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AWARENESS OF EDIBLE WINGED TERMITE (*Macrotermes natalensis*) AS A FOOD IN SELECTED COMMUNITIES OF IMO AND RIVERS STATES, NIGERIA

Ijeomah, H. M. and Mazi, E.C.

ABSTRACT- Inadequacy of information on available animal protein sources has been the major cause of increasing deficits in annual protein consumption in Sub Saharan Africa. Macrotermes natalensis is an edible insect, rich in animal protein and other vital nutrients but its level of awareness as regards edibility is unknown. This study examined people's level of awareness of the edible insect in the study area, assessed the effect of demographic characteristics on its awareness, and investigated various methods of Harvesting, Processing and Marketing the species in the study area. Data for this study were collected through a set of questionnaires which was complimented with oral interviews and field observations. Data obtained were analyzed using descriptive statistics such as percentages, tables and charts while Chi-square was used to test for associations. Macrotermes natalensis is known by all respondents (100%) in the study area. All respondents in Rumuokwuta and Ezi-orsu together with most respondents in Opuoma (96.4%) and Choba (97.6%) communities and can physically identify the species. All the respondents in Opuoma and Ezi-orsu are aware of the species name in their respective dialects. Greater percentage of respondents from the study area was aware that the species is edible, and could consume the species. The least number of respondents who could consume the species were from Choba (57.1%), an undergraduate student dominated community. Majority of the respondents in Ezi-orsu (87.5%) and Opuoma (78.6%) communities rated the awareness level of the species very high unlike in Choba where most respondents (61.9%) rated it low. Chi square test of associations showed that the awareness of the species is not significantly associated ($p>0.05$) with sex, age, marital status, occupation, household size, ethnic background and educational level of respondents. The edible winged termite is mostly harvested through light source with basin/bucket of water and utilized as food. Majority of the respondents are aware of the seasonal availability of the species, and the period for its abundance. Most respondents were quite knowledgeable about harvesting of the species and adjudged its mode of harvesting as not difficult. The major method of processing the species is frying in Rumuokwuta (100%), Ezi-orsu (95.0%), Opuoma (94.6%) and Choba (92.9%) communities. An edible winged termite is mostly sold in cups in Opuoma (69.6%) and Ezi-orsu (65.0%) unlike in Rumuokwuta (37.5%) and Choba (19.1%) communities. The species is sold in the markets of Ezi-orsu (92.5%) and Opuoma (78.6%). About 41% and 23% of the respondents from Choba and Rumuokuta respectively claimed that the species is not sold at all the communities. Half of the respondents in Rumuokwuta (50.0%) and few in Opuoma (46.4%), Choba (28.6%) and Ezi-orsu (27.5%) communities are unaware of any effective method of preserving the species in the study area. Awareness of the species as a source of food is high among rural and urban dwellers in the study area.

Keywords: Edible winged termite, local food sources, animal protein, awareness, Nigeria

Introduction

Tropical rainforest is endowed with diverse species of plants and animals that could be used for various consumptive and non-consumptive purposes. Consumption of wild resources is an important aspect of people's livelihoods especially in tropical region of the world, Africa inclusive (19; 14; 16; 20; 5).Many of these wild species are endemic to specific regions while their utilization in most cases is either community or region specific. The continuous increase in human population and its attendant increase in demand for food has created needs to search

for local, cheap but nutritious food items for augmenting the regular nutrition in rural areas. Concerted efforts are as well made towards rediscovering some neglected foods (that are still in existence) in attempts to secure balanced nutrition for many poor households.

Department of Forestry and Wildlife Management, University of Port Harcourt, P.M.B.5323, Port Harcourt, Rivers State, Nigeria. Email: henryijeomah@yahoo.com, henry.ijeomah @uniport.edu.ng

However, utilization of many species is limited by ignorance of the potentials of such plant or animal among households (6; 18) (especially as concerns the edibility and availability of the species) and culture of the people. This has resulted in over utilization of some species and the neglect and wasting of other potentially more useful species – For instance, breadfruit (*Treculia africana*), a delicacy among the Ibos of eastern Nigeria, one of the most expensive edible forest products in Imo state and a priority food for diabetic patients (7) is not utilized in Guyaka community of Quaanpan Local Government Area of Plateau State. It is also based on the same fact that wild rat, consumed as a delicacy by the Tivs of Benue State, is disregarded in other parts of Nigeria (18). Non consumption of *Treculia africana* in Guyaka does not in any way make households from the community socially better than most Nigerians who utilize the species. Similar case applies to individuals who abhor consumption of wild rat. Many individuals have by association or medical reasons become aware of the potentials of species forbidden by their indigenous culture and thereafter end up consuming (secretly) such resources. The high level of awareness among the inhabitants of eastern Nigeria (especially the Ibo speaking part) during the Nigerian civil war (between 1967 and 1970) concerning the efficacy of Agama lizard (*Agama agama*) in curing cough resulted in heavy consumption of *Agama agama* – a species that has been abundant in eastern Nigeria but generally disregarded therein. Haemolymph - the slimy substance from snail which poses a lot of challenges to remove during preparation of snail meal and therefore abhorred in many parts of Nigeria, is well consumed in Warri areas of Nigeria because of the high level of awareness of Warri dwellers concerning the efficacy of the substance in enabling safe delivery during pregnancy, and in boosting human fertility (9). A naturally growing facultative fungus of wood, *Ganoderma lucidium*, referred to as wonderful mushroom is utilized in Asian countries as natural health promoters against parasites, bacteria and viruses in Asia (17) and for the treatment of many diseases including allergies, arthritis, bronchitis, gastric ulcer, hyperglycemia, hypertension, chronic hepatitis, hepatic diseases, insomnia and cancer (21) because of the high awareness level of its medicinal values among households, unlike in Nigeria where the species is abundant but unpopular and therefore not being utilized.

According to Answer (4) good nutrition involves consuming a variety of foods in appropriate amounts. Consumption of poor quality foods on regular basis has been

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implicated for malnutrition and increasing health challenges in many areas (15). The rediscovery of potentially nutritious food especially the ones that could serve as sources of animal protein will to a greater extent assist in balancing the nutrient requirement of both rural and urban dwellers. Edible winged termite, an insect, is a source of animal protein but the level of households' awareness concerning its potentials as an edible species; its period of availability, method of harvesting; processing and marketing in communities in Rivers and Imo states is yet to be documented.

This study therefore aims to:

- examine people's level of awareness of the edible insect
- assess the effect of demographic characteristics on its awareness among the communities.
- investigate the methods of Harvesting, Processing and Marketing the species in the study area

STUDY AREA

This research project was carried out in Rivers and Imo states. Imo state lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E with an area of around 5,100sqkm (Figure 1a). Rivers State is bounded on the South by the Atlantic Ocean, to the North by Imo, Abia and Anambra States, to the East by Akwa Ibom State and to the West by Bayelsa and Delta states (Wikipedia,2015a).

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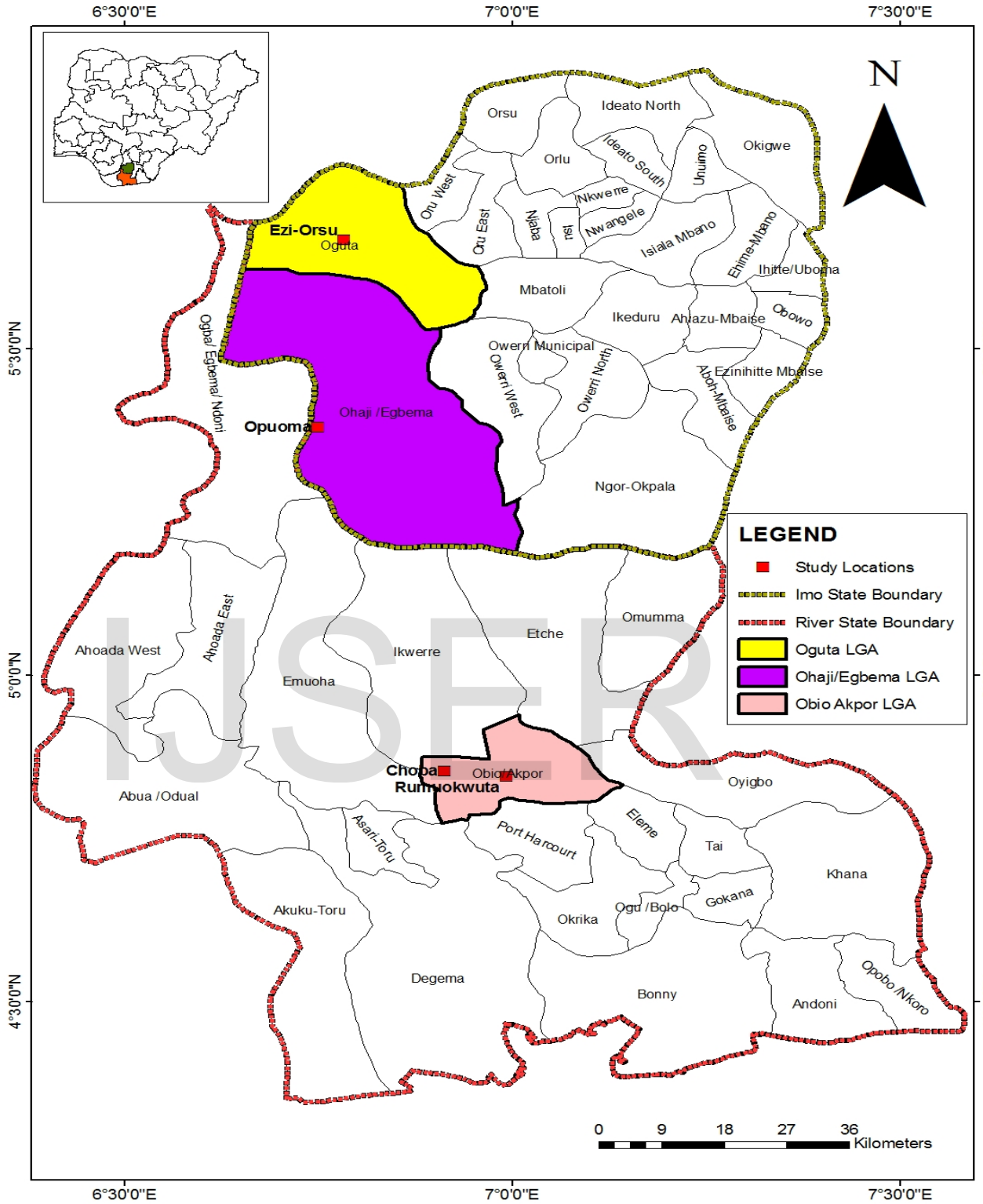

Figure 1a: Map of Rivers/Imo states showing the study areas

Source: (11)

SAMPLING TECHNIQUE

Rivers and Imo states were selected based on the relative abundance of edible winged termites therein. The areas were selected to represent Rural communities (Opuoma and Ezi-orsu, Imo state), Suburban communities (Choba) and Urban communities (Rumuokwuta) as was done by (11) in order to effectively evaluate and compare the level of awareness, methods of harvesting, processing and marketing of the species in these areas. Sixty questionaires were allocated to each selected community, for data collection, as presented in table 1a

Table 1a: Allocation of questionnaire to respondents in selected communities

Communities	No. of Households Sampled	No. of questionnaire Retrieved
Opuoma	60	56
Ezi-orsu	60	40
Choba	60	42
Rumuokwuta	60	40
Total number of households sampled in the four communities	**240**	**178**

Source: Field Survey, 2015

METHODS OF DATA COLLECTION

Data for this study were collected through structured questionnaire which were randomly administered to household representatives as shown in table 1a. Data obtained were complimented with interviews of indigenes of selected communities who have spent a minimum of ten years in the community and are quite knowledgeable about utilization of edible winged termites in the study area, and Field observation. A total of 240 households were sampled in the four communities being 60 respondents per community. However, only 178 questionnaires were used (table 1a).

METHODS OF DATA ANALYSIS

Data collected for the study were analyzed using descriptive statistics in the form of percentage, frequency of occurrence, tables and charts while Chi-square was used to test for associations.

RESULTS

The result shows the level of awareness of the edible insects, the effect of demographic characteristics on the awareness of the species in the study areas and the various methods of harvesting the species in the study area,

AWARENESS OF EDIBLE WINGED TERMITE

Results on awareness of edible winged termites are presented in tables 1b and 1c. Table 1b shows that all the respondents (100%) in the four studied communities are aware of the species and majority of the respondents in Opuoma (96.4%) and Choba (97.6%) communities and all in Rumuokwuta and Ezi-Orsu communities can identify the species. All the respondents in Opuoma and Ezi-Orsu know the name the species is called in their respective dialects. Greater percentage of the respondents from the study area was aware that the species is edible and could consume the species. However, the least number of respondents who could consume the species were from Choba (57.1%). According to Table 1c, majority of the respondents in Ezi-Orsu (87.5%) and Opuoma (78.6%) communities rated the awareness level of the species very high unlike in Choba (61.9%) where most respondents rated it low.

Table 1a: Respondents' level of awareness of edible winged termites in the study area

		Frequencies			
		Communities			
Parameters	**Variable**	**I**	**II**	**III**	**IV**
Are you aware of edible winged termite?	Aware	56(100%)*	40(100%)	42(100%)	40(100%)
	Not aware	0	0	0	0
Can you identify it?	Yes	54(96.4%)	40(100%)	41(97.6%)	40(100%)
	No	2(3.6%)	0	1(2.4%)	0
Do you know the local name in your dialect?	Yes	56(100%)	40(100%)	34(80.9%)	39(97.5%)
	No	0	0	8(19.0%	1(2.5%)
Is it consumed in your area	Yes	56(100%)	40(100%)	35(83.3%)	36(90.0%)

	No	0	0	7(16.7%)	4(10.0%)
Do you know someone that has consumed it?	Yes	54(96.4%)	37(92.5%)	37(88.1%)	36(90.0%)
	No	2(3.6%)	3(7.5%)	5(11.9%)	4(10.0%)
Can you consume it?	Yes	40(83.9%)	40(100%)	24(57.1%)	32(80.0%)
	No	9(16.0%)	0	18(42.9%)	8(20.0%)
Have you consumed it?	Yes	47(83.9%)	40(100%)	27(64.3%)	36(90.0%)
	No	9(16.0%)	0	15(35.7%)	4(10.0%)

*Numbers in parenthesis are percentage values

Source: Field Survey, 2014.

I – Opuoma Community, Imo State

II– Ezi- Orsu Community, Imo State

III– Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

Table 1b: Rating of Level of awareness of edible winged termites in the study area

		Communities			
Parameter	**Variable**	**I**	**II**	**III**	**IV**
	Very high	44(78.6%)*	35(87.5%)	3(7.5%)	9(22.5%)
Rating of awareness of the species in the study area	High	10(17.9%)	5(12.5%)	6(14.3)	15(37.5%)
	Low	2(3.6%)	0	26(61.9%)	2(5.0%)
	Very low	0	0	2(4.8%)	6(15.0%)
	No response	0	0	5(11.9%)	8(20.0%)

*Numbers in parenthesis are percentage values

Source: Field Survey, 2014.

I – Opuoma Community, Imo State

II– Ezi- Orsu Community, Imo State

III– Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

EFFECT OF DEMOGRAPHIC CHARACTERISTICS ON RESPONDENTS' AWARENESS OF EDIBLE WINGED TERMITES IN THE STUDY AREA

Results on effects of demographic characteristics on its awareness are presented in table 2. Table 2 shows no association (p>0.05) between demographic characteristics and awareness.

Table 2: Chi-square test of association between demographic characteristics of respondents and awareness of edible winged termites in the study area

		Frequencies (Percentages)			
Parameters	**Variable**	**I**	**II**	**III**	**IV**
Are you aware of edible winged termite?	Aware	56(100%)*	40(100%)	42(100%)	40(100%)
	Unaware	0	0	0	0

*Numbers in parenthesis are percentage values

Source: Field Survey, 2015

I – Opuoma Community, Imo State
II – Ezi- Orsu Community, Imo State
III – Choba Community, Rivers State
IV – Rumuokwuta Community, Rivers State

Chi-square test shows no association (p>0.05) between sex and awareness, age and awareness, marital status and awareness, occupation and awareness, household size and awareness, ethnic background and awareness and no level of association (p>0.05) between level of education and awareness of the species. i.e. - all the respondents were aware of edible winged termites in the four communities.

METHODS OF HARVESTING, PROCESSING AND MARKETING THE SPECIES IN THE STUDY AREA

Results on methods of harvesting, processing and marketing are presented in tables 3, figures 1b, 2, 3, Tables 4, 5 and figure 4. The different methods of

harvesting the species are shown in table 3.The edible winged termite is mostly harvested through light source with basin/bucket of water in Opuoma. Majority are aware that availability of the species is seasonal and that rainy season is period for harvesting the species. However, few respondents in Choba community (7.1%) are not aware of the period for harvesting the species (Figure1b). Figures 2 and 3 show that majority of the respondents have knowledge of how the species is harvested and admitted that the mode of harvesting the species is not difficult. The major method of processing the species is frying in Rumuokwuta (100%), Ezi-Orsu (95.0%), Opuoma (94.6%) and Choba (92.9%) communities as presented in table 4. Table 5 shows that edible winged termites is mostly sold in cups in Opuoma (69.6%) and Ezi-Orsu (65.0%) unlike in Rumuokwuta (37.5%) and Choba (19.1%) communities. Table 6 shows that the species is sold in the markets of Ezi-orsu (92.5%) and Opuoma (78.6%). About 41% and 23% of the respondents from Choba and Rumuokuta respectively indicated that the species is not sold at all in the areas (Table 6). Figure 4 shows that the species is mostly utilized as food while table 7 shows the different methods of preserving the species in the study area. Half of the respondents in Rumuokwuta (50.0%) and few in Opuoma (46.4%), Choba (28.6%) and Ezi-Orsu (27.5%) communities are unaware of any method of preserving the species in the study area.

Table 3: Methods of harvesting edible winged termites in the study area

	Frequencies			
	Communities			
Methods of Harvesting	**I**	**II**	**III**	**IV**
Light source and basin/bucket of water	55(98.2%)*	38(95.0%)	26(61.9%)	30(75.0%)
Sprinkling water on cement floor/bag under a light source	2(3.6%)	0	2(4.8%)	0
Collecting from holes in the morning	7(12.5%)	0	0	0
Collecting from farms, under stones, leaves, etc.	5(8.9%)	8(20.0%)	0	0
Use of brooms, hands, or clothes to flog/light/water	4(7.1%)	6(15.0%)	10(23.8%)	7(17.5%)
Don't know	1(1.8%)	1(2.5%)	4(9.5%)	5(12.5%)

*Numbers in parenthesis are percentage values

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Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

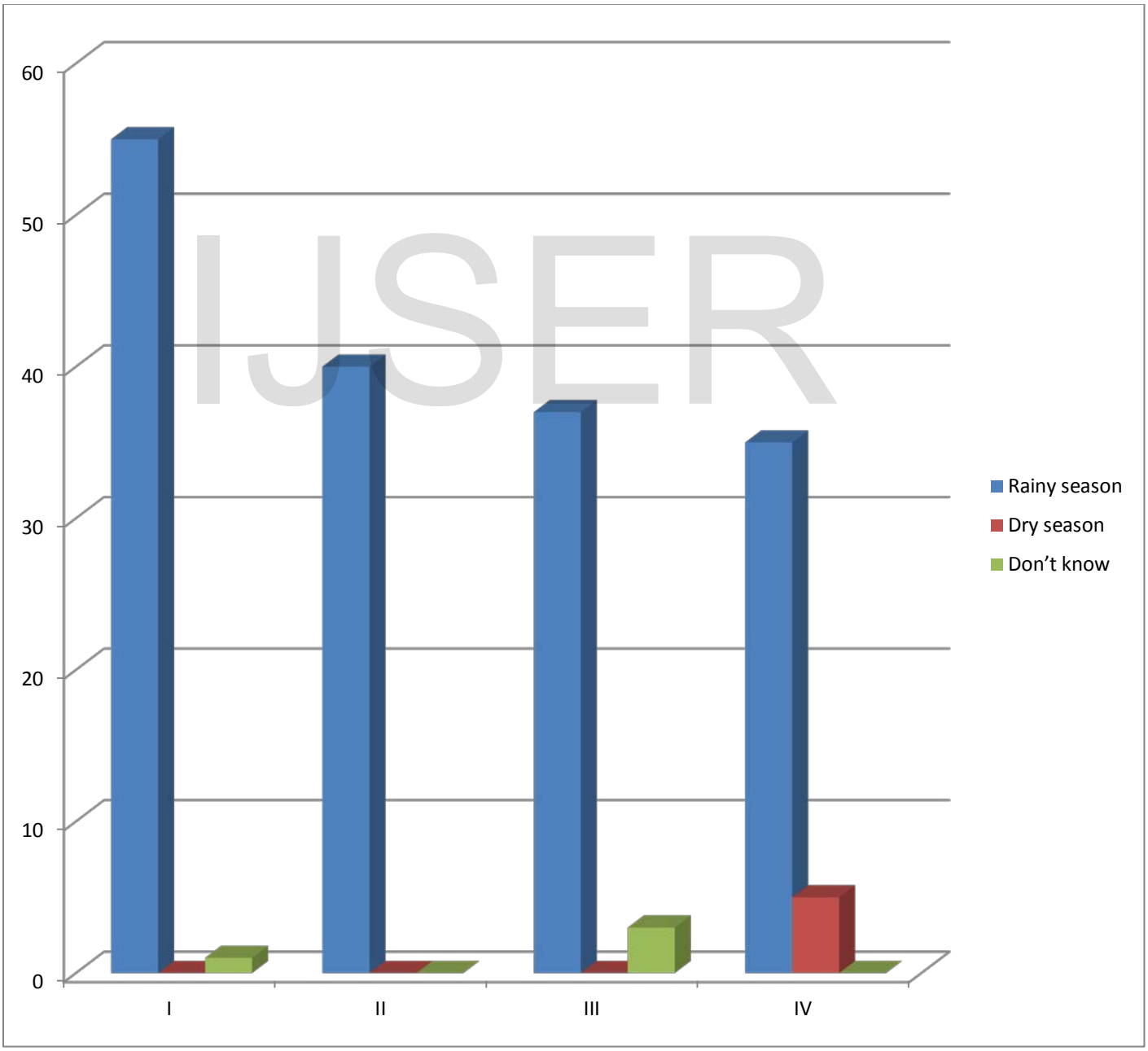

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Figure 1: Period of harvesting edible winged termites in the study area

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

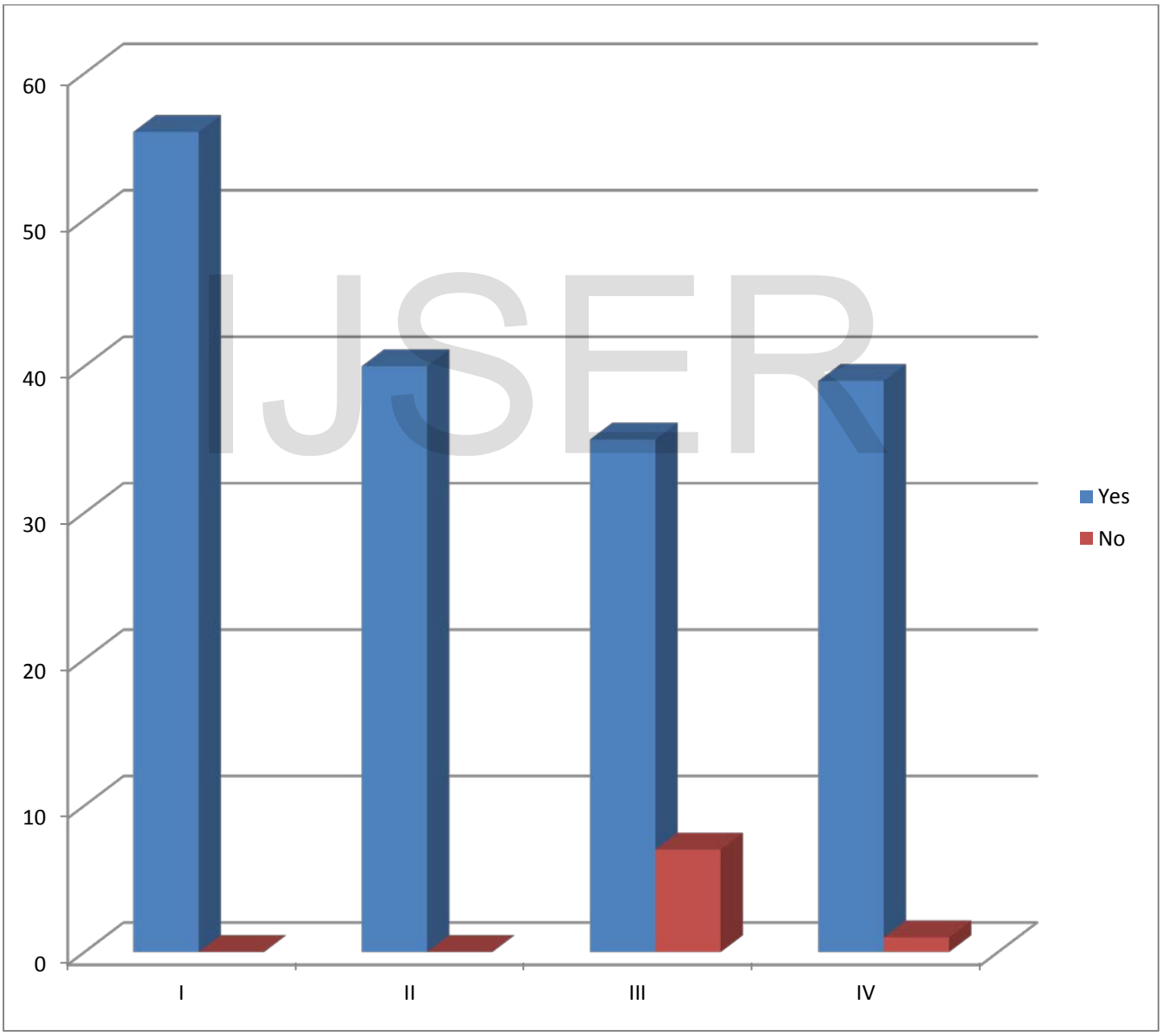

Figure 2: Respondents knowledge of harvesting method of edible winged termites in the study area

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

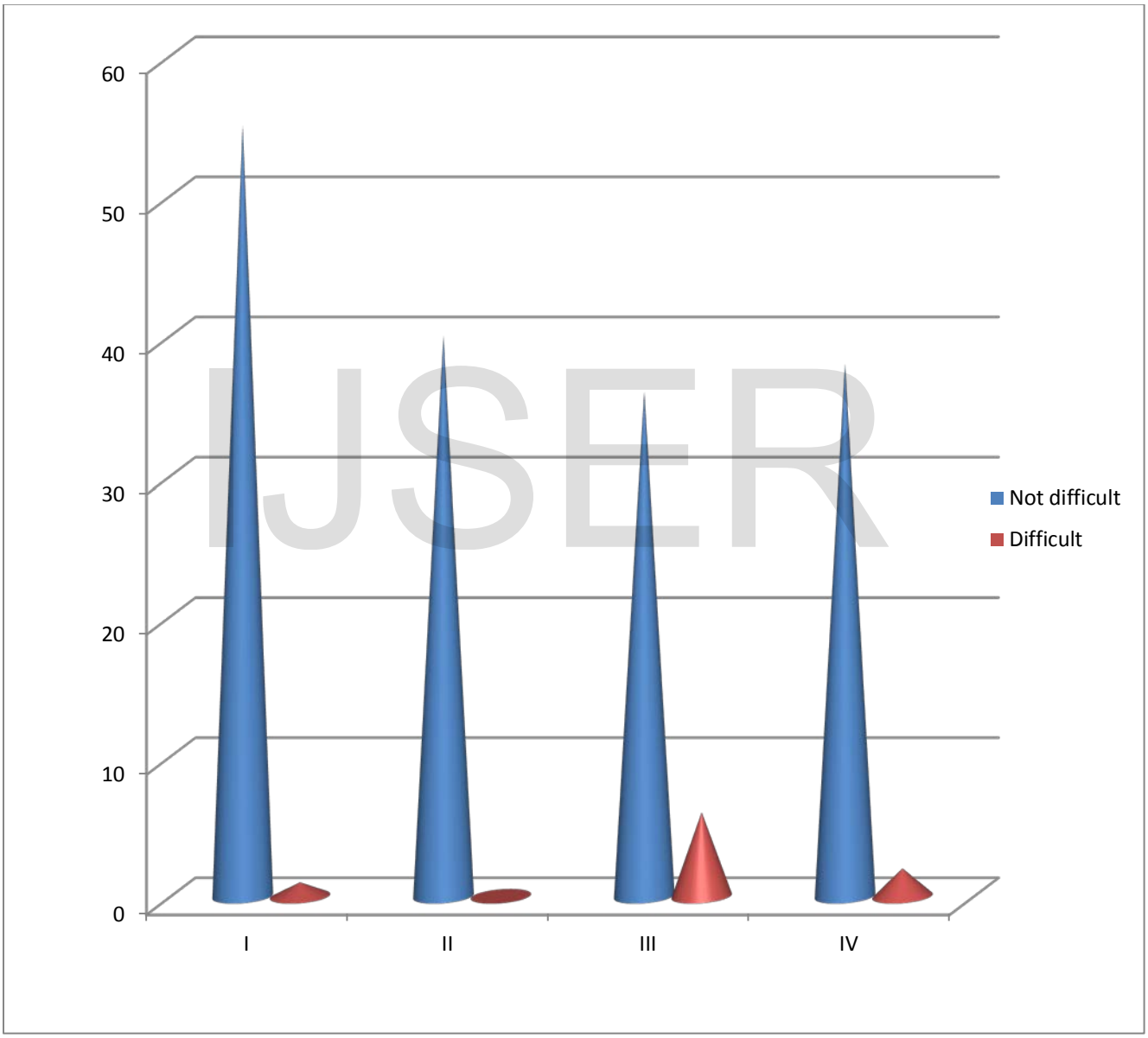

Figure 3: Respondents' assessment of mode of harvest of edible winged termites in the study area

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

Table 4: Ways of processing edible winged termites in the study area

	Frequencies (percentages)			
	Communities			
Ways of processing	**I**	**II**	**III**	**IV**
Frying	53(94.6%)*	38(95.0%)	39(92.9%)	40(100%)
Frying with little oil	3(5.4%)	5(12.5%)	2(4.8%)	1(2.5%)
Don't know	0	0	3(7.1%)	0

*Numbers in parenthesis are percentage values

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

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Table 5: Mode of sales of edible winged termites in the study area as identified by respondents

	Frequencies (percentages)			
	Communities			
Mode of sale	**I**	**II**	**III**	**IV**
Cups (Tomato& Milk cup)	39(69.6%)*	26(65.0%)	8(19.1%)	15(37.5%)
Tied in nylon bags	2(3.6%)	0	2(4.8%)	0
Shading	2(3.6%)	0	0	0
Trays/garnished with onions and pepper(cups)	11(19.6%)	11(27.5%)	0	0
Basin	2(3.6%)	0	0	0
Not sold at all	4(7.1%)	0	17(40.5%)	9(22.5%)
Don't know	6(10.7%)	3(7.5%)	17(40.5%)	16(40.0%)

*Numbers in parenthesis are percentage values

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

Table 6: Different ways of marketing edible winged termites in the study area

	Frequencies (percentages)			
	Communities			
Marketing	**I**	**II**	**III**	**IV**
Sold in markets	44(78.6%)*	37(92.5%)	8(19.1%)	10(25.0%)
Hawking	0	0	5(11.9%)	7(17.5%)
Sold at home	2(3.6%)	0	0	0
Not sold at all	4(7.1%)	0	17(40.5%)	9(22.5%)
Don't know	6(10.7%)	3(7.5%)	17(40.5%)	16(40.0%)

*Numbers in parenthesis are percentage values

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

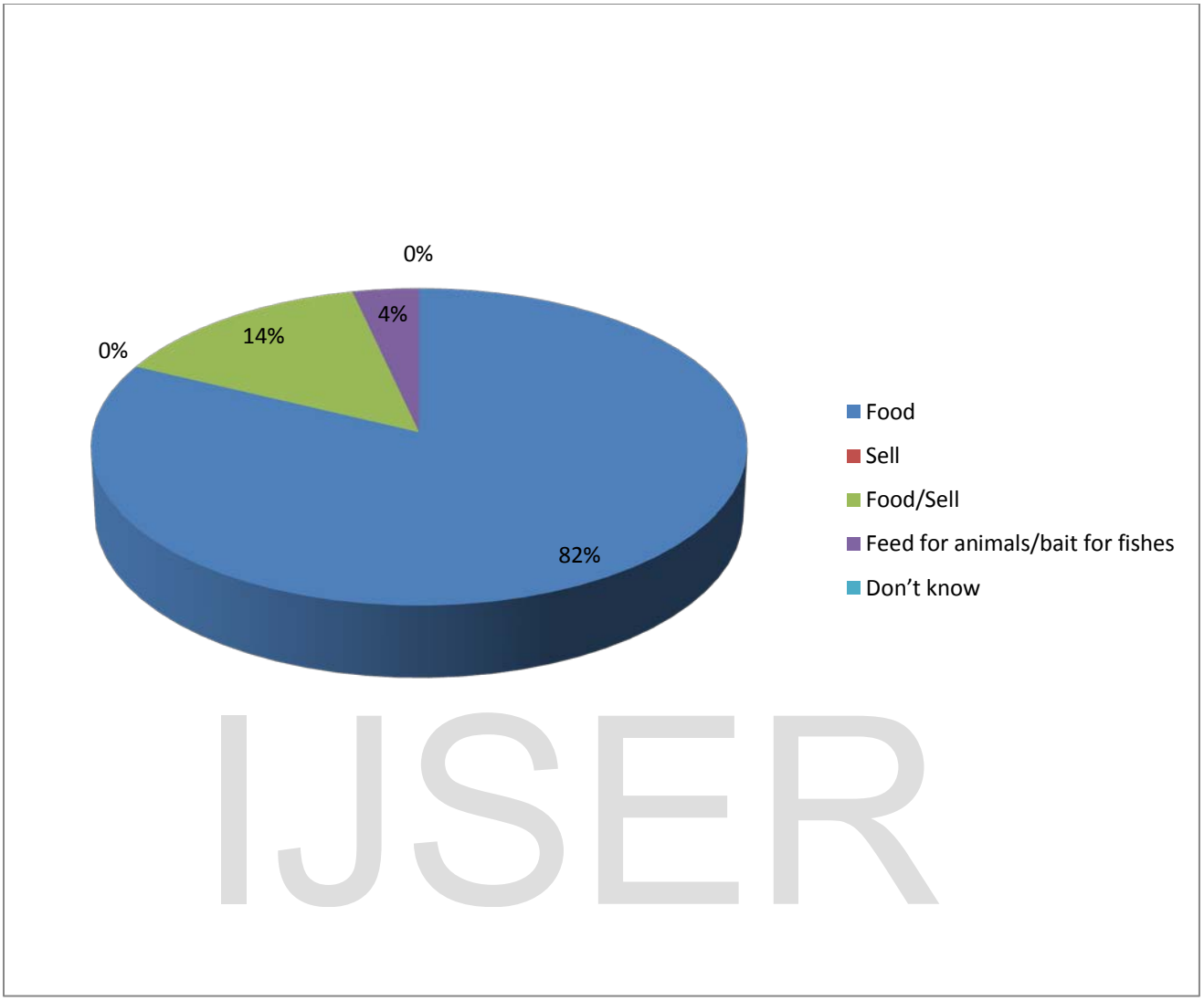

Figure 4: Method of utilizing edible winged termites in the study area

Source: Field Survey, 2015.

I – Opuoma Community, Imo State

II – Ezi- Orsu Community, Imo State

III – Choba Community, Rivers State

IV – Rumuokwuta Community, Rivers State

Table 7: Distribution of respondents based on method of preserving the species in the study area

	Frequencies (percentages) Communities			
Preservation methods	**I**	**II**	**III**	**IV**
Frying	3(5.4%)*	5(12.5%)	13(31.0%)	2(5.0%)
Sun-drying	13(2.3%)	5(12.5%)	3(7.1%)	1(2.5%)
Frying + sun-drying/fireplace	8(14.3%)	10(25.0%)	2(4.8%)	1(2.5%)
Sun-drying + container/bag	1(1.8%)	1(2.5%)	1(2.4%)	0
Air-drying	0	0	0	1(2.5%)
No method	26(46.4%)	11(27.5%)	12(28.6%)	20(50.0%)
Don't know	5(8.9%)	8(20.0)	11(26.2%)	15(37.5%)

*Numbers in parenthesis are percentage values

Source: Field Survey, 2015.

I – Opuoma Community, Imo State
II – Ezi- Orsu Community, Imo State
III – Choba Community, Rivers State
IV – Rumuokwuta Community, Rivers State

DISCUSSION

AWARENESS OF THE EDIBLE INSECT IN THE STUDYAREA

Interactions with respondents revealed that there is high level of awareness of the species in the study area (Table 1b). Majority of the respondents were also able to identify the species using vernacular names. This shows that the respondents are quite aware of the species and may have seen it many times to become aware of its local name in their dialect. *Macrotermes natalensis*, commonly called edible winged termites is traditionally called *Aku-ebe* in Opuoma, *Aku* in Ezi-Orsu, *Dundurun* in Choba and *Aku-mbere* or *Ndundun* in Rumuokwuta communities respectively. Similarly termites are well known in many parts of Nigeria including Delta North Senatorial zone of Delta State (12); Ondo State (3) and Benue State (2).

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The high level of awareness of the species in both Ezi-Orsu (87.5%) and Opuoma (78.6%) communities can be ascribed to the fact that these areas are rural communities and therefore rely more on knowledge and availability of wildlife species from forests for survival. Awareness level of the species was least in Choba community (table 1c). Choba is a student dominated community and majority of the occupants are non-indigenes of the community. Choba market is dominated by items that are student related. Although the availability of the species is linked with forests, where termitarium which serve as habitat for the species could be found, awareness level of the species is still high in Rumuokwuta, an urban area where forests rarely exist. This can be attributed to the fact that the species therein would have been sourced from somewhere else and brought to Rumuokuta as a business area for marketing. It can also be ascribed to the fact the respondents may have known the species from their indigenous communities before settling in Rumuokuta, an urban area. This may have been the reason most respondents from Rumuokuta became aware that the species is edible and admitted that it could be consumed by them.

METHODS OF HARVESTING, PROCESSING AND MARKETING OF THE SPEICES IN THE STUDY AREA

a. Harvest

Collection of the species is carried out mostly by women and children in rural, sub-urban and urban areas of Rivers and Imo State (Table 3). Harvesting of this species could be a cultural family role played by women and children in the study areas. Interactions with respondents from Opuoma revealed that the species is collected in the morning and night but mostly at night during swarming. This shows that the respondents are aware that the species has high affinity for water and is therefore attracted to light sources. Sometimes, water is sprinkled on the floor or on a large bag placed on the ground (to cover a large area). Brooms, clothes and hands are used to facilitate harvest when the quantity is large. This activity is carried out by women (together with children) who have been embarking on such projects for many years. The knowledge of harvesting the species is transferred from one generation to another. In the morning, some can be collected from the remnants or left-overs/escapees of the nights' harvest when they are seen moving in lines on the ground, in farms, under leaves, stones or hidden spots. Respondents claimed that they can be

collected from holes in the morning by children. Children can also be seen trying to hunt the species with brooms, clothes, hands or slippers. Harvesting edible winged termites creates fun as it is one of the joys of childhood.

Harvesting the species is very easy as compared to harvesting of edible maggot or cane rat (8). Women and children can easily embark on harvesting of the species because materials required for the operation are always available. Materials for harvesting, such as light source, plates, basin, bucket, water or bags are basic necessities utilized by most households and are found around the house.

Moreover, it does not require specialized tactics or skills and it is not physically demanding. Majority of the respondents are quite knowledgeable concerning how the species is harvested and have adjudged the mode of harvesting of the species as simple (figures 2 and 3). The species can be harvested with or without assistance and does not require one's presence to determine its harvest. This means that the species can harvest itself or be trapped in the harvesting facility once the materials for collection are put in place as they are attracted to light and hindered from flying away by water.

Collection of the species is not determined by sex, age, occupation, marital status, household size or level of education. Different methods of harvesting are used in the rural areas. This cannot be unconnected with the fact that it is abundant and readily available so they devise several strategies suitable for harvesting the species, and to ensure bounty harvest during its season. For example putting water in a bucket or sprinkling of water on the floor is not difficult and can be done by anybody irrespective of age or class. This is different from the findings of (10) in Udu Local government of Delta state where harvesting of tortoise is mostly carried out by mostly males and middle age groups. Few respondents from Choba or Rumuokwuta communities who do not have knowledge of harvesting the species most likely grew up in the cities.

b. Period of harvesting

Interactions with respondents revealed that availability of the species is seasonal (figure 1) and is more abundant in forest areas. This cannot be unconnected with the fact that deforestation destroys the potential habitats of the species in urban areas. In Opuoma, the respondents by an age old existing indigenous knowledge believe that the species emerges during the period of harvesting yam between May and

October in preparation for new yam festival in September and thus, seen as a sign of a new season. This coincides with the period of *ebe* (yam beetle), one of the major edible insects that is also harvested and consumed. This is different in Obowo community and some communities in Mbano local government area of Imo State where the species are reputed or claimed to emerge during the period of harvesting corn (maize). Respondents from Opuoma believe that the species usually appears when heavy rain is accompanied by thunder and lightning which causes the ground to become soft, where they make a suitable hole and fly out one after the other. This shows that most respondents in the study area are aware that the species is seasonal, and also know the season it swarms.

c. Processing

Frying is the most preferred method of processing the species (Table 4). This cannot be unconnected with the fact that it is the only indigenous method known to respondents, as that was passed down from generations and improvement and advancement of the method is yet to be carried out by respondents. The reason may also be that the species is majorly consumed as food by households. The species are washed, filtered; left to dry, wings' winnowed, salted and fried either in its own body fat or fried with little oil until they show signs of being crisp or slightly crisp. This is in line with the report of (23). Sometimes, seasonings, onions and pepper are added as form of processing, depending on preference. This non-vertebrate species could also be washed and immediately consumed in raw forms. However, few respondents consume it raw especially when few quantities are harvested as it cannot be processed. This has severally happened in Rumuokwuta community. The preferred method of processing in the study area is slightly different from that of the larvae of the rhinoceros beetle and the larvae of the palm weevil that are processed by either roasting or frying (13**);** crickets that are usually roasted; and the larvae of the African silkworn (moth) *Anaphe venata* roasted or dried in hot, white sand. Also, Agbydye *et al*., 2009 reported that dried form of *Macrotermes natalensis* are sold in Gboko main market of Benue State, Nigeria. Methods of processing edible insects are based on prevailing indigenous knowledge of communities.

d. Marketing of the species

Interactions with respondents from Opuoma and Ezi-Orsu communities revealed that edible winged termites are

normally sold in trays, garnished with onions and pepper like *suya* (processed dry meat) to make it attractive (table 5). The onions are sliced in neat round forms with pepper and placed on the processed termites to make it appealing to consumers and increase its marketability. The species is normally sold in cups (table 5): tomato cup (small-sized) between ₦50 - ₦100 and milk cup between ₦100 - ₦200. This slightly corresponds with the findings of (2). The amount varies with the type of cup used for measurement. Sometimes, in Opuoma community, the species are shaded between ₦10 – ₦20 or tied in nylon bags. This is similar to how crayfish is sold. The sale of this species in varying quantities and prices is to ensure that they are made available at varying and affordable prices to consumers irrespective of age groups and income levels. However, when the quantity is large, the species can also be sold in basins to retailers but this activity is carried out by the non-indigenes (majorly Ibos) that reside in Opuoma community. The reason is that outsiders are the major sellers of the species. The indigenes only harvest for consumption and those who could not harvest, buy for consumption. This is an indication of the species abundance in rural, sub-urban and urban areas of Rivers and Imo States. During its seasons, the species is sold in popular markets in Rivers State and beyond, such as Rumuokoro market, Oyigbo market, Mile one market, Mile three market, Aria-aria market in Aba, Abia state or hawked along Aba road. This agrees with the findings of (2) that the specie is sold in Gboko main market of Benue State. In Rumuokwuta community, the species is sold in cups displayed on trays or shaded on the ground by Ibo market women from Aba and other parts of the eastern Nigeria who source it from different parts of eastern Nigeria during the on season. Few respondents claimed that sometimes, the species can be seen hawked along Rumuokuta road by Ibo or Ijaw women. Few respondents do not know if the species is sold in that area (Table 6). This can be attributed to the fact that it is hardly seen in that area.

However, interactions with respondents from Choba community revealed that they are unaware whether the species is sold (40.5%) and the species is not sold at all (40.5%) in the local market (table 6). This is an indication that the species has not been fully exploited in this area. Choba is a student dominated area and most of the items sold are student – related.

e. Preservation

Most respondents are unaware of any existing method of preserving the species

(table 7). This can be attributed to the fact that the species is majorly utilized as snack for consumption. However, few respondents claimed that the species is fried and dried like meat and kept in containers and frequently sun-dried to avoid spoilage. This is based on the perception that it is the fat content that leads to the species' rancidity and eventual spoilage. Few respondents in Ezi Orsu (25.0%) and Opuoma (14.3%) communities claimed that it is fried, exposed to air or sun-dried or sometimes kept over the fire place. This is also similar to indigenous method utilized in preserving corn and okra in the study area.

CONCLUSION AND RECOMMENDATION

Edible winged termite is well known and consumed in the study area. Respondents' knowledge of its season of abundance and method of harvesting has resulted in the species' inclusion in the annual nutritional budget and meal plans of many households especially in Opuoma and Ezi- Orsu that are rural communities. Its costless and easy method of harvesting has made it a major seasonal source of animal protein in rural areas. Although it could be a source of income for some households in rural areas but the fact that it is relatively very cheap when compared with other wild games enables the harvesting family to consume it (instead of selling the harvest to generate revenue), thus helps in balancing the animal protein deficit usually experienced in rural areas. The costless nature of the species in rural areas enables households to consume it as frequently as desired. In Rumuokuta, an urban area, the species is sold to generate income. Urban dwellers who cherish consuming the species still buy it for consumption. The demand for the product creates market for sellers who supply the species from rural areas where they are abundant because of the presence of forests. The major challenge of the species utilization is that effective methods for preserving the species are inexistent in the study area.

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