

# Knowledge and Consumption Pattern of *Cirina Forda* (Westwood) Larva in Two Local Government Areas of Oyo State, Nigeria

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## ABSTRACT

**Background:** Insects have served as food for people for thousands of years worldwide. However, a decline is observed in insect consumption in communities where it used to be popular.

**Objective:** The study aimed at assessing consumption pattern of *Cirina forda* larva in two Local Government Areas (LGAs) of Oyo State, Nigeria, where its consumption is popular.

**Methodology:** Descriptive cross-sectional study involving 502 respondents randomly selected from Saki East and Iseyin LGAs was carried out. Pre-tested, semi-structured, interviewer-administered questionnaire was used to obtain information on the larva from the respondents. Data was analysed using frequencies, percentages and means.

**Results:** Mean age of respondents was  $46.3 \pm 16.4$  years, 99.8% were aware of existence of *C. forda* larva, and all had consumed it before. Majority (81.9%) of respondents consumed the larva within the past 2 years, 78.9% consumed it often. The larva was consumed either in roasted/dried (35.4%) or boiled/fried (35.9%) forms. However, 74.9% preferred its consumption as condiment in soups. Reasons for its consumption included: food habit and custom (29.7%), flavour/taste (17.0%), nutrition/health benefits (17.2%), and food habits/economic benefits (11.6%). About half (58.9%) of respondents did not know the nutritional/health benefits of *C. forda*. Its consumption is not affected by religion (99.8%) and traditional belief/myth (99.0%) but by availability.

**Conclusion:** Major limitations to consumption of *C. forda* larva are scarcity and inadequate knowledge on its nutritional/health benefits. There is need for public enlightenment on health-promoting benefits of the insect larva to promote its consumption.

**Keywords:** Entomophagy, *Cirina forda* larva, Consumption pattern, Nutritional benefits.

## INTRODUCTION

Consumption of edible insects is a traditional practice in many countries of the world, and it has the potential of contributing to food security [1]. The practice of entomophagy seems to be culturally universal, varying only with location, type of insects and the ethnic group involved [2]. Insect consumption plays an important role in human nutrition, and can be reared for their high nutritional qualities and sold to the populace that regards them as delicacies. They can be good source of quality protein as well as vitamins, minerals and fats ([3], [4], [5]). However, their taste and nutritional value vary with the species,

metamorphic stage, habitat and diet [6].

Some edible insects have nutritional value that can be compared with that of meat and fish, while others have higher proportion of protein, fat and energy value ([7],[4]). In West and Central Africa, insects are not used as emergency food to survive starvation, but are included as a normal part of the diet throughout the year or in seasons of occurrence ([8],[4]). In addition, insects have been used for cultural (rituals) as well as medicinal purposes [9].

Nearly 1,700 insect species are reported to be used as human food worldwide [10], while 30 species or more are used by indigenous populations in many developing countries as food. De Foliart ([11], [12], [13]) reported that scores of species of edible insects are prominent items of commerce in the town and village markets of Africa, tropical and semi-tropical regions of the world. According to Food and Agricultural Organisation of United Nations (FAO, [14]), the most commonly consumed insects include beetles (*Coleoptera*) (31%); caterpillars (*Lepidoptera*) (18%), bees, wasps and ants (*Hymenoptera*) (14%); grasshoppers, locusts and crickets (*Orthoptera*) (13%); cicadas, leafhoppers, plant-hoppers, scale insects and true bugs (*Hemiptera*) (10%); termites (*Isoptera*)

(3%); dragonflies (*Odonata*) (3%); flies (*Diptera*) (2%); and others (5%).

Pallid emperor moth (*Cirina forda*), a *Lepidoptera*, is a pest of Shea butter (*Butyrospermum paradoxa* or *Vitellaria paradoxa*) tree. Its larvae resemble silk worm caterpillars except that they do not spin cocoons; instead, they dig into the soil at the base of the host tree to pupate; hence they are called 'Kanni wole' in the South-western part of Nigeria. 'Kanni' means *Cirina forda* while 'wole' means to enter soil [15]. Some ethnic groups in the South-western Nigeria call it 'Monimoni'. The pallid emperor moth, *C. forda*, is a defoliator of Shea-butter tree, *Vitellaria paradoxa*, and is collected during the rainy season between June and August ([16],[17]).



Figure 1(a): *Cirina forda* larva defoliating Shea butter, (*Vitellaria paradoxum*) leaves.



Figure 1(b): Raw unprocessed *Cirinaforda* (Westwood) larva



Figure 1(c): Dry processed *Cirina forda* (Westwood) larvae (Sample photos by Researchers)

*Cirina forda* is heavily consumed in Nigeria, and is reported as the third most consumed insect in Benue State, Nigeria [17]. Its larva is a delicacy served as a snack food or cooked with soups and taken with carbohydrate food in Nigeria. It is eaten roasted or dried, and added to other foods, especially carbohydrate to enhance its nutritional value.

In spite of the seemingly nutritional, economic, environmental, and health benefits of insects, there has been a decline in their consumption over the years probably due to adoption of Western foods and decreased knowledge of preparation practices ([18], [19]), unavailability of the edible insects [20], uncontrolled harvesting [21], and loss of habitats leading to extinction of some species ([18],[22]). This study was therefore carried out to assess the current knowledge and consumption pattern of *Cirina forda* (*C. forda*) larva in Saki East and Iseyin Local Government Areas of Oyo State, South-western Nigeria, and its possible contribution to dietary diversity of consumers.

#### **METHODOLOGY**

The descriptive cross-sectional study was conducted in two Local Government Areas (LGAs) namely Iseyin, (IS) and Saki East (SE) Local

Government Areas of Oyo State where Shea butter tree is readily available, the insect larva obtained in abundance and its consumption very popular. Each LGA was stratified into rural and urban wards, and three wards each were randomly selected from the rural and urban wards that were listed, while two communities were chosen in each ward, making a total of twelve communities per LGA. The respondents were selected through snowballing technique in the chosen communities using the formula of Kasiulevicius *et al.*, [23]

$$n = \frac{Z^2 P (1-P)}{e^2}$$

Where n = required sample size, Z= standard normal value corresponding to 95% confidence level set at 1.96, P = prevalence of consumption (assumed 50%), and e = level of error tolerance 5%.

A total of five hundred and two (502) respondents (Saki East: 283, 121 males, 162 females, and Iseyin: 219, 88 men, 131 females) were selected for the study. A pre-tested semi-structured, interviewer-administered questionnaire was used to collect information from the respondents on socio-demographic characteristics,



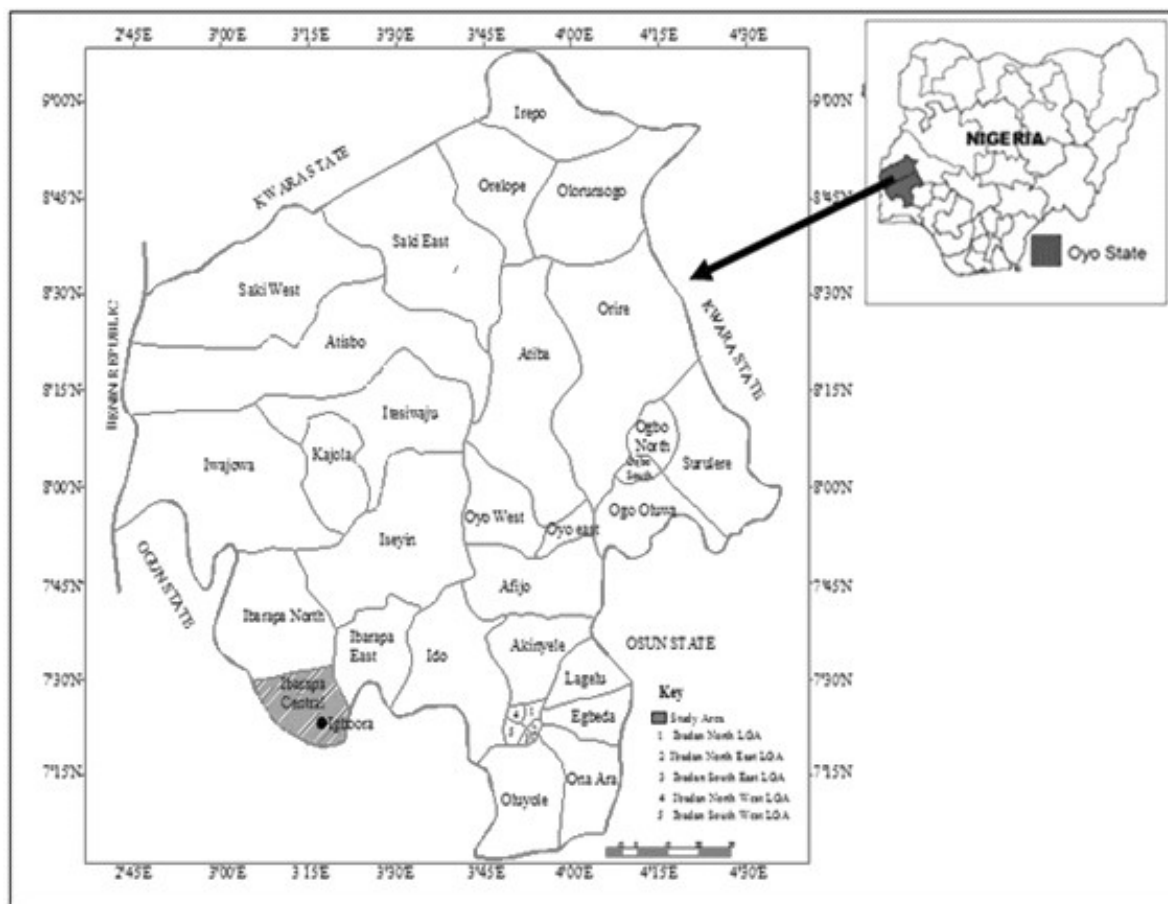


Figure 2: Map of Oyo State carved out of map of Nigeria.

consumption pattern and frequency of consumption, knowledge on nutrient content and benefits of consumption to health, availability and acceptability of the larva, limitation and restriction to consumption of *C. forda* larva.

#### Statistical Analysis:

The data obtained were cleaned, coded, entered into SPSS Version 21. Data were interpreted using descriptive statistics of frequency, percentages and means.

#### RESULTS

The result of socio-demographic characteristics of respondents is presented in Tables 1(a) and (b). Mean age of the respondents was  $46.3 \pm 16.4$  years, 38.0%, 35.5%, 23.5%, and 2.8% were within the age range of 20 - 39, 40 - 59, 60 - 79, and 80 - 99 years, respectively. More than half (58.4%) of the respondents were female, 99.5% were Yoruba, 69.7% were Muslims, 28.5% were Christians, 56.4% were from Saki East, while

43.6% were from Iseyin LGAs. Many (37.8%) of the respondents had no formal education, 25.1%, 25.3% and 11.8% had primary, secondary and tertiary level of education respectively (Table 1(a)).

The household size of the respondents ranged from 0 - 29 members. Majority of the households (81.1%) had between 0 - 9 members, 17.7% had 10 - 19 members, while 1.2% had household size greater than 19 members. Many (43.2%) of the respondents were traders, 20.1% artisans, 15.3% farmers, while 5.0% were civil servants. Majority (61.6%) of the respondents earned less than ₦20,000 per month, 26.9% earned between ₦20,000 and ₦39,000, 6.6% earned between ₦40,000 - ₦59,000 while only 5.0% earned ₦60,000 and above (Table 1(b)).

In Table 2(a), 99.8% of the respondents were aware of the existence of *C. forda*, 78.7% referred to it as "Monimoni" while 17.5% referred to it as

"Ikanni" in the local language. All respondents (100%) reported they had consumed *C. forda* before, 93.2% started its consumption since childhood, 81.9% had consumed it within the last 2 years, while 18.1% had not. Of the 18.1% that had not consumed it in the last two years, 59.3% mentioned scarcity of the insect larva as the reason for non-consumption, 14.3% did not consume it because of marriage, 8.8% because of civilisation, 8.8% because of both civilisation and scarcity, 7.7% did not consume the larva because of the problem of identifying the poisonous species, while 1.1% gave no response. About eight percent (8.2%) of respondents reportedly consumed *C. forda* daily, 45.6% consumed it weekly, 20.9% consumed it monthly, while 25.3% rarely consume the larva. Majority (87.1%) of the respondents reported that all members of their household do consume the larva.

About one-third each (35.4% and 35.9%) of respondents consumed *C. forda* in roasted/dried and boiled/fried forms, respectively; 51.8% consumed more than twenty pieces of larva and 31.5% consumed between 11 and 20 pieces of larva per meal, while 74.9% preferred consuming it as condiment in soups (Table 2 (b)). In Table 2 (c), the preferred form of consumption of the larva in soups were *Efo riro* (vegetable soup) (60.0%), *Efo* with *Egusi* (Vegetable with *Egusi*) soup (41.6%), and Sauce (30.1%). Other popular insects commonly consumed in the area of study include *Esunsun* (Winged Termites) (6.8%), *Ire* (Cricket) (22.9%), and both *Esunsun* and *Ire* (24.9%). Majority (82.4%) of the respondents reported that *C. forda* larva is very popular, much acceptable (73.7%), but seasonal (79.5%). Most (92.4%) of them reported that the larva is mainly available during rainy (wet) season, 98.4% reported that it is usually preserved/stored in dried form, and 34.7% indicated that it can be

preserved for one to three years (Table 3a); while 91.2% mentioned that it is usually available in the markets (Table 3b).

In Table 4, 29.7% of the respondents reportedly consumed *C. forda* as a result of food habit and custom, 17.0%, 17.2%, and 11.6% reportedly consumed it because of its flavour/taste, nutrition/health benefits, food habits/economic benefits, respectively; while 15.0% consumed the larva because of all of the benefits mentioned above. More than half (58.9%) of the respondents did not know the nutrition and health benefits of *C. forda*, 29.7% reported that the insect larva provides energy, proteins and vitamins while 7.8%, 1.2% and 2.4% reported that it helps in blood circulation, clear vision, and bowel movement, respectively. More than one-third (38.1%) of respondents reportedly consumed the larva because of the perceived benefits while 96.0% could not associate any health hazard or toxicity-related issue with consumption of the larva. However, 1.8% mentioned there is health hazard or toxic effect on consumption of the larva. Of the respondents that answered affirmatively about health issues (1.8%), 37.5% stated flatulence after consumption, 25.0% mentioned death, 25.0% cough, and 12.5% mentioned itchy skin, as the health hazards associated with the larva consumption.

Almost all respondents (99.8%) reported that religion does not affect the consumption of *C. forda*, 99.0% mentioned that there is no traditional belief/myth attached to it. Respondents agreed that availability (56.1%), age (99.0%), and cost (99.4%) do not affect the insect larva consumption, but food habits/custom (64.5%) was the general opinion of people as regards *C. forda* consumption in their locality (Table 5).

**Table 1a: Socio-demographic characteristics of the respondents**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Age (Years) mean age = 46.3±16.4 years</b>			
< 20	1 (0.2)	0 (0.0)	1 (0.3)
20-39	191 (38.0)	65 (31.1)	126 (43.0)
40- 59	178 (35.5)	85 (40.7)	93 (31.7)
60-79	118 (23.5)	51 (24.4)	67 (22.9)
80-99	14 (2.8)	8 (3.8)	6 (2.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Sex</b>			
Male	209 (41.6)	209 (100.0)	0 (0.0)
Female	293 (58.4)	0 (0.0)	293 (100.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Ethnic group</b>			
Yoruba	501 (99.8)	208 (99.5)	293 (100.0)
Hausa	1 (0.2)	1 (0.5)	0 (0.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Religion</b>			
Christianity	143 (28.5)	52 (24.9)	91 (31.1)
Islam	350 (69.7)	151 (72.2)	199 (67.9)
Traditional	9 (1.8)	6 (2.9)	3 (1.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>LGA</b>			
Saki East	283 (56.4)	121(57.9)	162 (55.3)
Iseyin	219 (43.6)	88 (42.1)	131 (44.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Marital Status</b>			
Single	24 (4.8)	8 (3.8)	16 (0.5)
Married	405 (80.7)	184 (88.0)	221 (75.4)
Divorced	4 (0.8)	1 (0.5)	3 (1.0)
Separated	17 (3.4)	4 (1.9)	13 (4.4)
Widowed	52 (10.4)	12 (5.7)	40 (13.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Level of Education</b>			
Tertiary	59 (11.8)	29 (13.9)	30 (10.2)
Secondary	127 (25.3)	49 (23.4)	78 (26.6)
Primary	126 (25.1)	63 (30.1)	63 (21.5)
No formal Education	190 (37.8)	68 (32.5)	122 (41.6)
Total	502 (100.0)	209 (100.0)	293 (100.0)

**Table 1b: Socio-demographic characteristics of the respondents (cont'd)**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Number of household member</b>			
0-9	407 (81.1)	159 (76.1)	248 (84.6)
10-19	89 (17.7)	46 (22.0)	43 (14.7)
20-29	6 (1.2)	4 (1.9)	2 (0.7)
<b>Total</b>	<b>502 (100.0)</b>	<b>209 (100.0)</b>	<b>293 (100.0)</b>
<b>Occupation</b>			
Civil Servant	25 (5.0)	15 (7.2)	10 (3.4)
Trader	217 (43.2)	37 (17.2)	180 (61.4)
Artisan	101 (20.1)	48 (23.0)	53 (18.1)
Farmer	77 (15.3)	49 (23.4)	28 (9.6)
Others (specify)	82 (16.3)	60 (28.7)	22 (7.5)
<b>Total</b>	<b>502 (100.0)</b>	<b>209 (100.0)</b>	<b>293 (100.0)</b>
<b>Family Income (₦)</b>			
< 20,000	309 (61.6)	103 (49.3)	206 (70.3)
20,000-39,000	135 (26.9)	72 (34.4)	63 (21.5)
40,000-59,000	33 (6.6)	20 (9.6)	13 (4.4)
60,000-79,000	7 (1.4)	3 (1.4)	4 (1.4)
80,000-99,000	9 (1.8)	5 (2.4)	4 (1.4)
10,000 and above	9 (1.8)	6 (2.9)	3 (1.0)
<b>Total</b>	<b>502 (100.0)</b>	<b>209 (100.0)</b>	<b>293 (100.0)</b>

**Table 2a: Pattern and frequency of consumption of *C. forda* by respondents**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Do you know <i>C. forda</i> (Monimoni)?</b>			
Yes	501 (99.8)	209 (100.0)	292 (99.7)
No	1 (0.2)	0 (0.0)	1 (0.3)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>What name is it called in your local language?</b>			
<i>Monimoni</i>	395 (78.7)	172 (82.3)	223 (76.1)
<i>Ikanni</i>	88 (17.5)	32 (15.3)	56 (19.1)
Others (specify)	19 (3.8)	5 (2.4)	14 (4.8)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Have you consumed <i>C. forda</i> before?</b>			
Yes	502 (100.0)	209 (100.0)	293 (100.0)
No	0 (0.0)	0 (0.0)	0 (0.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>When did you start consuming <i>C. forda</i>?</b>			
Since childhood	468 (93.2)	200 (95.7)	268 (91.5)
Adolescent	22 (4.4)	7 (3.3)	15 (5.1)
Adulthood	10 (2.0)	1 (0.5)	9 (3.1)
Others (Specify)	2 (0.4)	1 (0.5)	1 (0.3)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>In the past 2 years, have you consumed <i>C. forda</i>?</b>			
Yes	411 (81.9)	171 (81.8)	240 (81.9)
No	91 (18.1)	38 (18.2)	53 (18.1)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>If no, why?</b>			
Marriage	13 (14.3)	8 (21.6)	5 (9.4)
Civilization	8 (8.8)	3 (8.1)	5 (9.4)
Scarcity	54 (59.3)	20 (54.1)	34 (64.2)
Civilization & Scarcity	8 (8.8)	4 (10.8)	4 (7.5)
Poisonous species	7 (7.7)	2 (5.4)	5 (9.4)
No response	1(1.1)		
Total	91 (100.0)	37 (100.0)	53 (100.0)
<b>Do you consume <i>C. forda</i> often?</b>			
Yes	396 (78.9)	161 (77.0)	235 (80.2)
No	106 (21.1)	48 (23.0)	58 (19.8)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>How often do you consume <i>C. forda</i>?</b>			
Daily	41 (8.2)	20 (9.6)	21 (7.2)
Weekly	229 (45.6)	95 (45.5)	134 (45.7)
Monthly	105 (20.9)	40 (19.1)	65 (22.2)
Rarely	127 (25.3)	54 (25.8)	73 (24.9)
Total	502 (100.0)	209 (100.0)	293 (100.0)



**Table 2b: Pattern and frequency of consumption of *C. forda* by respondents (cont'd)**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Aside from you, which other member of your household consume <i>C. forda</i>?</b>			
All	437 (87.1)	188 (90.0)	249 (85.0)
Husband	11 (2.2)	0 (0.0)	11 (3.8)
Wife	10 (2.0)	10 (4.1)	0 (0.0)
Children	12 (2.4)	3 (1.4)	9 (3.1)
None	32 (6.4)	8 (3.8)	24 (8.2)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>If yes, how often do they consume <i>C. forda</i>?</b>			
Daily	41 (8.2)	19 (9.1)	22 (7.5)
Weekly	225 (44.8)	95 (45.5)	130 (44.5)
Monthly	99 (19.8)	40 (19.1)	59 (20.2)
Rarely	106 (21.2)	47 (22.5)	59 (20.2)
Never	30 (6.0)	8 (3.8)	22 (7.5)
Total	501 (100.0)	209 (100.0)	292 (100.0)
<b>In what form do you consume <i>C. forda</i>?</b>			
Roasted / dried	173 (35.4)	61 (29.2)	112 (38.2)
Boiled	46 (9.2)	17 (8.1)	29 (9.9)
Powdered	3 (0.6)	1 (0.5)	2 (0.7)
Fried	100 (19.9)	39 (18.7)	61 (20.8)
Boiled and fried	180 (35.9)	91 (43.5)	89 (30.4)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>What quantity do you consume per meal? (Pieces)</b>			
< 5	3 (0.6)	1 (0.5)	2 (0.7)
5-10	81 (16.1)	24 (11.5)	57 (19.5)
11-20	158 (31.5)	107 (36.5)	107 (36.5)
>20	260 (51.8)	127 (43.3)	127 (43.3)
Total	502 (100.0)	293 (100.0)	293 (100.0)
<b>How do you prefer its consumption?</b>			
Pack	6 (1.2)	1 (0.5)	5 (1.7)
Spice in food	23 (4.6)	11 (5.3)	12 (4.1)
Condiment in soup	376 (74.9)	144 (68.9)	232 (79.2)
Bottled / fried	6 (1.2)	3 (1.4)	3 (1.0)
Others (Specify)	91 (18.1)	50 (23.9)	41 (14.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)

**Table 2c: Pattern and frequency of consumption of *C. forda* by respondents (cont'd)**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>If you prefer <i>C. forda</i>s condiment in soup, what soup do you like it with?</b>			
Snack/Spice	31 (6.2)	14 (6.7)	17 (5.8)
Tomato sauce	151 (30.1)	51 (24.4)	100 (34.1)
<i>Efo riro</i>	30 (6.0)	17 (8.1)	13 (4.4)
<i>Egusi</i>	32 (6.4)	17 (8.1)	15 (5.1)
<i>Efo &amp; Egusi</i>	209 (41.6)	85 (40.7)	124 (42.3)
All	44 (8.8)	22 (10.5)	22 (7.5)
Others	5 (1.0)	3 (1.4)	2 (0.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Is there a difference between its consumption rate in the past and present?</b>			
Yes	323 (64.3)	128 (61.2)	195 (66.6)
No	157 (31.3)	72 (34.4)	85 (29.0)
I don't know	22 (4.4)	9 (4.3)	13 (4.4)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>If yes, why is there a difference?</b>			
Income	27 (5.4)	10 (4.8)	17 (5.8)
Civilization	109 (21.8)	39 (18.8)	70 (24.1)
Seasonality	26 (5.2)	15 (7.2)	11 (3.8)
Education	3 (0.6)	2 (1.0)	1 (0.3)
Price	6 (1.2)	4 (1.9)	2 (0.7)
Civilization & seasonality	12 (2.4)	5 (2.4)	7 (2.4)
Civilization, seasonality & price	130 (25.9)	49 (23.6)	81 (27.8)
Death, poison	8 (1.6)	4 (1.9)	4 (1.4)
No response	182 (35.7)	81 (38.5)	100 (33.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Can you mention other edible insects people consume in your locality here?</b>			
<i>Esunsun</i>	34 (6.8)	7 (3.3)	27 (9.2)
<i>Igango</i>	28 (5.6)	14 (6.7)	14 (4.8)
<i>Ire</i>	115 (22.9)	57 (27.3)	58 (19.8)
<i>Esunsun &amp; Ire</i>	125 (24.9)	60 (28.7)	65 (22.2)
All	31 (6.2)	16 (7.7)	15 (5.1)
I don't know	169 (33.7)	55 (26.3)	114 (38.9)
Total	502 (100.0)	209 (100.0)	293 (100.0)

**Table 3a: Availability and accessibility of *C. forda* to the respondents**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>How popular is <i>C. forda</i> in your locality?</b>			
Very popular	413 (82.4)	181 (86.6)	232 (79.2)
Popular	78 (15.6)	26 (12.5)	52 (17.7)
Rarely known	7 (1.4)	0 (0.0)	7 (2.4)
Not known at all	4 (0.6)	2 (0.5)	2 (0.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>How popular is <i>C. forda</i> in your locality?</b>			
Very acceptable	370 (73.7)	164 (78.5)	206 (70.3)
Acceptable	132 (26.3)	45 (21.5)	87 (29.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Is <i>C. forda</i> available all year round in your locality?</b>			
Yes	82 (16.3)	45 (21.5)	37 (12.6)
No	399 (79.5)	160 (76.6)	239 (81.6)
I don't know	21 (4.2)	4 (1.9)	18 (5.8)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>If no, what season of the year is it mainly available?</b>			
Raining (Wet)	379 (92.4)	158 (75.6)	221 (75.4)
Dry	16 (3.2)	43 (20.6)	64 (21.8)
I don't know	22 (4.4)	8 (3.8)	8 (2.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Can <i>C. forda</i> be stored/preserved?</b>			
Yes	464 (92.4)	194 (92.8)	270 (92.2)
No	16 (3.2)	6 (2.9)	10 (3.4)
I don't know	22 (4.4)	9 (4.3)	13 (4.4)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>If yes, in what form was it stored/preserved?</b>			
Dried	494 (98.4)	206 (98.6)	288 (98.3)
Wet	2 (0.4)	1 (0.5)	1 (0.3)
Others (Specify)	6 (1.2)	2 (1.0)	4 (1.4)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>For how long can it be stored/preserved? (Month)</b>			
< 1	62 (12.4)	21 (10.0)	41 (14.0)
1-3	174 (34.7)	53 (25.4)	121 (41.3)
4-6	94 (18.7)	48 (23.0)	46 (15.7)
7-12	75 (14.9)	35 (16.7)	40 (13.7)
>12	97 (19.3)	52 (24.9)	45 (15.4)
Total	502 (100.0)	209 (100.0)	293 (100.0)

**Table 3b: Availability and accessibility of *C. forda* of the respondents (cont'd)**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Is <i>C. forda</i> available in the market all year round?</b>			
Yes	206 (41.1)	90 (43.3)	116 (39.6)
No	265 (52.9)	105 (50.5)	160 (54.6)
I don't know	31 (6.0)	14 (6.3)	17 (5.8)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>In what way do you purchase <i>C. forda</i>?</b>			
Tomato tin	21 (4.2)	7 (3.3)	14 (4.8)
Milk tin	283 (56.4)	101 (48.3)	182 (62.1)
Rubber	73 (14.5)	40 (19.1)	33 (11.3)
Mudu/Congo	118 (23.5)	57 (27.3)	61 (20.8)
Others (Specify)	7 (1.4)	4 (1.9)	3 (1.0)
Total	502 (100.0)	209 (100.0)	209 (100.0)
<b>How long can the quantity last?</b>			
0-9 days	472 (94.0)	199 (95.2)	273 (93.2)
10-19 days	24 (4.8)	9 (4.3)	15 (5.1)
20-29 days	4 (0.8)	1 (0.5)	3 (1.0)
30-39 days	1 (0.2)	0 (0.0)	1 (0.3)
>39 days	1 (0.2)	0 (0.0)	1 (0.3)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Is <i>C. forda</i> available in the market for all?</b>			
Yes	458 (91.2)	198 (94.7)	260 (88.7)
No	37 (7.4)	9 (4.3)	28 (9.6)
I don't know	7 (1.4)	2 (1.0)	5 (1.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>What is the average cost? (₦)</b>			
0-9,000	501 (99.8)	208 (99.5)	293 (100.0)
10,000 and above	1 (0.2)	1 (0.5)	0 (0.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)

**Table 4: Knowledge of nutrient content and benefits of *C. forda* consumption of respondents**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Why do you consume <i>C. forda</i>?</b>			
Flavor and taste	85 (17.0)	30 (14.4)	55 (18.8)
Food habit/custom	149 (29.7)	63 (30.1)	86 (29.5)
Nutrition/health benefit	86 (17.2)	45 (21.5)	41 (14.0)
Food habit/Economical	58 (11.6)	26 (12.4)	7 (2.4)
All except nutritional benefits	35 (7.0)	14 (6.7)	32 (11.0)
All of the above	75 (15.0)	25 (12.0)	21 (7.2)
Others (Specify)	14 (2.6)	6 (2.9)	51 (17.1)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>What are the nutrition and health benefits of <i>C. forda</i>?</b>			
Helps in blood circulation	39 (7.8)	23 (11.0)	16 (5.5)
Clear vision	6 (1.2)	4 (1.9)	2 (0.7)
Bowel movement	12 (2.4)	9 (4.3)	3 (1.0)
I don't know	295 (58.9)	115 (55.0)	180 (61.6)
Gives energy, protein & vitamins	150 (29.7)	58 (27.8)	92 (31.0)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Does these benefits influence your consumption?</b>			
Yes	191 (38.1)	88 (42.1)	103 (35.3)
No	246 (49.1)	100 (47.8)	146 (50.0)
I don't know	65 (12.8)	21 (10.0)	44 (14.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>Do you know any health/toxic related issue(s) related to its consumption?</b>			
Yes	9 (1.8)	2 (1.0)	7 (2.4)
No	481 (96.0)	204 (97.6)	277 (94.5)
I don't know	12 (2.2)	3 (1.4)	9 (2.7)
Total	502 (100.0)	209 (100.0)	293 (100.0)
<b>If yes, what are they?</b>			
Flatulence	3 (37.5)	2 (100.0)	1 (16.7)
Itchy skin	1 (12.5)	0 (0.0)	1 (16.7)
Death	2 (25.0)	0 (0.0)	2 (33.3)
Cough	2 (25.0)	0 (0.0)	2 (33.3)
Total	8 (100.0)	2 (100.0)	6 (100.0)

**Table 5a: Limitation and restriction to consumption of *C. forda* of the respondents**

Variable	Total N (%)	Male N (%)	Female N (%)
<b>Does religious belief affect its consumption?</b>			
Yes	1 (0.2)	1 (0.3)	0 (0.0)
No	500 (99.8)	209 (99.7)	292 (100.0)
Total	501 (100.0)	209 (100.0)	292 (100.0)
<b>Is there any traditional belief/myth attached to its consumption?</b>			
Yes	5 (1.0)	1 (0.5)	4 (1.4)
No	496 (99.0)	208 (99.5)	288 (98.6)
Total	501 (100.0)	209 (100.0)	209 (100.0)
<b>If yes, what do people say about its consumption?</b>			
Affect rainfall	4 (100.0)	1 (100.0)	3 (100.0)
<b>Does availability affect its consumption?</b>			
Yes	220 (43.9)	82 (39.2)	138 (47.1)
No	281 (56.1)	127 (60.8)	154 (52.7)
Total	501 (100.0)	209 (100.0)	292 (100.0)
<b>If yes, in what ways?</b>			
Scarcity	220 (100.0)	82 (100.0)	138 (100.0)
<b>Does age affect its consumption?</b>			
Yes	5 (1.0)	1 (1.4)	2 (0.7)
No	496 (99.0)	206 (98.6)	290 (99.3)
Total	501 (100.0)	209 (100.0)	292 (100.0)
<b>If yes, which age group consumes it?</b>			
Adult > 35 years	4 (100.0)	2 (100.0)	2 (100.0)
Yes	3 (0.6)	2 (1.0)	1 (0.3)
No	498 (99.4)	207 (99.0)	291 (99.7)
Total	501 (100.0)	209 (100.0)	292 (100.0)
<b>If yes, why?</b>			
Too expensive	3 (100.0)	2 (100.0)	1 (100.0)
<b>What is the general opinion of people in your locality concerning <i>C. forda</i> consumption?</b>			
Nutritious	47 (9.4)	22 (10.5)	25 (8.6)
Economical	58 (11.6)	27 (12.9)	31 (10.6)
Food habit/custom	323 (64.5)	136 (65.1)	187 (64.0)
I don't know	37 (7.4)	8 (3.8)	29 (9.9)
Civilization/fading interest	35 (7.0)	16 (7.7)	19 (6.5)
Death /disease	1 (0.2)	0 (0.0)	1 (0.3)
Total	501 (100.0)	209 (100.0)	292 (100.0)

**Table 5 (b): Limitation and restriction to consumption of *C. forda* of the respondents (cont'd)**

Variable	Total N (%)	Male N (%)	Female N (%)	X <sup>2</sup>	p-Value
<b>Do you prefer it to meat, fish or eggs?</b>					
Yes	200 (39.9)	80 (38.3)	120 (41.1)	0.226	0.821
No	277 (55.3)	121 (57.9)	156 (53.4)		
Indifference	24 (4.8)	8 (3.8)	16 (5.5)		
Total	501 (100.0)	209 (100.0)	292 (100.0)		
<b>Why?</b>					
Fleshy/boneless	24 (4.8)	7 (3.3)	17 (5.8)	-0.135	0.893
Personal preference	157 (31.3)	67 (32.1)	90 (30.8)		
Economical	32 (6.4)	12 (5.7)	20 (6.8)		
Nutrition /health benefits	60 (12.0)	29 (13.9)	31 (10.6)		
Taste/flavour	60 (12.0)	21 (10.0)	39 (13.4)		
Indifference	31 (6.2)	11 (5.3)	20 (6.8)		
Others (specify)	137 (27.3)	62 (29.7)	75 (25.7)		
Total	501 (100.0)	209 (100.0)	292 (100.0)		



## DISCUSSION

Consumption of *Cirina forda* larva cuts across all age groups, sex, ethnic group, religion, marital status, educational level, occupation and financial status of respondents in the two selected Local Government Areas (Table 1). The socio-demographic characteristics of the respondents are similar to those reported by Manditsera *et al.*, [1]. Socio-demographic and economic status of respondents had nothing to do with the consumption of the insect larva, as most of them reported that they were aware of its existence and had all consumed it before at a point in time since childhood. It is usually referred to as "Monimoni" in the local language by most of the respondents, while few people referred to it as "Ikanni".

*C. forda* was consumed by most people on weekly basis, and few consumed it daily. For most respondents that had not consumed it in the past two years, scarcity, marriage and civilization, were reasons for their non-consumption, while some did not because of the fear of consuming the poisonous species. Non-consumption of the larva due to civilization as reported by some of the respondents in this study corroborates the findings of Ebenebe *et al.*, [24], who reported that insects eating was greatly associated with poverty, as the rich/elites dropped the habits for the poor and the illiterates in the rural communities. Also, a common belief is that traditional foods like edible insects, are considered to be primitive and are not accepted by Western communities [1].

The forms in which the larva is being consumed are either roasted/dried, boiled, fried or in powder. The most preferred form of *C. forda* consumption was as condiment in soups such as 'Efo riro' (vegetable soup), tomato sauce and 'Egusi' (melon) soup. This supports the statement of Fasoranti and Ajiboye [25] that the insect is widely used as an ingredient in vegetable soups. A decline in the rate of consumption of *C. forda* larva reported by the respondents was attributed to different reasons ranging from civilization, seasonality, price and income, to fear of consuming the poisonous species. These reasons are in line with reasons reported by other researchers for reduced consumption of edible insects, namely - adoption of Western foods ([18], [20],[26]), decreased knowledge of preparation practices [19], unavailability of the edible insects [20], uncontrolled harvesting [21], and loss of

habitats, leading to extinction of some species ([18], [22]).

*Cirina forda* larva was reported by most of the respondents not to be available all year round, probably due to its seasonality. This supports the reports of Odeyemi and Fasoranti [16]; and Agbidye and Nongo [17] which stated that the larva is usually collected during the rainy season between June and August. Also, Latham [27] reported that cultivation and bush burning reduces the availability of edible caterpillars.

Food habits/custom, flavour and taste, nutritional/health benefits and economic preferences were the reasons adduced for the consumption of the larva. Consumption of the insect as a result of its taste and nutritional benefits by respondents in this study corroborates the findings of Manditsera *et al.*, [1]. Obopile and Seeletso [28] reported that taste is a major motive for insect consumption, while nutritional benefit was not the major reason for consuming insects. Manditsera *et al.*, [1] reported that respondents consume insects for their nutritional value because they perceived insects as high value nutritious food, but do not know the exact nutritional values; only generalising that insects are rich in protein and health promoting components. This was also observed in this study, as most of the respondents reported that they did not know the nutritional and health benefit of this insect, but some mentioned it that it gives energy, protein and vitamins, helps in blood circulation and clear vision. The lack of nutrition potential of this larva calls for an extensive public enlightenment on the nutritional importance and health benefits of *C. forda* larva. The preference of *C forda* larva over meat, fish or eggs by some of the respondents was based on the insect larva being fleshy/boneless, economic reasons, nutrition and health benefits, and taste / flavour. One of the major factors limiting the consumption of the insect larva was availability. This is in line with the findings from other studies which also indicated that availability influences preference and consumption of edible insects ([1], [29],[22],[28]). Age was also identified as contributing factor to the consumption of the larva, as few of the respondents indicated that it is mostly consumed by adults 35years and above. Studies have shown that there is a tendency for the younger populations to abandon the practice of entomophagy due to westernisation of

traditional diets ([30],[31]). A few also reported that religious beliefs and traditional beliefs/myth affects the consumption.

Religion has been reported to affect the consumption of certain foods. Dube *et al.*, [18] stated that entomophagy is strictly forbidden in some religious practices. Manditsera *et al.*, [1] reported that 21.7% of urban and 8.7% of rural respondents were strictly forbidden from eating edible insects by their religion. However, this assertion is contrary to the findings in this study, as almost all respondents stated that religion and traditional beliefs and myths do not affect their consumption of *C. forda* larva.

### CONCLUSION AND RECOMMENDATION

*Cirina forda* larva is the most popular among the insects relished in the study area, as most of the respondents were aware of its existence and often consume it. It is usually consumed roasted, dried, boiled, fried or in powdered forms, but majorly as condiment in soups. The major reasons for its consumption by the respondents include among others, its flavour and taste, food habits/custom, nutritional/health benefits, and economic preferences. However, scarcity in the market, civilization, marriage, and possible adulteration with poisonous species are the limitations to the consumption of the larva. Majority of the respondents reportedly did not know the nutritional and health benefits of the insect larva, hence, there is need to create a wide public enlightenment programme on its nutritional and health benefits so as to improve its consumption alongside some other edible insects, especially among the youths; thereby promoting dietary diversity, which has been recommended as a good option for meeting dietary needs of both individual and the general populace. This will also help to conserve the wild (Shea butter) tree producing the insect from extinction due to urbanisation. Further study to investigate the nutrient bio-availability and safety of consumption of the insect larva is required.

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**Authors' comment:** This is the first report on a comprehensive study carried out on suitability, acceptability and safety for consumption of *Cirina forda* larva by humans.

**Conflict of Interest:** The Authors declare that there is no conflict of interest, as the study was self-sponsored and this article has not been submitted for publication elsewhere.