omojola, A. B. (2018). Quality attributes and safety of processed meat products in Ibadan, Nigeria. *Nigerian Journal of Animal Production*, *45*(4), 210-221.

Mancini, M. C., and Antonioli, F. (2020). To what extent are consumers' perception and acceptance of alternative meat production systems affected by information? The case of cultured meat. *Animals, 10*(4), 656.

Mancini, M.C. and Antonioli, F. (2019). Exploring consumers' attitude towards cultured meat in Italy. *Meat Science*, *150*, 101-110.

McAfee, A.J., McSorley, E.M., Cuskelly, G.J., Moss, B.W., Wallace, J.M.W., Bonham, M.P., and Fearon, A.M. (2010). Red meat consumption: An overview of the risks and benefits. *Meat Science*, *84*(1), 1–13.

O'Riordan, K., Fotopoulou, A., and Stephens, N. (2017). The first bite: Imaginaries, promotional publics and the laboratory grown burger. *Public Understanding of Science*, *26*(2),148-163.

Obayelu, A.E., Ogbe, A.O. and Edewor, S.E. (2020). Gender gaps and female labour participation in agriculture in Nigeria. *African Journal of Economic and Management Studies*, *11*(2), 285-300.

Pan, A., Sun, Q., Bernstein, A.M., Schulze, M.B., Manson, J.E., Stampfer, M.J., Willett, W. C., and Hu, F.B. (2012). Red meat consumption and mortality: Results from 2 prospective cohort studies. *Archives of Internal Medicine*, *172*(7), 555-563.

Papier, K., Fensom, G.K., Knuppel, A., Appleby, P. N., Tong, T. Y. N., Schmidt, J. A., Travis, R. C., Key T. J. and Perez-Cornago, A. (2021). Meat consumption and risk of 25 common conditions: outcome-wide analyses in 475,000 men and women in the UK Biobank study. *BMC Medicine*, *19*(1), 1-14.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

Pereira, P. M. C. C. and Vicente, A. F. R. B. (2013). Meat nutritional composition and nutritive role in the human diet. *Meat Science*, *93*(3), 586-592.

Rolland, N. C. M., Markus, C. R. and Post, M. J. (2020). The effect of information content on acceptance of cultured meat in a tasting context. *PLoS ONE*, *15*(4), e0231176.

Siegrist, M., Sütterlin, B., and Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, *139*, 213–219.

Treich, N. (2021). Cultured meat: Promises and challenges. *Environmental and Resource Economics, 79*(1), 33-61.

Ugwueze, M. I., Omenma, J. T., and Okwueze, F. O. (2022). Land-related conflicts and the nature of government responses in Africa: The case of farmer-herder crises in Nigeria. *Society*, *59*(3), 240-253.

Valente, J. D. P. S., Fiedler, R. A., Sucha Heidemann, M., and Molento, C. F. M. (2019). First glimpse on attitudes of highly educated consumers towards cell-based meat and related issues in Brazil. *PLoS ONE*, *14*(8): e0221129.

Van Loo, E.J., Caputo, V., and Lusk, J. L. (2020). Consumer preferences for farm-raised meat, lab-grown meat, and plant-based meat alternatives: Does information matter? *Food Policy*, *95*, 101931.

Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D. and Barnett, J. (2015). 'Would you eat cultured meat?': Consumers' reactions and attitude formation in Belgium, Portugal, and the United Kingdom. *Meat Science*, *102*, 49-58.

Verbeke, W., Pérez-Cueto, F.J.A., de Barcellos, M.D., Krystallis, A., and Grunert, K.G. (2010). European citizen and consumer attitudes and preferences regarding beef and pork. *Meat Science*, *84*(2), 284-292.

Weinrich, R., Strack, M., and Neugebauer, F. (2020). Consumer acceptance of cultured meat in Germany. *Meat Science*, *162*, 107924.

Wilks, M. and Phillips, C. J. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PLoS One*, *12*(2), e0171904.

Wilks, M., Phillips, C. J. C., Fielding, K., and Hornsey, M. J. (2019). Testing potential psychological predictors of attitudes towards cultured meat. *Appetite*, *136*, 137-145.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., and Jonell, M. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447-492.

Zhang, M., Li, L. and Bai, J. (2020). Consumer acceptance of cultured meat in urban areas of three cities in China. *Food Control*, *118*, 10739.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815