Journal of Research in Forestry, Wildlife & Environment Vol. 13(4) September, 2021
E-mail: jrfwe2019@gmail.com**;** jfewr@yahoo.com
http://www.ajol.info/index.php/jrfwe

jfewr ©2020 - jfewr Publications
ISBN: 2141 – 1778
Ancha et al., 2021

CONSUMERS ACCEPTANCE AND WILLINGNESS TO PAY FOR EDIBLE INSECTS IN MAKURDI METROPOLIS, BENUESTATE, NIGERIA

Ancha, P.U.,[1] Ikyaagba, E.T.[2] and Kaor, C.D.[3]

1,2,3. Department of Social and Environmental Forestry, Federal University of Agriculture Makurdi, Benue State, Nigeria.
***Corresponding Author**: *anchapaul@gmail.com*

ABSTRACT

The study was conducted to provide information on consumers' acceptance and willingness to pay (WTP) for edible insects in Makurdi metropolis due to paucity of information on the acceptance and WTP of the insects. Stratified random and systematic sampling techniques were employed for data collection from 120 respondents. Data were analyzed using descriptive statistics, five-point Likert rating scale, and Contingent Valuation Method (CVM). The results show that all the respondents (100%) have heard of edible insects. However, 81.67% of the respondents reported eating edible insects, 33.2% ate edible insects because of its taste while 29.4% ate forest insects for its nutritive values, 23.08% disgust eating insect products. Edible forest insect identified by the respondents were cricket 30.46%, caterpillar 29.23%, termites 29.54%. Others were grasshopper 5.85%, honey bee and locust 2.46% respectively. Cricket was the most preferred edible insect (48.33%). The total willingness to pay was ₦72951/yr while the mean willingness to pay for conservation of edible insects was ₦*744.40/yr*. The study recommends for the conservation of edible insects by Government, local authorities, Non-Governmental Organizations (NGOs) and individuals to ensure the sustainability of edible insects in the locality.

Keywords: Edible insects, consumers, acceptance, willingness to pay, Makurdi

Correct Citation of this Publication
Ancha, P.U., Ikyaagba, E.T. and 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 & Environment* Vol. 13(4): 159 - 170

INTRODUCTION

The global demand for nutritious and acceptable food, driven by a growing population as well as increased consumption per capita, is increasing Clark and Tilman (2014). Extrapolating the current trend of rising incomes driving the demand for meat protein and total calories will, according to Clark and Tilman (2014) result in an increased global consumption. It is projected that in 2050, humanity will need a total of 15% more calories and 11% more protein, compared to today. These trends pose a threat to a sustainable development, from an environmental as well as a health perspective, and alternative dietary scenarios are needed. As one of many possible alternatives, edible insects have been put forward as a resource efficient source of protein and other essential nutrients (Dobermann *et al.*, 2017).

The production of animal protein is linked to high resource consumption, requiring a lot of agricultural land, water and energy. Traditional livestock farming and meat production are also morally questionable. Interest in alternative protein source which can be produced using fewer resources has rapidly increased in recent years. Due to a report by the FAO (2013) and the commitment of individual scientists, public interest in insect as an alternative protein source has increased. Approximately 2,000 species of

edible insects have been identified globally to date (Jongeman, 2015). In many cultural spheres, for examples, in East Asia, Africa and South America, they are harvested from the wild and are part of the traditional diet (FAO, 2013). In contrast, in Western countries they tend to trigger disgust rather than a desire to eat. Forest insect are insect found in the forest. Insect are in the phylum Arthropoda which includes all animals with exoskeletons and segmented bodies. This includes class insecta and class arachnida. Out of the approximately 30 (thirty) insect order not all are forest insects. Most of which are edible insect.

Entomophagy is the scientific term for consumption of insects (Meyer-Rochow, 2010). Entomophagy is practiced in many countries around the world but predominantly in parts of Asia, Africa and Latin America (Ramos-Elorduy, 2009, Clarkson *et al.*, 2019). Insects supplement the diets of approximately 2 billion people and have always been a part of human diets (Akhtar and Isman, 2018). People throughout the world have been eating insects as a regular part of their diets for millennia. As people in rural areas suffer from under nutrition, especially protein-energy malnutrition (PEM) in Africa, Latin America and Asia, alternative nutritional food sources are needed (Akhtar and Isman, 2018). From ants to beetle larvae – eaten by tribes in Africa and Australia as part of their subsistence diets – to the popular, crispy-fried locusts and beetles enjoyed in Thailand, it is estimated that insect-eating is practiced regularly by at least 2 billion people worldwide (Akhtar and Isman, 2018). About 2000 insect species have been documented in literature as edible, most of them in tropical countries (Ramos-Elorduy, 2005; Johnson, 2010, Akhtar and Isman, 2018). The most commonly eaten insect groups are beetles, caterpillars, bees, wasps, ants, grasshoppers, locusts, crickets, cicadas, leaf and plant hoppers, scale insects and true bugs, termites, dragonflies and flies.

In-spite of the strong aversion shown to Entomophagy (consumption of edible insects) due to civilization, insects have played an important part in the history of human nutrition in Africa, Australia, Asia and the Americas (Ramos-Elorduy, 2009; Clarkson *et al.*, 2019). Hundreds of species have been used as human food. Globally, about 14 insect orders contain one or more species of edible insects. Africa is one of the leading continents that consume insects as food (Johnson, 2010). In Africa, insects form part of the traditional diets of millions of people and are also used as feed for their farm animals. Nowadays, Entomophagy is a major entomological research interest with focus on its future prospect for food and feed security.

Insects have always involved fear and disgust (Nonaka, 2009) by a lot of people and the distinction between edible or inedible insects is mainly based on culturally transmitted information. When a new food is introduced in a culture, it generally induced feelings of fear and rejection called "neophobia". This could be rejection of insects because of the knowledge of their origin and habitats or the rejection due to anticipated negative post-ingestion consequences. Studies on edible insects in the locality included Agbidye *et al.* (2009) who reported on the marketability and nutritional qualities of some edible forest insects in Benue State, Nigeria. and Agbidye and Nongo (2012) who investigated harvesting and processing techniques of the larvae of *Cirina forda* Westwood (Lepidoptera: Saturniidae), among the Tiv people of Benue state, Nigeria. However, there is limited or no study on consumer acceptance and willingness to pay for edible forest insects as food in Makurdi metropolis. It is against this background that the study was conducted to provide information on consumer acceptance and willingness to pay for edible forest insects for decision making and policy.

MATERIALS AND METHODS

Study Area

Makurdi Local Government Area (LGA) lies between latitude 7° 43′ 56′′ N and longitude 8° 32′ 10′′ E. The Local Government shares boundary with Guma LGA to the North-East, Gwer LGA to the South, Gwer West LGA to the West and Damai LGA of Nasarawa State. The LGA is divided into two land masses by the River Benue into North and South Bank. Makurdi LGA has a population of 300,377 from the 2006 census, with a land mass of 16 Kilometer radius. Makurdi town, the headquarter of the LGA also serves as State capital of Benue State.

The climate of the LGA is divided into the tropical wet and dry climate with a double maximal of and August break as the main climatic phenomenon. The rainy season last from April to October while the dry season last from November to March. This long dry season has adverse impacts on rain as a source of water for wildlife consumption, domestic and agricultural uses. The climatic situation is mainly controlled by two air masses, the South West (tropical maritime) which is responsible for rainy season and the North East (tropical continental) which is responsible for dry season in Nigeria. This later air mass is always accompanied by cold harmattan wind.

The temperature of Makurdi LGA is generally high throughout the year due to constancy of insulation with a mean maximum temperature of 33°C and minimum of 25.3°C with an annual range of 7.7°C with the hottest month being February and March. Humidity in Makurdi is quite high always in excess of 50% and occasionally reaching 95%. This is responsible for heavy cloud which remains unbroken for weeks which lowers the day temperature for the month of July and September. The mean annual rainfall in Makurdi is 1250mm.

The topography of the study area is typical of undulating to gentle sloping in a North-South direction. The principal soil types are sandy soils which are mostly found at the plain lands and clayey loam which are mostly found at the synclines. The vegetation of the study area is a guinea savanna type. The shrub has bold and broad leaves. Predominant tree species in the area are *Khaya senegalensis, Prosopis africana, Daniella oliveri, Vitellaria paradoxa, Parkia biglobosa, Andropogon gayanus, Ceiba pentandra, Cynodon dactylon, Vitex doniana, Philostigma thorningii.* It contains most of the animal species that is typical of the Northern guinea savanna of West Africa.

The indigenous inhabitant of the study area is the Tiv ethno-linguistic group. Other ethno-linguistic groups in the area include the Idomas, Etilos, Igedes, Igalas, Hausas, Yourubas, and Ibos amongst others. The LGA has 11 council ward which includes Agan, Ankpa/Wadata, Bar, Central South Mission, Fiddii, Mbalagh, Modern Market, North Bank I, North Bank II and Wailomayo. The study area is made up of people who are engage in civil service, trading and agrarian peasantry, the LGA also has markets to promote trade and commerce which in turn generate revenue.

Population Sampling Procedure and Sample Size

Population of the study consisted of households and market places within in Makurdi metropolis. The metropolis was stratified into locations. Five (5) locations in Makurdi metropolis were randomly selected for the study (Table 1), twelve (12) households in each of the locations were selected through systematic random sampling technique giving sixty (60) households. Two (2) mature persons were purposively selected in each of the household based on their knowledge on edible insect insects. Therefore, the sample size for the study was one hundred and twenty (120) consumers of edible insects, as shown in Table 1.

Table 1. Sampling Procedure for the Study

S/No	Location	Household/Location	Respondents/Household	Sample size
1.	North bank I	12	2	24
2.	Wurukum	12	2	24
3.	Wadata	12	2	24
4.	Logo I	12	2	24
5.	Modern market	12	2	24
	Total	60	-	120

Data Collection

Data for the study were generated using semi-structured questionnaire. The questionnaire was divided into four thematic sections. The first section solicited information on the socio-economic characteristics of the respondents in the study area. Section two sought for information on different types of edible insects. Section three was on respondents' reasons for eating or not eating insects as food in while the fourth section solicited information on the respondents' willingness to pay for edible insects in Makurdi metropolis.

Data Analysis

Descriptive statistics such as frequency, mean, tables and percentages were used to describe the socio-economic characteristics of the respondents on edible insects in the study area. It was also used to present results of the different species of edible insects in the study area and reason for eating or not eating insects in the study area. The Contingent Valuation Method (CBM) as used by Ancha *et al.,* (2015) was adopted to determine the willingness to pay (WTP) values of edible insects in the study area.

The WTP values of the edible insects in the study area was determined by application of the formulae:

$$WTP = \frac{\sum fx}{n} \text{ …….. [1]}$$

Where:

WTP= mean willingness to pay value

Σ= Summation sign

f = frequencies of respondents

x = value of the insects in Naira (₦) and

n = number of respondents

RESULT

Socio-Economic Characteristics of Respondents on

Result on the socio-economic characteristics of respondent on awareness of edible insects in Makurdi metropolis is shown in Table 2. The result shows that 53.33% of respondent were male while 46.67%. of respondents were female. Also, majority 71.00% of the respondents were below 40 years with most of the with the age category of 31 – 40 had 25.83%, while 29 .00% were above 40 years with 24.17%, of the respondents within the age bracket of 51 – 60yrs. The table 2 also revealed that 81.67% of the respondents had one form of education of the other with 45% of the respondents attending tertiary education while 18.33% had non-formal education. Similarly, 50.83%, of the respondents were married, 32.50%, were single, 6.67% were divorced while 10%. were widow(er). In terms of occupation, 27.50%, were traders, 23.33%, were students 18.33% were civil servants while 14.17% were farmers. The result also shows that 38.33%, of the respondents earned annual income of below ₦ 250,000 while only 5% of the respondents earned above ₦ 1,000,000 per year. Majority 52.50% of the respondents had household size of 4 -6 persons while only 8.33% had above 10 persons in the household.

Table 2. Socio-Economic Characteristics of Respondent on Edible Insects in Makurdi Metropolis

Variable	Category	F(n = 120)	%
Sex	Male	64	53.33
	Female	56	46.67
Age category	< 21	11	9.17
	21 – 30	23	19.17
	31 – 40	31	25.83
	41 – 50	29	24.17
	51 – 60	17	14.17
	> 60	9	7.50
Educational status	Primary	12	10.00
	Secondary	32	26.67
	Tertiary	54	45.00
	Non-formal	22	18.33
Marital status	Single	39	32.50
	Married	61	50.83
	Divorced	8	6.67
	Widow(er)	12	10.00
Occupation	Farmer	17	14.17
	Civil servant	22	18.33
	Public servant	20	16.67
	Traders	33	27.50
	Students	28	23.33
Annual income	<₦ 250,000	46	38.33
	₦ 251,000 – ₦ 500,000	34	28.33
	₦ 501,000 – ₦ 750,000	18	15.00
	₦ 751,000 – ₦ 1,000,000	16	13.33
	>₦ 1,000,000	6	5.00
Number of persons in the household	1 – 3	27	22.50
	4 – 6	63	52.50
	7 – 9	20	16.67
	10 and above	10	8.33
Number of educated persons in the family	1 – 3	73	60.83
	4 – 6	36	30.00
	7 – 9	11	9.17

Information on Consumption of Edible Insect in Makurdi Metropolis

The result of the study as presented in Table 3 revealed (100%) respondent have in one way or the other heard of edible insects, Majority 81.67% of the respondent have eaten edible insects while 18.33% do not tested edible insects before.

Reasons for Eating Insects in Makurdi Metropolis

A total of 9 reasons were listed by respondents as being responsible for their consumption of insects (Table 4). Taste was the number one reason as 33.2% of the respondents eat insects because of the taste, 29.4%, eat due to health reasons while the least reason was authority recommendation with only 0.4% of respondents.

Reasons for Not Eating Insects in Makurdi Metropolis

Three reasons were mentioned by respondents as being responsible for thein no consumption of insects (Table 5), 44.4% of the respondents do not just like it, 37% disgust it while 18.5% do not eat it due to hygiene factor.

Willingness of the People to Introduce Insects in their Diet in Makurdi Metropolis

The result of the study as presented in Table 6 shows that 81.67% of the respondents were willing to introduce insects into their diets while 18.33% were not willing to introduce insects in to their diets. Majority 83.33% of the respondents were ready to suggest to friends and relatives to introduce insect protein in their diets were while 16.67% of the respondents were not willing to suggest to friends and relatives to introduce insect protein in their diets were. Furthermore, 81.67% of the respondents were willing to buy insects products if available in the market while 18.33% were not ready to do so.

Table 3. Information on Consumption of Edible Insect in Makurdi Metropolis

Variable	Category	F(n = 120)	(%)
Have you ever heard of edible insects	Yes	120	100.0
	No	-	
Do you eat insects	Yes	98	81.67
	No	22	18.33

Table 4. Reasons for Eating Insects in Makurdi Metropolis

Reasons	F*	%
Health	77	29.4
Environment	16	6.1
Taste	87	33.2
Crispy	21	8.0
Trend	23	8.8
Exciting	13	5.0
For fun	7	2.7
Influence	17	6.5
Authority recommends	1	0.4
Total	262	100

F = Multi-choice Responses*

Table 5. Reasons for Not Eating Insects in Makurdi Metropolis

Reasons	F*	%
Not hygienic	5	18.5
Don't like it	12	44.4
Disgusting	10	37.0
Total	27	100

F = Multi-choice Responses*

Table 6. Willingness of the People to Introduce Insects in their Diet in Makurdi Metropolis

Variable	Category	F (n=120)	%
Will you be willing to introduce insect in your diet	Yes	98	81.67
	No	22	18.33
Can you suggest to friends and relatives to introduce insect protein in their diets	Yes	100	83.33
	No	20	16.67
Will it be your intention to buy products with insect protein rather than traditional protein sources, if available in the market	Yes	98	81.67
	No	22	18.33

Reasons for Peoples Intention Not Buying Products with Insect Protein

The result in Table 7 shows that reasons given by respondents were eating insects is disgusting 23.08%, insects-based foods have negative texture properties 14.29%, insects-based foods have negative taste properties 16.48%, believe that eating insect is not part of our diets each 16.48, believe that insects-based foods imply poor hygiene 19.78%, and believe that eating insects is not socially acceptable 9.89%.

Information on Edible Insects in Makurdi Metropolis

The result on the information on edible insects in Makurdi Metropolis is shown in Table 8. The result shows that 81.67% of the respondents could identify the edible insects in their locality, with the insects ranging from crickets with 30.46%, termites 29.54%, caterpillar 29.23%, grasshopper 5.85% and honey bee and locust with 2.46% respectively. Majority 81.67% were willing to continue to eat insects.

Types of edible Insects in Makurdi Metropolis

A total of 6 edible insects were listed by respondents, crickets was ranked number one as the most preferred with 48.33%, termites was ranked second, caterpillar third. The respondents who were willing to continue consuming edible insects. Grasshopper was ranked fourth while Honey bee and Locust were ranked fifth. As shown in Table 9.

Amount People are Willing to Pay for the Conservation of Edible Insects

The result on the amount consumers are willing to pay conservation of edible insects is shown in Table 10. The result shows that the amount people were willing to pay for the conservation of edible insects is ₦744.40/yr.

Table 7. Reasons for Peoples Intention Not Buying Products with Insect Protein

Reasons	F*	%
The idea of eating insects' products disgusts me	21	23.08
Fear that insects-based foods have negative texture properties	13	14.29
Fear that insects-based foods have negative taste properties	15	16.48
Believe that insects-based foods imply poor hygiene	18	19.78
Believe that eating insect is not part of our diets	15	16.48
Eating insects is not socially acceptable	9	9.89
Total	91	100

F = Multi-choice Responses*

Table 10. Information on Edible Insects in Makurdi Metropolis

Variable	Category	F(n = 120)	%
Can you identify edible insects in your locality	yes	118	98.33
	No	2	1.67
Which of the edible insects do you prefer most?	Crickets	58	48.33
	Caterpillar	37	30.83
	Termites	25	20.83
Are you willing to continue consuming edible insects	Yes	98	81.67
	No	22	18.33

Table. 11. Types of edible Insects in Makurdi Metropolis

Edible Insects	F*	%	Rank
Caterpillar	95	29.23	3
Cricket	99	30.46	1
Termites	96	29.54	2
Grasshopper	19	5.85	4
Honey bee	8	2.46	5
Locust	8	2.46	5
Total	325	100	

F = Multi-choice Responses*

Table 12. Amount People are Willing to Pay for the Conservation of Edible Insects

WTP Amount (₦)	Mid-Point (x)	F	Fx
100 – 199	149.5	6	897
200 – 299	249.5	11	2744.5
300 – 399	349.5	8	2796
400 – 499	449.5	5	2247.5
500 – 599	549.5	22	12089
600 – 699	649.5	8	5196
700 – 799	749.5	6	4497
800 – 899	849.5	5	4247.5
900 – 999	949.5	6	5697
1000 and >	1549.5	21	32539.5
Total	-	98	72951

WTP = Willingness to pay = ₦744.40/yr

DISCUSSION

The study recorded high number of male respondents this could be due to the sampling procedure which was not sensitive to gender. Similar experience was recorded by Ebenebe *et al.* (2017) in south eastern Nigeria and Olarewaju *et al.* (2020) in south western Nigeria. Majority of the respondents were 40 years and below this is an indication that consumption of insects is not just common among the old people as young active Nigerians are also consuming insects. This agreed with studies by Ebenebe *et al.* (2017), Olarewaju *et al.* (2020). The study also established that majority of the respondents had

one form of education of the this is an indication of growing literacy level in Nigeria and Benue state in particular. This agreed with the submission by Yusuf *et al.* (2013) that there is improvement in the literacy level in Nigeria. The study also demonstrated that consumption of Insects is not only restricted to illiterate also those who are literate also eat insect. This is in line with the findings of by Ebenebe *et al.* (2017), Olarewaju *et al.* (2020) where majority of their respondents were literate. Good number of respondents were business people this implied that consumption is not just for the poor but people with daily income also consume insects. Olarewaju *et al.* (2020) study recorded more civil servant who also have steady sources of income. This disagreed with the opinion that insects are food for the poor (Nonaka, 2009).

Insects are traditional foods in many cultures and it plays an important role in human nutrition. The study has shown that all the respondents were aware of edible insects. This implied that insects are common among the people within Makurdi metropolis, who were probably not ethnically homogenous. This agreed with the work of Hlongwane *et al.* (2020) and Olarewaju *et al.* (2020). The study demonstrated that there was a high level of insects' consumption among respondents within Makurdi metropolis, as over 80% of the respondents consumed one insect of the other. Similar experience was recorded by Hlongwane *et al.* (2020) in South Africa. This is an indication that insect consumption is popular among people in Makurdi just like other parts of Nigeria. This correlate with Adeoyi *et al.* (2014) who reported these insects as the majorly consumed insect in Benue state. This disagreed with

This present study has established that the main factors that influence people acceptance to consume insects within Makurdi metropolis were taste and health benefit. This agreed with the submissions of Nonaka (2009) and Wendin and Nyberg (2021) that taste influenced consumers acceptance of insects. Boer *et al*. (2013) also submitted that the different level of preference and acceptance of insects can be attributed to the taste. Similarly, Sogari (2015); Ruby *et al*. (2015); Verbeke (2015) and House (2016) opined that those who have interest in environment and health aspect of their food will be more willing to accept to consume. Many people due to health reasons they cannot eat red meat, therefore the available protein to them is from insects. To this end many are willing to adopt insects as meat substitute (House, 2016).

It was observed that out of the few respondents that do not insects, a good percentage of them refused to eat insects just because they do not just like insects. Similar findings were recorded by Verneau*et al*. (2016); Tan *et al*. (2017). Another good number of them was because they disgust insects. This confirmed submissions by Nonaka (2009); House (2016); Bae and Choi (2020); Wendin and Nyberg (2021) that disgust was a major factor behind consumers rejecting of insects. Others consider insects to be dirty, Studies (House, 2016; Megido *et al.,* 2018) has shown that many people refused to eat insects because they consider them to be unclean and u unhygienic even though good number of insects are herbivore which feed only on plants.

Due to the love and interests in insects, large percent of the respondents were willing to introduced their friends and relative into insects' diets and consumption and they were also willing to buy edible insect products if available in the market. The is an indication of level of acceptance of insects and its products in the study area. It also shows that insects are well known among respondents in the study area unlike in western world as reported by Wendin and Nyberg (2021).

It was observed most people in Makurdi Metropolis were could identify at least up to five different insect species. And good number of them have high preference for cricket followed by termites and caterpillar respectively. The different level preference can be attributed to the taste and this agrees with the study by Boer *et al*. (2013). Agbidye and Ningo (2012) also reported high consumption of caterpillar in Benue State. Unlike in South Africa where termites (Hlongwane *et al.,* 2020) where the most consumed crickets were the most preferred in this study.

Information about the species of edible insects within the area revealed that many people are aware of insect consumption and the available species includes termite, caterpillar, cricket and grasshopper. The types of insects recorded in this study were similar to those reported by Ebenebe *et al.* (2017 and Olarewaju *et al.* (2020) in South eastern Nigeria and Hlongwane *et al.* (2020) in South African.

The findings on the amount people are willing to pay for the conservation of edible insects is ₦744.40/yr this agrees with the findings of Pradeep *et-al.* (2007). They use the Contingent Valuation Method to assess non-market economic valuation in India. They reported that the mean WTP for tourist for environmental fund was (Rs 6.73). Similar observations were also reported by Kim *et al.* (2007) and Jianjiun *et al.* (2008).

CONCLUSION AND RECOMMENDATION

Insects could be a promising option for those consumer groups which value a sustainable food choice and look for alternatives to traditionally produced animal protein. Various approaches have to be put in place to make insects more attractive, as long as the insect is visible as a whole, these strategies are probably more interesting for consumers who are looking for a culinary adventure.

Most of the people in the study area eat insects because of the taste and influence from friends and relatives and not for the nutritive value. Women have the most disgust for eating insect. People in the study area were willing to pay for the conservation for insects to ensure sustainability with a mean WTP of ₦744.40/yr. Collecting these edible insects for food would not only protect their host plants but it could benefit the environment by reducing the need to use pesticides. It is recommended that people should be enlightened more on the nutritive value of edible insect. The most preferred edible insects, especially those with high nutritional content, can be reared or cultivated in the home gardens with the application of modern tools and techniques and sold to the people, who regard them as delicacies. This may serve twin purpose of insect (natural resource) use as food and conservation. Insect food-based products should be made/processed to increase consumers' willingness to eat insects. There is need for research on the industrial scale mass-production of edible insects, for increased recognition of the nutritional and environmental importance of insects by the government and general public. There should be an increase in the involvement of the media and academia in dispelling unfounded cultural biases in the urban dwellers towards insect as food.

REFERENCE

Adeoye, O. T., Oyelowo, O. J., Adebisi-Fagbohungbe, T. A and Akinyemi, O. D. 2014. Eco-Diversity of Edible Insects of Nigeria and Its Impact on Food Security. *Journal of Biology and Life Science* 5 (2) 175 –187

Agbidye, F.S, Ofuya, T.I. and Akindele, S.O. (2009). Marketability and Nutritional Qualities of Some Edible Forest Insects in Benue State, Nigeria. *Pakistan Journal of Nutrition*, 8:917-922.

Agbidye, F. S. and Nongo, N. N. (2012). Harvesting and processing techniques of the larvae of *Cirina forda* Westwood (Lepidoptera: Saturniidae), among the Tiv people of Benue state, Nigeria. *Journal of Applied Bioscience*. 3533-3539

Akhtar, Y. and Isman, M. B. (2018). Insects as an Alternative Protein Sources. In protein in Food Processing 2nd edition 263-288

Ashiru, M.O. (1988). The food value of the larvae of Anaphe venatabutler (Lepidoptera:

Boer, J., Schösler, H. and Boersema, J. (2013). Motivational differences in food orientation and the choice of snacks made from lentils, locusts, seaweed or "hybrid" meat. *Food Quality and Preference*. 28. 32-35. 10.1016/j.foodqual.2012.07.008.

Clark M. and Tilmann D. (2014). Global diets link environmental sustainability and human health. Nature, 515(7528), 518-22.

Clarkson, C., Birch, J. and Mirosa, M. (2019) Locusts as a Sources of Lipids and Proteins and Consumer Acceptance.

Encyclopedia of Food Chemistry, 167-172

Dobermann D, Swift J and Field L M. (2017). Opportunities and hurdles of edible insects for food and feed Nutrition Bulletin, 42, 293-308.

Ebenebe, C.I., Amobi, M.I., Udegbala, C., Ufele, A.N. and Nweze, B.O. (2017). Survey of edible insect consumption in south-eastern Nigeria. *Journal of Insects as Food and Feed*, 3(4): 241-251.

FAO (1995): Non-wood forest products for rural income and sustainable forestry. Non-wood forest products 7. FAO. Rome.

FAO (2013). Edible Insects: Future Prospects for Food and Feed Security. Accessed on 12/08/2021, from http://www.fao.org/

Hlongwane, Z.T.; Slotow, R.; Munyai, T.C. Indigenous Knowledge about Consumption of Edible Insects in South Africa. Insects 2021, 12, 22.

House, J. (2016). Consumer acceptance of insect-based foods in the Netherlands: Academic and commercial implication. *Appetite* 107: 47-58.

Jiannjun, J., Wang, Z. and Liu, X. (2008). Valuing Black-faced Spoobill Conservation in Mao. A Policy and Contingent Valuation Study. *Journal of Ecological Economics*, 68(issue 1-2): 328-335.

Johnson, D.V. (2010). Contribution of edible forest insects to human nutrition and to forest management. In: Durst, P.B., Johnson, D.V., Leslie, R.N. and Shono, K. (Eds). Forest Insects as Food: Humans Bite Back. Proceedings of a workshop on Asia-Pacific resources and their potential for development 19-21 February 2008, Food and Agriculture Organization Regional Office for Asia and Pacific. Chiang Mai, Thailand pp. 5-22.

Jongeman, Y. (2015). World list of edible insects. Retrieved from: https://www.wur.nl/upload_mm/7/4/1/ca8baa25-b035-4bd2-9fdc-a7df1405519a_WORLD%20LIST%20EDIBLE%20INSECTS%202015.pdf. Accessed on 21 November, 2021.

Kim, S.S., Wong, K.K.F. and Chao, M. (2007). Assessing the Economic Value of a world Heritage Site and Willingness to Pay Determinants: A Case of Changdeok Palace. *Journal of Tourism Management*, 28:317-322.

Megido, C. R., Haubruge, É., Francis, F. (2018) Insects, The Next European Foodie Craze?. In: Halloran A., Flore R., Vantomme, P. and Roos, N. (eds) Edible Insects in Sustainable Food Systems. Springer, Cham. https://doi.org/10.1007/978-3-319-74011-9_21

Meyer-Rochow, B.B. (2010). Ethomophagy and its impacts on World Cultures: The need for multidisciplinary approach. In: Durst, P.B., Johnson, D.V., Leslie, R.N. and Shono, K. (Eds). Forest Insects as Food: Humans Bite Back. Proceedings of a workshop on Asia-Pacific resources and their potential for development 19-21 February 2008, Food and Agriculture Organization Regional Office for Asia and Pacific. Chiang Mai, Thailand pp. 23-36.

Nonaka, K (2009). Feasting on Insects. *Entomological Research* 39(5): 304-312

Olarewaju T.O., Orumwense L.A., Oke O.S., Idowu A.B. and Adeboye T.E. (2020). Assessment of Knowledge on Functional Values of Edible Insects in Peri Urban Communities of Ijebu Ode Local Government Area, Ogun State Nigeria. Journal of Tropical Agriculture, Food, Environment and Extension 19 (4): 1-5.

Pradeep, C., Bliss, S. and Vindhyya, P.T. 2007. Non-market Economic Valuation in Developing Countries: Role of Participant Observation method in Contingent Valuation Method Analysis. *Journal of Forest Economics*, 13:259-275.

Ramos- Elorduy, J. (2009). Anthropo-entomophagy: Cultures, evolution and sustainability. *Entomological Research* 39: 271–288

Ruby, M. B., Rozin, P., and Chan, C. (2015). Determinants of willingness to eat insects in the USA

and India. *Journal of Insects as Food and Feed*, 1(3), 215-225.

Shockely, M. and Dossey, A.T. (2014). Insects for Human Consumption. Mass production of Beneficial Organisms: Invertebrates and Entomopathogens. Academic press 617-652pp

Sogari, G. (2015). Entomophagy and Italian consumers: An exploratory analysis. *Progress in Nutrition*, 17(4), 311-316.

Tan, H.S.G., Verbaan, Y.T. and Stieger, M. (2017) How will better products improve the sensory-liking and willingness to buy insect-based foods? *Food Research International* 95-105.

Verbeke, W. (2015). Profiling consumers who are ready to adopt insects as a meat substitute in a Western society. *Food Quality and Preference*, 39, 147-155.

Verneau, F., La Barbera, F., Kolle, S., Amato, M., Del Giuduce, T., and Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. *Appetite*, 106, 30-36.

Wendin, K. M.E. and Nyberg, M.E. (2021) Factors Influencing Consumers perception and Acceptability of Insect-based foods. Current Opinion in Food Science. 40: 67-71

Yusuf, M.A., Babangida, L., Usman, A. and Idris, A.H. (2013). Comparative Study of the State of Literacy in Nigeria and Cuba. *European Scientific Journal* 9(19): 34-44