The Bioscientist Journal Vol. 14 (1): 11 – 27, March 2026
Journal of the Faculty of Biosciences, Nnamdi Azikiwe University, Awka, Nigeria
Available online at http://www.bioscientistjournal.com
DOI 10.54117/the_bioscientist.v14i1.201



Full Length Research Article

The Influence of some Social Factors on the Acceptance of Entomophagy Within University Campus Community in Nigeria

*[1]Oriolowo O. B., [1]Joseph O. J., and [2]Daramola O. T.

[1]Department of Biology Federal University of Education P.M.B 39 Kontagora, Niger State, Nigeria
[2]Department of Biology Federal College of Education, Ididep, Ibiono, Akwa-Ibom State, Nigeria

***Corresponding Author:** oriolowotayo@yahoo.com

***Article History**: Received: 1st November, 2025 Accepted: 3rd March, 2026*

Abstract

There are increased calls for the use of less conventional animal protein sources like edible insects to feed the fast-growing population of the world. Edible insects are culturally acceptable and their production poses less threat to the environment. However, their consumption is beginning to dwindle due to the influence of Western culture. The study examined some social factors that affect the acceptance of entomophagy among a campus community in Nigeria. A total of 138 respondents were surveyed using a random sampling technique. Data were collected through a structured questionnaire and analyzed using descriptive statistics, Mann-Whitney U-test, Z-test, Chi-square, Cramér's statistics and Spearman correlation. The results showed that about 85.51% of the respondents had once tasted edible insects, 88% of them were introduced to entomophagy by family and friends, 60% obtained edible insects through hunting, 60% mostly consume grasshoppers and only about 58% were willing to continue eating edible insects in the future. Gender, religion and tribal affiliations do not influence entomophagy among the respondents. However, social factors like age, education, status, residency period, parents' education and occupation significantly ($P<0.05$) affect entomophagy. The younger generation showed propensity to reject entomophagy, while the highly educated showed tendency to continue consuming edible insects. The level of association between entomophagy and these social factors suggests that the attitude to reject entomophagy is probably at its formative stage and proper enlightenment, especially of the younger ones on the benefits of the consumption of edible insects could increase the acceptability of entomophagy among them.

Keywords: Entomophagy, Malnutrition, Social factors, Acceptance, Nigerians

Introduction

Poverty is a condition of insufficient or total lack of necessities of life, including food, shelter, education and safe water. It is also an unacceptable deprivation in terms of economic opportunity, health and security. Despite Nigeria's natural wealth, poverty is still endemic and the quality of life among Nigerians has progressively fallen over time. Nigeria is ranked 163 among 191 developing countries with a Human Development Index of 0.535 (UNDP, 2022). About 133 million Nigerians are living below the poverty line which is below $2.15 per day with a Multidimensional Poverty Index (MPI) of 0.257 (NBS, 2022). Food insecurity is an offshoot of poverty and it is manifested in the form of hunger and malnutrition. An aspect of food insecurity that measures the quality of food intake is known as malnutrition, which could either be protein-energy or micronutrient malnutrition. Over 815 million people worldwide are suffering from a lack of calories and nutrients in their diet (FAO, 2017), while no less than 2 billion people are suffering from micronutrient deficiency otherwise known as "hidden hunger" (FAO, 2014).

The effects of malnutrition are expressed in the forms of underweight, wasting, stunted growth and low life expectancy of 55 years among Nigerians (World Bank, 2019). Malnutrition has been implicated in at least half of the children's deaths worldwide, and lack of animal protein in the human diet is a major contributor to malnutrition in many African countries (UNICEF, 2015a). Nigeria has the highest number of malnourished children in the Africa and the second highest in the world. Nigeria loses about 2400 children per day due to malnutrition and about 14.7 million children under the age of five suffer from moderate and severe acute wasting (PUNCH, 2022). Several efforts have been made by the Nigerian government and their international partners like the World Health Assembly (WHA) to address malnutrition through initiatives like Scale Up Nutrition (SUN) and the inclusion of nutrition in the Sustainable Development Goals (SDGs) (Adeyemi *et al*., 2022). However, progress towards the goals has been slow because significant under-nutrition challenges are yet to be addressed and actualizing the 2025 target remains doubtful. For instance, Nigeria is still ranked 145th out of 157 countries in progress towards actualizing the Sustainable Development Goals (Sachs *et al*., 2017) and has more than 11.7 million children under 5 years with chronic malnutrition, the highest in Sub-Saharan Africa (NPC, 2014). This has led to the consideration of utilizing other less popular food sources to tackle malnutrition. One of these is the direct consumption of edible insects as human food, a practice known as entomophagy. It was first suggested by Meyer-Rochow to explore such alternative foods to ease global food shortages and this idea has slowly grown and led to the current interest in entomophagy (Baghele *et al*., 2013).

Edible insects have played an important part in the history of human nutrition in Africa, Asia and Latin America. About 2 billion people worldwide from 300 ethnic groups and 113 countries feed regularly on over 2000 species of edible insects as part of their diets (Tao and Li, 2018). Out of the over 524 species of insects consumed in Africa, 91 species are consumed in West Africa (van Huis *et al*., 2013), while about 22 species belonging to one of the orders: Isoptera, Orthoptera, Coleoptera, Hemiptera, Hymenoptera and Lepidoptera, are consumed in Nigeria (Alamu *et al*., 2013).

Studies in Nigeria have shown that entomophagy has contributed significantly to the reduction in malnutrition (Jacob *et al*, 2013; Emmanuel *et al,* 2025). Edible insects contain significant amounts of protein, fats, essential minerals and vitamins (Teffo *et al*., 2007). In those cultures where the use of insects as food is traditional, they are highly prized and much sought after as food. Apart from their nutritional value, they serve as a source of income for individuals and families. They are exported across borders to other African and European countries (Srivastava *et al*., 2009). Consumption of edible insects has the potential to positively improve food security, economic opportunity and livelihood of vulnerable people (Aung *et al*., 2023). Entomophagy has attracted lots of attention and its gains in acceptance and popularity have been viewed as a promising means of mitigating the challenges of hunger and malnutrition facing the world.

Although entomophagy is accepted in many parts of the world, the practice is still not acceptable in many Western societies (Sogari *et al.*, 2019). In recent times, studies on the consumers' attitudes toward entomophagy have been conducted in non-entomophagy countries, but only a few such studies focused on consumers from traditional insect-eating countries (Anankware *et al.*, 2017). However, with the gradual acceptance of Western culture, the consumption of edible insects may have reduced in many traditional insect-consuming countries (Ghosh *et al.,* 2019). This trend calls for more in-depth studies to understand the limiting factors and how their association might have influenced the acceptance or rejection of insect as food among the younger generations in traditionally insect-eating countries like Nigeria.

Nigeria presently has the highest population in Africa and with an annual population growth of about 2.6%, her population is expected to grow to a staggering 440 million by the year 2050 (PRB, 2013). Such an expected population increase, coupled with environmental degradation, could pose a major challenge to adequate supply of animal-based protein. Lack of animal protein in the human diet is common in many African countries, and this has been connected with high rates of infant and maternal mortality (UNICEF, 2015b). This has led to the call for edible insects as alternative sources of animal protein to combat protein-energy malnutrition prevalence in developing countries. However, it is uncertain whether such a proposal will be generally accepted by the younger and upcoming generations in Nigeria. This is because many time human food preferences are not only conditioned by nutritional benefits but also by social factors, environment and economic pressures. Every human diet carries not only bundles of nutrients but also significant symbols and identity, which contribute to their food preferences (Vane-Wright, 1991; Chang *et al*., 2010).

Human acceptance or rejection of food is determined by three broad factors: individual, product-related and environmental factors (Randall and Sanjur, 1981; Shephard and Raat, 1996). Individual factors include gender, age, education, income and knowledge. Product-related factors include nutritional values, taste, smell and safety, while environmental factors include family, ethnicity, location and religion. The formation and transmission of such food identity from generation to generation requires primarily the family as the first agent of socialization. This food socialization is not confined to childhood but represents a continuous process throughout life, as many other

agencies such as schools, peer groups, religion, advertisers and mass media, could change or modify it. This therefore raises the question of whether humans will accept edible insects as food or not. A few studies in Nigeria have recently examined entomophagy from human sociological perspectives using the general population in their survey (Ancha *et al*., 2021). However, none, to the best of our knowledge, have focused on the University campus community where our potential future leaders and policymakers are being groomed. The objective of this study was to determine how some social factors influence the level of acceptance of entomophagy among members of the Federal University of Education Kontagora, Nigeria, campus community.

Methodology

Study area

The survey took place on the campus of Federal University of Education Kontagora, Niger State, Nigeria, between April and June 2023. The University is located in the North-Central zone of Nigeria. The campus community is multi-cultural, hosting people from difference ethnic, religion and social status. Primarily Niger State has the Nupe, Gbaggi, Hausa, Kamberi as the major ethnic group; but of because Education, farming, trading and so on, Niger state also host many other ethnic groups like Igbo, Yoruba, Ebira, Ibibio, Adara and so on. The three major religions in Nigeria, Christianity, Islam and traditional religion are well practice by inhabitants of the campus community.

Study design

The study was cross-sectional survey research which employed systematic sampling of participants between April and June 2023. A semi-structured questionnaire was used to obtain data on the influence of certain sociological parameters on the participants' acceptance or rejection of entomophagy.

Study population

The study population consists of Federal University of Education Kontagora community. Majority of targeted participants were students, the younger generations which could determine whether or not entomophagy will be embraced and entrenched in the future generation (Stoger, 2017). Other two participant groups in the study were the University staff and other residents on the campus.

Determination of minimum sample size

The sample size for the survey was calculated using the estimated population of the people on the campus. The sample size for the survey was arrived at using the formula proposed by Yamane (1967) as illustrated below:

Estimate population on the campus = 6090

Adopted formula:

$$n = \frac{N}{1 + N(e^2)}$$

Where n = minimum sample size required, N = Population of the campus, 1 = constant and e = margin error.

Thus, when N = 6090 and a = 0.085

$$n = \frac{N}{1 + N(e^2)} = \frac{6090}{1 + 6090 \times (0.085^2)} = \frac{6090}{1 + 6090 \times 0.007225} = \frac{6090}{45.00025}$$

$$n = 135.33 \cong 135$$

Selection of the study participants

Systematic sampling method was used to select participants (students, staff and others). A total of 138 individuals participated in the survey. Their demographic characteristics such as age, gender, religion, education level and tribe were recorded for each participant. Information about entomophagy was included in the questionnaire, and responses were elicited from the participants.

Administration of the questionnaire used

The questionnaire used comprises two sections: A and B. Section A consists of participants' bio-data, like gender, age group, education level, religion, tribe, parents' education level, parents' occupation and years of residence in Kontagora. Other items in section A include the type of insect mostly consumed, sources of the insect and who first introduced them to eating insects. Section B consists of 15 question items scaled on five Likert scales of strongly agree, agree, disagree, strongly disagree and undecided. The question items sought the opinion of the respondents on the following: whether they accept or reject entomophagy, allergic response to eating insects, tribal acceptance of entomophagy, poverty and malnutrition in Nigeria and the potential of combating malnutrition in Nigeria with entomophagy. In all, each participant answered 27 questions.

Data Analysis

Data collected were encoded and analyzed with SPSS version 16.0. Descriptive analysis was used to analyze the participants' bio-data, such as gender, age group, religion, tribe, education level, status, year of residence, parents' occupation and education level. Responses to each of the 15 question items were summed into two groups of 'agree' and 'disagree' and each was analyzed using the Mann-Whitney U-test followed by a Z-test to determine the significance of their responses to each question item. A combination of the chi-square test (to measure statistical significance between consumption of edible insects and social demographic variables), Cramér's V (φ_c) and Spearman's correlation statistics (to measure the strength of the association (Cramer's, 1964) were used to determine the level of association between the propensity to consume edible insects and selected variables. The following interpretations of Cramér's test on the level of association were used: >0.5 high, 0.3-0.5 moderate, 0.1-0.3 low, and 0-0.1 little if any.

Results

Social demographic characteristics of the respondents

From the 150 questionnaires administered to the participants, a total of 138 valid questionnaires were recovered and used. Thus, a total of 138 individuals participated in the survey, 52.17% were males while 47.83% were females (Table 1). The majority (63.77%) fell within the age range of 16-30 years, while 8.70% were within the age range of 51-60 years. A significant number (82.61%) had either an undergraduate degree or currently pursuing one, 14.49% had a postgraduate degree (Master's and / or PhD) while 2.9% had basic education (primary and secondary). Calculated 56.52% of the respondents practice Christianity, 42.75% practice Islam and 0.73% practice traditional religion. Tribal affiliations of the respondents showed that 31.88% were Yoruba, 21.02% Hausa, 15.22% Nupe, 7.25% Igbo, 6.52% Adara, while 18.12% comprise other tribes like Ebira, Kambari, Gbagi, Ibiobio, Kagoma, Zuru, Ibiobio and Idoma, the minor tribal representatives in the survey. The status of the respondents revealed that 30.44% were staff (academic and non-academic), 47.10% were students and 22.46% were other residents on the campus. The years of their residence showed that 41.31% have lived in kontagora between 1-5 years, 21.02% between 6-10 years and 37.68% had lived over 11 years. On the respondents' parents' levels of education, 31.88% had basic education, 37.68% were undergraduates, 20.30% had postgraduate degrees and 10.14% had no formal education. Parents' occupations showed 42.75% to be civil servants, 42.75% to be involved in trades or businesses, 4.35% were artisans and 10.15% were farmers.

Table 1: Social demography of the respondents

Variable	Characteristics	Frequency (n)	% (N= 138)
Gender	Male	72	52.17
	Female	66	47.83
Age group (years	16-20	18	13.04
	21-30	70	50.73
	31-40	18	13.04
	41-50	20	14.49
	51-60	12	8.70
Education level	Basic	04	2.90
	Undergraduate	114	82.61
	Postgraduate	20	14.49
Religion	Christianity	78	56.52
	Islam	59	42.75
	Traditional	01	0.73
Tribe	Yoruba	44	31.88
	Hausa	29	21.01
	Nupe	21	15.22
	Igbo	10	7.25
	Adara	09	6.52
	Others	25	18.12
Status	Staff	42	30.44
	Students	65	47.10
	Others	31	22.46
Residency period (years)	1-5	57	41.31
	6-10	29	21.01
	>11	52	37.68
Parents' Education level	Basic	44	31.88
	Undergraduate	52	37.68
	Postgraduate	28	20.30
	No formal Education	14	10.14
Parents' occupation	Civil servant	59	42.75
	Business/trading	59	42.75
	Artisan	06	4.35
	Farming	14	10.15

Response to questionnaire items

Table 2 shows the summary of respondents' answers to the questionnaire items. Those who agreed to having eaten insects at one time or the other were 85.51%, those still willing to continue eating edible insects were 57.97% and the responses to both question items were significant (P= 0.05). Those who believed that there is extreme poverty in Nigeria were 65.94% , 73.19% alluded to increase in the prices of food items in the past three years, 60.87% believed that it is cheaper to eat edible insects, 63.045 felt eating edible insects could reduce malnutrition in humans, 65.22% recommended edible insects as alternative animal protein source, 68.12%

agreed that sale of edible insects could boast people sources of income, 65.22% said edible insects could supplement the high cost of animal protein presently being experienced and all the responses were significant (P= 0.05). Those who claimed to have had allergic reactions after eating edible insects were 31.16%, while 33.33% said entomophagy is not acceptable in their tribes, 33.33% felt that those who eat insects are uncivilized or barbaric and all these responses were not significant (P = 0.05). 84% believed more enlightenment on the importance of edible insects is necessary, 65.94% want more people to be encouraged to farm edible insects, 70.29% wished the government could provide financial support for those intending to go into insect farming and all these responses were significant (P= 0.05).

Table 2: Summary of responses to questionnaire item

S/N	Question item	Agree Freq.	%	Disagree Freq.	%	Z-test
1	I have eaten insects before	118	85.51	18	13.04	2.88*
2	I would like to continue eating insects	80	57.97	49	35.51	2.72*
3	I had an allergic reaction(s) after eaten insects	43	31.16	84	60.87	0.40
4	Eating insects is a taboo in my tribe	46	33.33	87	63.04	0.32
5	It is barbaric and uncivilized to eat insects	46	33.33	80	57.97	0.48
6	There is poverty and hunger in Nigeria	91	65.94	38	27.54	2.72*
7	The cost of food has risen in the last 3 years	101	73.19	29	21.01	2.80*
8	It is cheaper to eat edible insects	84	60.87	41	29.71	2.55*
9	Edible insects could reduce malnutrition	87	63.04	43	31.16	2.88*
10	Edible insects are good sources of protein	90	65.22	42	30.43	2.72*
11	Sales of edible insect could boast household income	94	68.12	36	26.09	2.88*
12	More enlightenment is need on the importance of edible insects	95	68.84	34	24.64	2.72*
13	People should be encouraged to farm insects	91	65.94	34	24.64	2.88*
14	The government should provide financial support for insect farmers	97	70.29	33	23.91	2.72*
15	Edible insects can supplement the high cost of animal protein	90	65.22	34	24.64	2.56*

- Level of Significance, $\alpha = 0.05$

Types of insects consumed, sources and how they were introduced to entomophagy

Five major types of edible insects were consumed by the respondents. Figure 1 showed that about 60.0% of the respondents mostly consume grasshoppers, 29.17% consume termites, 6.67% consume dung beetle larvae, 3.33% consume *Cirina forda* larvae and 6.67% consume palm weevil larvae. Figure 2 revealed that 60.0% hunt for their edible insects, 22.0% get theirs from the market or restaurants and 18.0% cannot remember their sources of edible insects. Figure 3 shows how the respondents were first introduced to eating edible insects. About 35.0% were introduced to entomophagy by their parents, 25.0% by their siblings, 28.0% by their friends and 12.0% first got into eating insects by chance.

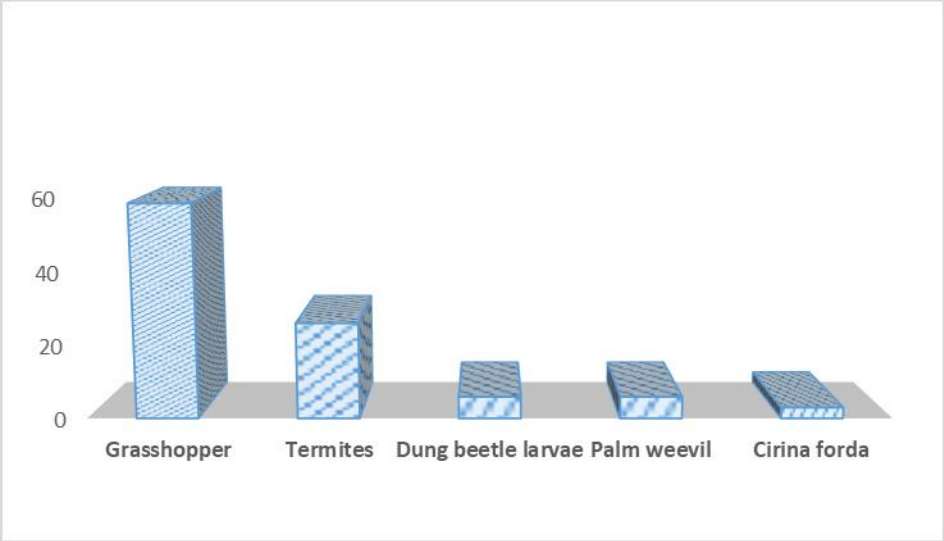


Figure 1: Respondents' Most consumed edible insects

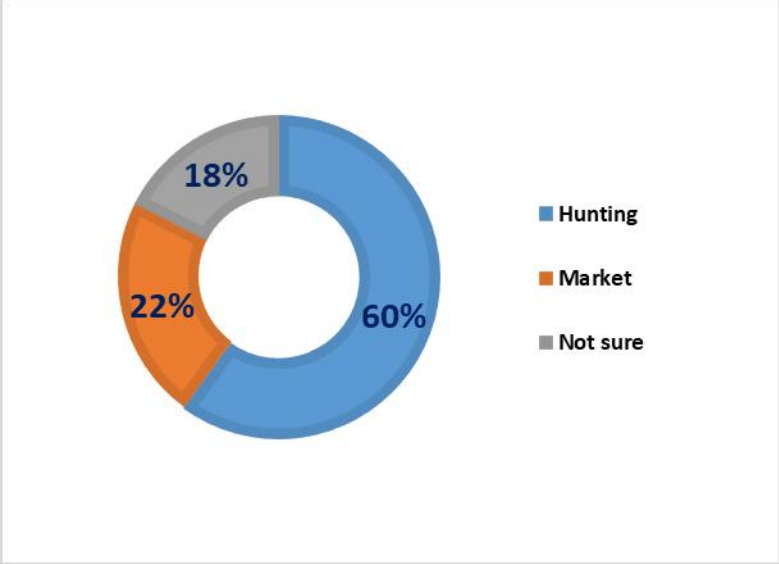


Figure 2: Major sources of edible insects

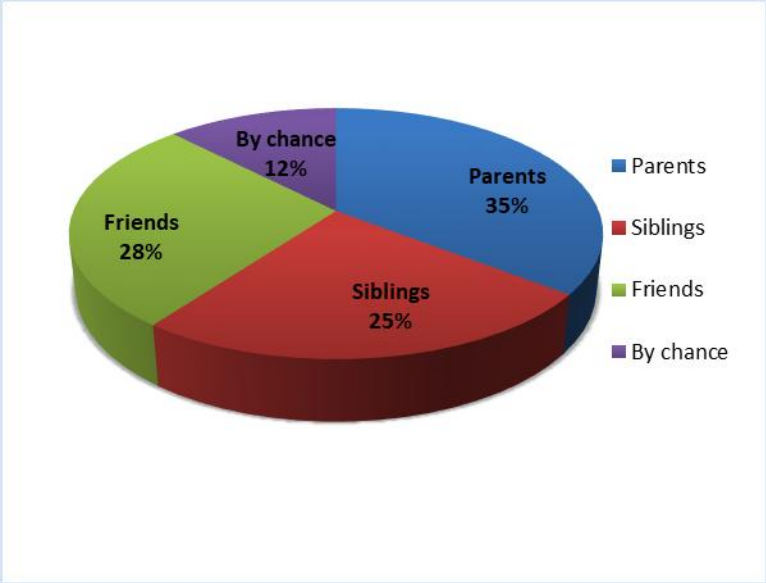


Figure 3: How respondents were introduced to entomophagy

Factors influencing the acceptance or rejection of entomophagy

In Table 3, the study revealed no significant (χ^2= 0.25; df =1; P=0.619) association between gender and propensity to accept or reject entomophagy among the respondents. A significant association χ^2= 12.91; df=1, P=0.002) was established between age groups and entomophagy practice. Religions of the respondents do not significantly (χ^2= 2.82; df=1, P=0.093) affect their acceptance of entomophagy. The level of education of the participants significantly (χ^2= 9.18; df=2, P=0.010) influenced their choice of insect as food or not. Tribal affiliation does not significantly (χ^2= 5.14; df =5, P=0.339) affect their decisions to accept entomophagy. Their status either as students, staff or non-student/staff residents significantly (χ^2= 21.03; df =2, P=0.000) influenced their entomophagous choices, moreover, the number of years the participants had lived in Kontagora has significant (χ^2= 18.03; df =2, P=0.000) effect with their acceptance of entomophagy. The respondent's parents' education level significantly (χ^2= 8.92; df =3, P<0.030) determined their choices of entomophagy and lastly, their parents' occupations have significant (χ^2= 45.22; df =3, P>0.000) on their acceptance of entomophagy.

Table 4 shows the level of association between entomophagy and some selected social variables. Cramér's V (φ_c) values show that social variables like age group, status, years of residency and parents' occupation have significant weak association with entomophagy while gender, religion, education level, tribe affiliation and parents' education have little and negligible association with the practice of entomophagy.

Table 3: Acceptance of Entomophagy and socio-demographic variables

Variable	Characteristics	Freq.(n)	χ^2 (df)	P-value
Gender	Male	72	0.25 (1)	0.619
	Female	66		
Age group (Years)	16-30	88	12.91(2)	0.002*
	31-45	33		
	46-60	17		
Religion	Christianity	78	2.82 (1)	0.093
	Islam	59		
Education level	Basic	04	9.18 (2)	0.010*
	Undergraduate	114		
	Postgraduate	20		
Tribe	Yoruba	44	5.14 (5)	0.339
	Hausa	29		
	Nupe	21		
	Igbo	10		
	Adara	09		
	Others	25		
Status	Staff	42	21.03 (2)	0.000*
	Students	65		
	Others	31		
Residency Period (years)	1-5	57	18.03 (2)	0.000*
	6-10	29		
	+11	52		
Parents' Education level	Basic	44	8.92 (3)	0.030*
	Undergraduate	52		
	Postgraduate	28		
	No formal Education	14		
Parents' Occupation	Civil servant	59	45.22 (3)	0.000*
	Business/trading	59		
	Artisan	06		
	Farming	14		

Table 4: Correlation between Entomophagy and selected social variables

Variable	**Spearman Corr.**	**df**	**Significance**	**Cramér's V (φ_c)**
Age group	-0.108	1	0.619	0.110
Gender	-0.073	1	0.017	0.073
Religion	0.050	1	0.093	0.050
Education level	-0.093	2	0.010	0.093
Tribe	-0.060	5	0.339	0.069
Status	-0.015	2	0.000	0.142
Years of residency	-0.113	2	0.000	0.130
Parents' education	-0.033	3	0.030	0.091
Parents' occupation	0.119	3	0.000	0.206

V (φ_c): >0.5 high; 0.3-0.5 moderate; 0.1-0.3 low; 0-0.1 little if any

Discussion

The present study investigated factors limiting the acceptance of edible insects as food by the Federal College of Education Kontagora, Nigeria, Campus community. The outcome showed that there was a decrease in the willingness of those who had at one time or the other eaten edible insects to continue eating them in the future. This confirms the possibility of change in human food culture over time (Asp, 1999). This also supports the view that young people in developing countries are gradually rejecting entomophagy as they abandon their cultural food habits for Western food (Hlingwane *et al*., 2021). This supports the postulation that Africans may, like the Jewish communities, reverse their previous habits of consuming edible insects because of Westernization (Amar, 2003). Although, few of the participants (27.54%) who do not wish to continue eating edible insects may be unwilling due to the side effects or allergies they experienced after consumption. Reactions like nausea, vomiting, diarrhoea, headache, dizziness, difficulty in breathing, and itching have been associated with the consumption of edible insects (Ribeiro *et al*., 2021).

The study also shows that the majority of the respondents feed mostly on grasshoppers and termites. Anankwane *et al*. (2017) also reported grasshoppers and termites as the two most consumed insects in the northern region of Ghana. The prominence of these two insect species might be attributed to ecological or ubiquitous reasons. Grasshoppers are more common in the northern savanna regions of Nigeria where Kontagora is located while termites are ecologically more spread than dung beetle, palm weevils and *Cirina forda*. Moreover, it was observed from the study that entomophagy is learned mostly through imitation from parents, siblings and friends. The majority of participants (82.0%) obtain their edible insects from hunting and purchase from the markets. This corroborates the submission of Anankwane *et al*. (2017) who said that entomophagy is part of people's cultural heritage in Africa. This implies that family, the primary agent of socialization plays an important role in entrenching the norm of eating edible insects in our societies.

Factors influencing entomophagy

The study revealed that gender does not significantly influence the acceptance or rejection of edible insects as food. This is contrary to other findings which either showed males or females to have more acceptance of entomophagy (Yuksel & Canhital, 2017; Ghosh *et al*., 2019). The family and friends' socialization or entrenchment of entomophagy may be the reason for these findings. The age group significantly affected the acceptance of entomophagy in this study. The percentage of those who are willing to continue feeding on edible insects were (51.13%), (69.70%) and (70.59%) for the young, middle age and elderly respectively. This implies that older people showed more acceptance of entomophagy than the younger ones. Similar results were observed among the Ghanaian and Chinese populations (Anankwane *et al*., 2017, Liu *et al*., 2020). The reasons for this could be that older people have more indigenous knowledge about edible insects (Liu *et al*., 2020) while young people are neglecting their food culture for Western food culture (Hlongwane *et al*., 2021). Religion does not significantly influence the choice of the respondents to either accept or reject entomophagy. This is not surprising because the two major religious faiths, Islam and Christianity of the respondents do not prohibit the eating of edible insects. Schrader *et al*. (2016) reported how the Holy Bible in the book of Leviticus 11:21-22 made mention of locusts and beetles as

permissible human food, while El-Mallahk & El-Mallakh (1994) made mention of the ants, locusts, bees, lice and termites as consumable insects as evidence of entomophagy in Islamic belief. However, this finding is at variance with the finding of Abdullahi *et al*. (2021) where they reported restraints to entomophagy by those whose religious faith forbids the consumption of food derived from animal sources.

Respondents' education level also has a significant impact on their acceptance or rejection of entomophagy. Individuals with basic education (primary/secondary) showed a lower tendency (25%) to continue eating edible insects, while people with a higher education level (master/PhD) showed a higher (70%) propensity to continue feeding on edible insects. This finding is similar to the findings of Mwiiga *et al*. (2022) who reported a positive association between education level and willingness to consume edible insects. Anankwane *et al* (2017), earlier proffer that this phenomenon could be because well-educated people are more likely to be opened to new experiences including trying edible insects as they travel far and near. Moreover, educated people are likely to be aware of the nutritional advantages of edible insects and so eat them more often (Liu *et al*., 2020).

Participants' tribal affiliation does not significantly affect their choice to accept or reject edible insects as food. This could be because entomophagy has been identified with various tribes or ethnic groups in Nigeria (Alamu *et al*., 2013). This implied that there is no tribal barrier to acceptance of entomophagy among the respondents in this study. This is at variance with the findings of Aung *et al.* (2013) who reported a higher propensity for eating edible insects among the Kachin, Kayah and Rakhine tribes of Myanmar because they have been practicing entomophagy as a heritage from the time of their ancestors, unlike the Burmese and Mon tribes. The status of the respondents had a significant effect on their acceptance of entomophagy. Only 41.15% of the students wish to continue eating edible insects as against 69.04% and 61.29% for staff and other residents respectively. This corroborates the submission that young people from developing countries are continuously rejecting insect-eating habits (Hlongwane *et al*., 2021).

The period of residency of the respondents in Kontangora significantly influenced their choice of entomophagy. Those who have lived for more than eleven years had greater willingness (71.15%) to continue eating edible insects in the future, while those with residency of between 1-5 years have less willingness (43.37%). Many of those with 1-5 years of residency are students who came to school and are to leave the community after their studies. A good number of them might not be well equipped with indigenous or traditional knowledge of how to obtain and prepare edible insects as delicacies. Those who have lived over eleven years were either born in Kontagora or lived long enough to have imbibed the culture of entomophagy. These results suggest that peoples' locality and years of residency could alter or modify their food habits.

Parents' education level influenced the desire to continue with the practice of consuming edible insects. Respondents whose parents had no formal education and those whose parents had postgraduate education (master/PhD) had a higher propensity to continue using edible insects as food. Moreover, individuals whose parents are civil servants (76.27%) and those whose parents are farmers (64.28%) had a greater desire to consume edible insects than those whose parents are artisans and traders. These results support the finding of Shephard & Raat (1996) who opined that

household factors such as family background could affect the actions or inactions of people towards entomophagy. This observation could be because many parents with non-formal education are farmers who have indigenous knowledge of entomophagy and have passed such to their children. A higher propensity to eat insects in the future is observed in children whose parents had higher education and civil servants may be because of their parents' nutritional knowledge of edible insects passed down to them. These parents had adequate and relevant information required to make informed decisions on the consumption of edible insects for their households. This was reflected in their responses as shown in Table 2 where 65.22% of the respondents attested to insects' food being a good alternative source of animal protein. This is because when humans select or adopt food to be eaten, product-related factors like nutritional values, taste and smell are usually considered.

Strength of association between variables and acceptance of entomophagy

The study revealed no significant (P = 0.619) difference between gender and entomophagy, religion and entomophagy (P = 0.093), and tribal affiliation and entomophagy (P = 0.339). There exist significant differences between entomophagy and age group (P = 0.002), education level (P = 0.0100), status (0.000), years of residency (0.000), parents' education level (P = 0.030) and parents' occupation (0.000). However, the level of association between entomophagy and age group (V (φ_c) = 0.110, r= -0.108), years of residency (V (φ_c) = 0.130, r = -0.113), status (V (φ_c) = 0.142; r = 0.065) and parents' occupation (V (φ_c) = 0.206; r = 0.119) were low, while the associations between entomophagy and respondents' education level (V (φ_c) = 0.093; r= -0.093) and parents' education level (V (φ_c) = 0.091; r = 0.033) were negligible (using Cramér's V (φ_c) statistics) (Table 4). Similar low or negligible associations between entomophagy and level of education, age, locality and occupation were reported for the Ghanaian population (Anankwane *et al*., 2017). A low/negligible association between these variables and entomophagy suggests that the propensity to reject edible insects as food among our younger generation is at the formative stage and this could be reverted easily through renewed public campaigns and enlightenment on the benefits of including edible insects as part of their diets and the inclusion of entomophagy into the learning curriculum in schools (Petersen *et al*., 2020).

Conclusions

Entomophagy is practiced in the study area. A good number of the respondents believed that there are poverty and malnutrition in Nigeria and feeding on edible insects could be a dual solution to these challenges. Entomophagy was, however, found to be influenced by parents' occupation, respondents' status, residency period, age and education levels of respondents and their parents. Gender, religion and tribal or ethnic affiliation do not affect the respondents' stance on entomophagy. The inconsequential influence of religion and ethnicity showed that the practice of entomophagy is culturally entrenched in Nigeria. Many of our younger generation are gradually drifting towards rejecting entomophagy in the future. Factors contributing to their attitude are acquired and alien to African culture. Their present perceptions of entomophagy are suspected to be a result of knowledge gap on entomophagy between the younger and the older generations. The attitude is presently at the formative stages and can be reverted

by attitudinal change through deliberate campaigns and enlightenment.

Authorship contribution statement

O.O.B: Conceptualization and design, methodology, investigation, data curation and analysis, writing and editing. **J.O.J:** Data curation, writing, review and editing. **D.O.T**: Data curation, writing, review and editing. All authors: Read and agreed to the published version of the manuscript.

Declaration of Competing Interest:

The authors **Oriolowo, O.B., John O.J. and Daramola, O. T.** declare no conflict of interest.

References

Abdullahi, N., Igwe, E. C., Dandago, M. A. & Yunusa, A. K. (2021). Consumption of edible insects: the challenges and the prospects. Food Science and Tech Journal, 3(1), 1-24.

Adeyemi, O., Toure, M., Covic, N., van den Bold M., Nisbett, N. & Headey, D. (2022) Understanding drivers of stunting reduction in Nigeria from 2003 to 2018: a regression analysis. Food Security, 1-17.

Anankware, J. P., Osekre E. A., Obeng-Ofori, D. & Khamala, C. M. (2017) Factors that affect entomophagical practices in Ghana. Journal of Insects as Food and Feed, 3(1), 33-41. https://doi.org/10.3920/JIFF2016.0007

Ancha, P. U., Ikyaagba, E. T. & Kaor, C. D. (2021). Consumers' acceptance and willingness to pay for edible insects in Makurdi metropolis, Benue state, Nigeria. Journal of Research in Forestry, Wildlife and Environment, 13(4), 159-170.

Alamu, O. T., Amao, A. O., Nwokedi, C. I., Oke, O. A. & Lawal, I. O. (2013). Diversity and nutritional status of edible insects in Nigeria: A review. International Journal of Biodiversity and Conservation, 5(4), 215-222. http://DOI:10.5897/IJBC12.121

Amar, Z. (2003) The Eating of Locusts in Jewish Tradition after the Talmudic period. The Torah Madda Journal. 11: 186-202.

Asp, E. A. (1999). Factors affecting food decisions made by individual consumer. Food policy, 2, 287-294

Aung, M., Dürr, J., Borgemeister, C. & Börner, J. (2023). Factors affecting consumption of edible insects as food: entomophagy in Myanmar. Journal of Insects as Food and Feed, 9(6): 721-739

Baghele, M., Mishra, S., Mayer-Rochow, V. B., Jung, C. & Ghosh, S. (2022). A review of the nutritional potential of edible snails: A sustainable underutilized food resource. Indian Journal of Natural Products and Resources. 13(4): 419-433

Chang, R. C. Y., Kivela, J. & Mak, A. H. N. (2010). Food preferences of Chinese tourists. Annals of Tourism Research, 37(4), 989-1011.

Cramér, H. (1948) Mathematical methods of statistics. Princeton University Press, Princeton, NJ, USA, 282 pp.

El-Mallakh, O. S. & El-Mallakh, R. S. (1994). Insects of the Qur'an (Koran). American Entomologist, 40, 82-84

Emmanuel, O. E., Ogbe, O. C., Ehilen, O. E. & Ehiwario, N. J. (2025). Nutritional compostion of four edible insects in

southern Nigeria. Nigerian Journal of Pure and Applied Sciences, 38:5199-5206

F. A. O (2014) Second international conference on nutrition better nutrition better lives. Available from: http://www.fao.org/about/meetings/icn2/toolkit/keymessages/en/

F. A. O. (2017). The State of Food Insecurity in the World. FAO, Rome. Food and Feed. 1(2): 121-129. https://doi.org/10.3920/jiff2014.0014

Ghosh, S., Jung, C., Meyer-Rochow, V. B. & Dekebo, A. (2019) Perception of entomophagy by residents of Korea and Ethiopia revealed through structured questionnaire. Journal of Insects as Food and Feed 6: 59-64. https://doi.org/10.3920/JIFF2019.0013

Hlongwane, Z. T., Slotow, R. & Munyai, T. C. (2021). Indigenous knowledge about the consumption of edible insects in South Africa. Insects, 12(1), 22. https://doi.org/10.3390/insects12010022

Jacob, A. A., Emenike, A. F., Arowore, K., Olusegun, O. & Anugwon, U. (2013). Entomophaga: A Panacea for protein deficiency-malnutrition and food insecurity in Nigeria. Journal of Agricultural Science, 5(6): 25-31

Liu, A. J., Li, J. & Gomez, M. I. (2020). Factors influencing consumption of edible insects for Chinese consumers. Insects 11: 10. https://doi.org/10.3390/insects11010010

Mwiinga, L., Ogara, S. & Chaamwe, N. (2022). The Influence of Mobile Apps and Media, Towards Entomophagy Awareness and Acceptability. International Journal of Advanced Research, 5(1), 131-144. https://doi.org/10.37284/ijar.5.1.824

National Population Commission (NPC) [Nigeria] and ICF International (2014). Nigeria Demographic and Health Survey 2013. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF International.

NBS (2022) Nigerian Multidimensional Poverty Index (MPI). National Bureau of Statistics Report 2022. 184pp. https://nigerianstat.gov.ng

Petersen, M., Olson, O. & Rao, S. (2020). University Student Perspectives of Entomophagy: Positive Attitudes Lead to Observability and Education Opportunities. Journal of Insect Science, 20(5), 1-6. https://doi:10.1093/jisesa/ieaa120

Population Reference Bureau (2013) "2013 World Population Data Sheet." Available at: http://www.prb.org/pdf13/2013population-data-sheet.eng.

PUNCH (2022) Nigeria must address malnutrition; 2400 children die daily-UNICEF. Punch news November 18, 2022. www.punch.org

Randall, E. & Sanjur, D. (1981). Food preferences – their conceptualization and relationship to consumption. Ecology of Food and Nutrition. 11(3): 151-161.

Ribeiro, J. C., Sousa-Pinto, B., Fonseca, J. S., Fonseca, S. C. & Cunha, L. M. (2021). Edible insects and food safety: allergy. Journal of Insects as Food and Feed, 7, 833-847.

Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D. & Teksoz, K. (2017). SDG Index and Dashboards Report 2017. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

Schrader, J., Oonincx, D. G. A. B. & Ferreira, M. P. (2016). North American entomophagy. Journal of Insects as Food and Feed. 2: 111-120.

Shepherd, R. & Raats, M. (1996). Attitudes and beliefs in food habits. In: H. L. Meiselman, H. MacFie, (eds) Food choice, acceptance and consumption. Springer, Boston, MA, USA. 346-362pp. https://doi.org/10.1007/978-1-4613-1221-5

Sogari. G., Menozzi, D. & Mora, C. (2019). The food neophobia scale and young adults' intention to eat insect products. Int J Consum Stud 43(1): 68-76.

Srivastava, S. K., Babu, N. & Pandey, H. (200). Traditional insect bioprospecting- As human and medicine. Indian Journal of Traditional Knowledge, 8(4), 485-494

Tao, J. & Li, Y.O. (20180. Edible insects as a means to address global malnutrition and food insecurity issues. Food Quality and Safety, 2:17-26

Teffo, L. S., Toms, R. B. & Eloff, J. N. (2017). Preliminary data on the nutritional composition of the edible stink-bug, Encosternum delegorguei, consumed in Limpopo province, South Africa. South Afr. J. Sci., 103, 434 - 436.

UNDP (2022). Uncertain times, unsettled lives: Shaping our future in a transforming world. Human Development Report 2022. United Nations Development Programme. New York, NY 10017. pp 320. www.undp.org

UNICEF (2015a). UNICEF for every child: Nutrition. Annual Results 2015. Report. New York, NY 10017, USA. Pp 93. www.unicef.org

UNICEF Nigeria (2015b). United Nations International Children's Emergency Fund Maternal and child health. https://www.unicef.org/nigeria/children_1926.html

UNICEF (2017). The State of the World's Children. Available at:https://www.unicef.org/sowc/

United Nations Development Programme (UNDP) (2022). Human Development Report. NewYork, NY 10017. pp 320. www.undp.org

World Bank (2019). World Bank development report; building human capital. The reason why the government should get involved, pp 49-52. http://documents.worldbank.org/curated/en/

Van Huis, A., Van Itterbeeck, J., Klunder, H., Mertens, E., Halloran, A., Muir, G. & Vantomme, P. (2016). Edible

insects: prospects for food and feed security. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy, FAO Forestry Paper no. 171, 201pp. Available at: http://www.fao.org/docrep/018/i3253e/i3253e.pdf.

Vane-Wright, R. I. (1991). Why Not Eat Insects? Bulletin of Entomological Research, 81, 1-4

Yamane, T. (1967). Statistics: An introductory Analysis, 2nd Edition, New York, Harper and Row.

Yuksel, E. & Canhital, R. (2017). A survey of public opinion about entomophagy in Eeciyes University. International Journal of Agriculture and Wildlife Science (IJAWS), 4(2), 203-208. https://doi:10.24180/ijaws.440555