INTRODUCTION

It is predicted that meat consumption will increase by 76% by the year 2050 [1] when the global human population will be about 9 billion [2]. Consumption of meat contributes largely to food-related deforestation [3] resulting in the rise of greenhouse emissions [4]. It is based on these evidence that Food and Agriculture Organization (FAO) encourages the consumption of edible insects especially in European countries where the practice is not popular. Other than the West, consumption of edible insects is widely accepted in many countries of the world [5] and is expected to increase by 47% between 2019 and 2026 [6]. Insects as micro-livestock [7] have seen an increased attention recently [2,8,9,10] and are being predicted to play a major role in the food supply systems in the years to come [10]. They are the most abundant species among all the animal species on earth [11] and provide a better sustainable animal protein source as their production demand for water [12], feed [13] and space [14] is less. They also generate less greenhouse gas emissions [15, 16] and waste [14] and contribute significantly to national and global food security [17].

FAO reported that eating insects promotes health, sustenance of the ecosystem and provides social and economic significance [2]. More than 1,900 insect species have been identified for consumption [2, 18, 19] by 3,071 ethnic groups in the world [20]. Insects that are frequently eaten worldwide include beetles, caterpillars, wasps, grasshoppers, ants, locusts, crickets, cicadas, leafhoppers, planthoppers, scale insects, flies, termites, dragonflies and true bugs [2, 21, 22]. However, little recognition of entomophagy is reported in the United States and some European countries due to perceived social norms [23].

Research shows that insect food plays a major role in the nutrition of many people in Asia, Africa and Latin America [24, 25]. About 250 species of insects are consumed in sub-Sahara Africa [14]. According to the report from Thailand [26], about one billion people in the world are malnourished and 98% of them are from Africa and Asia [27]. It is reported that insect-based foods are richer in proteins [24, 25, 28], mono and polyunsaturated fatty acids [29] and provide better alternative protein than livestock [30]. However, accepting insects as food source is often shrouded with insect neophobia [31]. Many individuals express discomfort during the initial consumption stage [32, 33]. Therefore, education [34] and familiarity of eating insects [35] are important for acceptance of entomophagy. Recent studies indicate that people accept insects as food because their consumption is positively correlated to friendly environment [36, 37, 38], food sustainability [36], higher nutrients composition [36] and health reasons [37]. In Africa, insects are widely consumed among many cultures. About 85% of the people in the Central African Republic [39], 91% in Botswana [14] and 70% in The Democratic Republic of Congo [40] eat insects as food. Policy makers, research scientists and International Organizations such as the United Nations started promoting diversification of food sources to curtail the difficulties of food production arising from climate change. Entomophagy was one of the main considerations [2].

In Ghana the demand for meat as protein source has significantly increased in recent years. About 90% of meat protein is imported and this practice makes meat

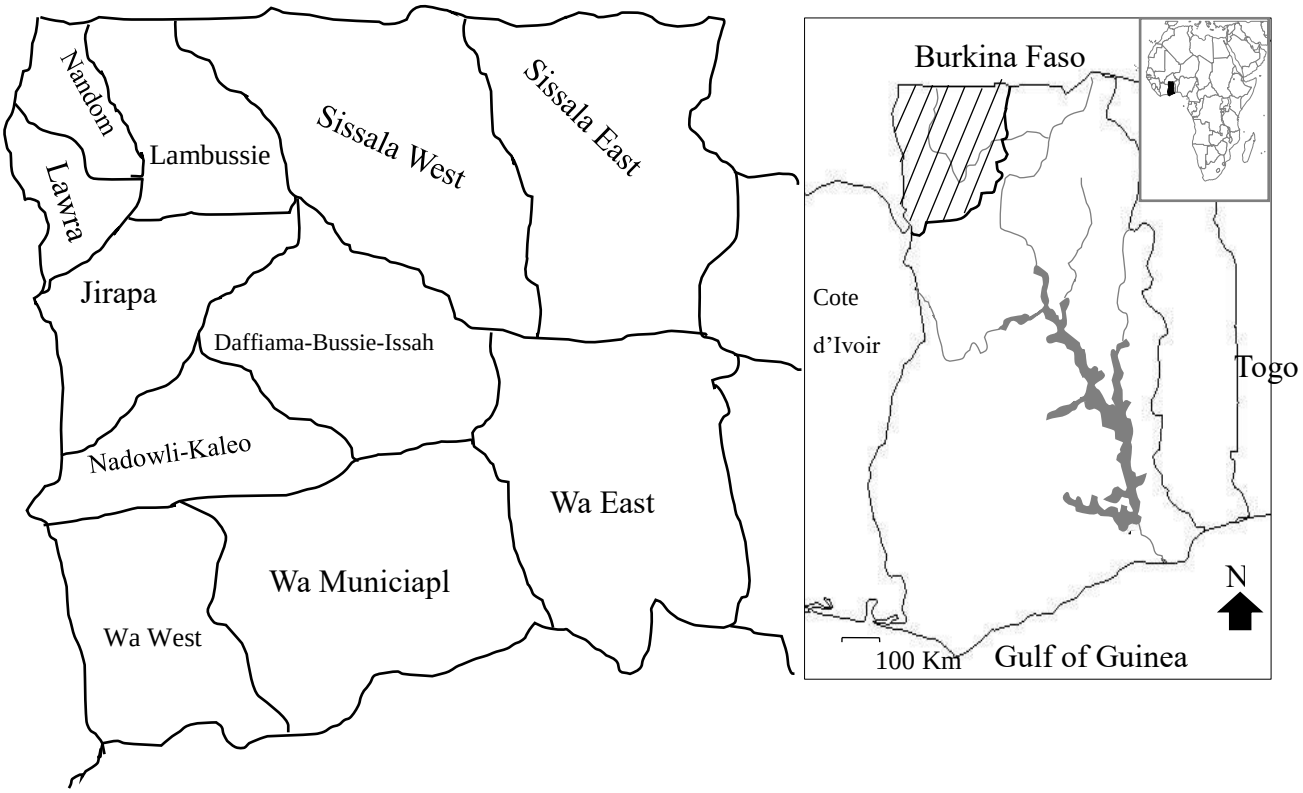
consumption unsustainable [41]. Insects food provides sustainable protein source for humans and animals [14, 42]. The Upper West Region is one of the smallest regions in Ghana with poor food security. As a result, many Non-governmental Organizations have concentrated projects whose scopes are on sustainable food production to ameliorate the nutrition situation. So far, no support on entomophagy is available, presumably because of lack of adequate information on insects consumption. Nine edible insects have been identified recently and eight of these are eaten in the Upper West region [43]. However, the studies concentrated on only two communities (Wa as urban and Yaala as rural) with two hundred respondents sampled from both communities. To look for alternative, relatively cheap and readily available sources of protein, we conducted a wider survey to identify the types of insects eaten, determine the factors that influence entomophagy and identify negative impressions toward entomophagy.

MATERIALS AND METHODS

Study location

The study was carried out in the Upper West region of Ghana. The region has eleven administrative districts located at the northwestern corner of Ghana with latitude 9.8°- 11.0° North and longitude 1.6°- 3.0° West. It is bounded by Burkina Faso to the North and West, to the East by Upper East and Northern Regions and to the South by Northern Region. The population size is 868,479 representing 2.8% of the national population [44]. The main languages are Dagaare, Waali and Sissala with each language having several dialects. Fifty-two communities across eleven districts in the Upper West Region were visited to administer questionnaire (Fig. 1). The communities visited included Mangu, Kambali, Zinpene, Sombo, Bamahu, Semii, Piisi, Nako, Kunfaabiala, SDD UBIDS, Kpongpaala, Konta, Zongo, Dondoli, Water Village, Teegberi (Wa Municipality), Duori, Jirapa and kunkyene-kpong (Jirapa Municipality), Kokoligue, Gozir, Gozir New Town (Nandom Municiaplity), Tumu College, Stadium, Mossi Zongo, Zumbugu (Sissala East), Sorbele, Fielmuo old market, Fielmuo new market (Sissala West), Lawra market (Lawra Municipality), McCoy College, Loho, Kaleo (Nandowli/Kaleo district), Daffiamah Zongo, Mission Area (Daffiamah-Bussie-Issa), Dorimon, Bieli, Naayiri, Buka, Tanina, Poyentanga, Maasi, Kuse, Bienye (Wa West), Chaggou, Bulenga (Wa East), Karni, Lambussie, Piina, Chebogo, Koro, Bognuo (Lambussie district).

Fig. 1. District map of Upper West Region showing interview locations. The study location is shaded on the map of Ghana and enlarged on the left pane.



Sample size calculation

The sample frame included all people of Upper West Region aged eighteen years and above (18+ years). The calculation was based on the 2010 population and housing census of Ghana where 361,009 people of Upper West region were aged above eighteen years. The sample size was calculated using the Slovin's formula which was recently used by Anankware JP, et al [43] as stated below.

n = N/1+N(a2)

Where;

n = sample size, N = sample frame, 1 = constant, a2 = margin of error

N = 361009, a = 0.03 (3% margin of error).

Therefore; n = 361009/1+361009(0.032) = 1,108 respondents

Data collection procedures

A cross-sectional survey was purposively conducted using a semi-structured questionnaire designed using KoboToolbox collect software and was self-administered. During the face-to-face (FTF) interview, the communities were randomly selected in each district by simple ballot method. Names of communities and seasonality of insects were given by key informants and with the help of Google map. The respondents were natives of the Upper West region and non-natives who have settled permanently, raised families and could speak one or more of the native languages in the region. The questionnaire administration and direct observation of insects in the field lasted from February to July, 2021. Insects in season were directly observed in the field and photos taken by the researchers. Only five insects could be seen and observed in the field during the study. Information on their demographic characteristics, types of insects and factors influencing their consumption was collected. A total of 802 respondents answered the questionnaire representing 72% of the sample size. The researchers could not get the required sample size because we could not get to all the communities in the rainy season and some of the people were unwilling to answer the questionnaire. During the FTF interview, questions were translated to the main local languages (Dagaare, Sissali and Waali) for respondents who could not speak or write English Language. Responses were then entered into the questionnaire in English language for data processing.

Statistical analysis

The data was exported to Microsoft Excel 2013, merged and cleaned to 743 valid respondents. It was then coded and analyzed using Statistical Package for Social Sciences (SPSS) version 16.0 for Windows. Both descriptive and inferential statistics were performed to describe the characteristics of the sample and make predictions, respectively. Microsoft Excel 2013 was used to generate graphs.

RESULTS

Demographic characteristics of respondents

Respondents in this study were analyzed based on their socio-economic characteristics such as age, home district, religion, marital status, number of dependents, education, primary occupation and ethnicity (Table 1). The mean age 35.81 years with standard deviation of 4.39. Eighty three percent (83%) of respondents were below the age of 60. Majority of the respondents were

from the Wa municipal (21.8%), the capital town of the Upper West Region while the least number of respondents were from Daffiamah-Bussie-Issah (2.3%). In terms of religion, christians were the majority (59%). Most respondents were married (60.7%). About 72% of respondents had less than five dependents while 78% had formal education from basic to tertiary level. The primary occupation for most respondents (30.7%). Majority of the respondents were Dagaaba (67%) while other minor ethnic settlers such as Fulani, Frafra and Kasena altogether constituted 1.5%.

Table 1. Demographic characteristics of respondents (n = 783)

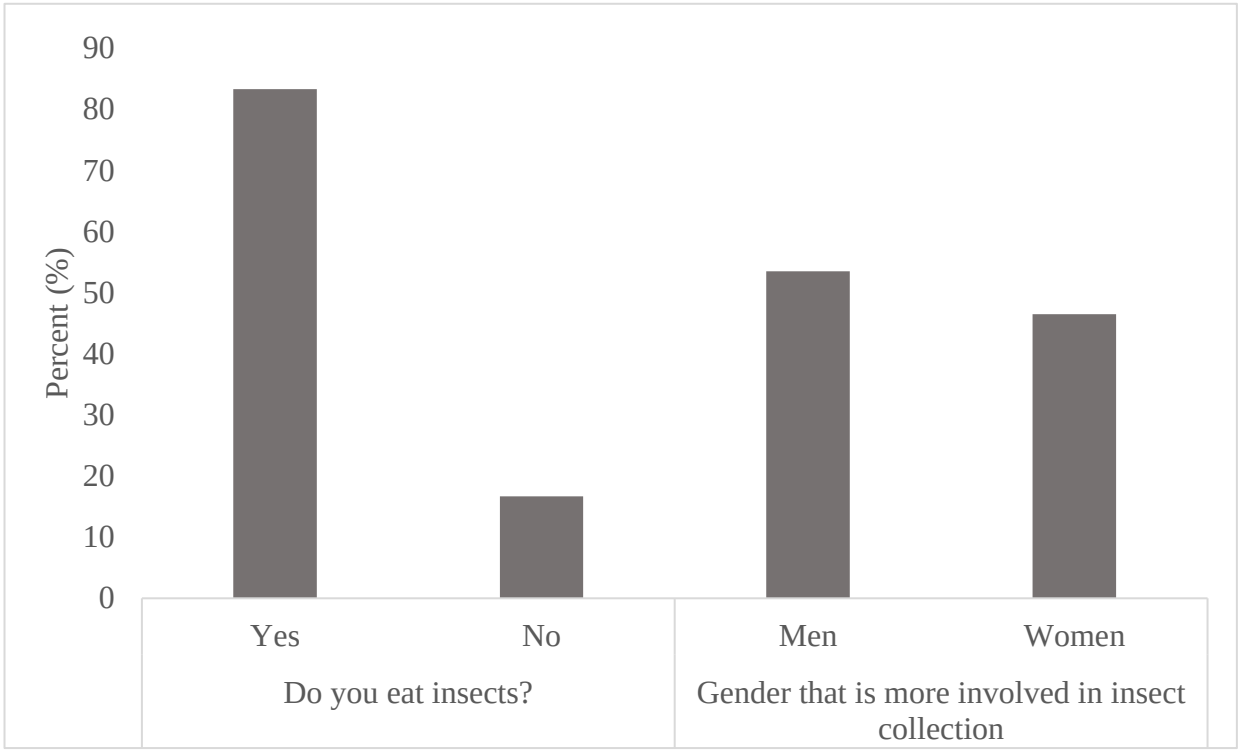
Variable	Respondents	Percent (%)
Age Group (Years)	20's	10.9
	30's	33.5
	40's	24.5
	50's	13.9
	60's	8.8
	70's	8.4
M(SD)	35.81 (14.39)	-
Home District	Wa East	8.6
	Sissala West	7.7
	Sissala East	5.2
	Wa West	20.2
	Nandowli-kaleo	7.7
	Lambussie	5.5
	Nandom Municipal	11.0
	Jirapa Municipal	4.0
	Lawra Municipal	6.0
	Dafiamah-Bussie-Issah	2.3
	Wa Municipal	21.8
Religion	Christianity	59.3
	Muslim	38.0
	Traditional	2.7
Marital status	Single	34.7
	Married	60.7
	Separated	1.1
	Divorced	0.3
	Widowed	3.2
Dependents	<5	71.8
	5 - 10	22.5
	>10	5.7
Educational Qualification	None	22.3
	Basic Education	27.3
	Senior High School	19.9
	Tertiary Education	30.5
Occupation	Farmer	30.7
	Educator	11.1
	Researcher	1.8
	Student	19.7
	Unemployed	15.3
	Self employed	10.2
	Other	11.2
Ethnicity	Dagaaba	66.5
	Sissala	6.4
	Waala	23.8
	Moshi	1.8
	Fulani	1.0
	Frafra	0.4
	Kasena	0.1

M(SD)=mean age and standard deviation

Acceptance of insects as food and the gender that is more involved in insect collection in the Upper West Region of Ghana

Figure 2 shows the acceptance of insects as food as well as the gender that is more involved in collecting insects by people in the Upper West Region of Ghana. About 83% of the respondents accepted insects as food while about 54% of total respondents being men were more involved in insect collection.

Fig. 2: Acceptance of insects as food and the gender that is more involved in insect collection in the Upper West Region of Ghana.



Factors influencing consumption of insects

I eat insects due to hunger 4.71 2.09

Table 2 shows the factors that influenced acceptance of entomophagy on a Seven-point Likert scale from 1 = strongly agree to 7 = strongly disagree in the Upper West Region of Ghana. The means and standard deviations were calculated for the variables measured. Theses variables with means (M) and standard deviations (SD) included 'it is convenient eating insects' (M=2.53; SD=1.52), 'insect foods are natural' (M=1.74; SD=0.68), 'my culture accepts edible insects' (M=2.01; SD=0.97), 'I have experience of eating insects' (M=1.99; SD=1.23), 'nutrients are higher in insect foods' (M=2.73; SD=1.62), 'insect foods are medicinal' (M=2.28; SD=1.38), 'it is pleasurable eating insects food' (M=2.66; SD=1.60) which are lower than the overall mean of 2.99; SD = 1.63. Variables such as 'insect foods make the environment safer (M=3.71; SD=1.94), 'it is easier collecting insects (M=4.13; SD=2.07) and 'I eat insects due to hunger' (M=4.71; SD=2.09) had their means greater than the overall mean.

Table 2. Factors influencing consumption of insects (n = 652)

Factor	Mean	SD
Insect foods are natural	1.74	0.68
I have experience of eating insects	1.99	1.23
My culture accepts edible insects	2.01	0.97
Insect foods are medicinal	2.28	1.38
It is convenient eating insects	2.53	1.52
It is pleasurable eating insects	2.66	1.60
Nutrients are higher in insect foods	2.73	1.62
Insect foods make the environment safer	3.71	1.94
It is easier collecting insects	4.13	2.07
I eat insects due to hunger	4.71	2.09

Note: Overall mean (M) = 2.99 and overall Standard deviation (SD) = 1.63; 1 = strongly agree; 2 = agree; 3 = slightly agree; 4 = neutral; 5 = slightly disagree; 6 = disagree; 7 = strongly disagree

Negative impressions for eating insects as food

Table 3 shows the negative impressions that consumers complained of as being made by those who did not accept insects as food. Majority of the respondents (57.7%) did not complain of any negative impressions from their colleagues for consuming insects. Some respondents had more than one negative impressions (53.1%). Some of the negative impressions include 'insect food is strange to eat' (17.4%), 'insect food is for the poor' (10.2%), 'insect food is poisonous' (8.9%), 'I fear to eat insect food' (6.2%), 'I will have low public image for eating insect food' (3.0%) and 'my culture does not accept insects as food' (1.6%).

Table 3. Reasons for negative impressions for consuming insects based on 276 responses

Negative impressions from non- consuming colleagues	Frequency	Percent (%)
No	376	57.7
Yes	276	42.3
Reasons for Yes (multiple responses n = 305)		
Insect food is strange to eat	52	17.4
Insect food is for the poor	31	10.2
Insect food is poisonous	27	8.9
I fear to eat insect food	19	6.2
I will have low public image for eating insect food	9	3.0
Cultural barrier	5	1.6
More than one negative impressions	162	53.1

Types of insects/arachnids eaten by respondents

Table 4 show the types of insects that are consumed by the respondents. In this study, six edible insects and one arachnid have been identified including the bee larvae. Bee larvae were the most consumed (59.2%) in this study. The next most consumed insect was the shea tree caterpillars (42.0%) followed by cattle ticks (34.8%) which are arachnids and termites (26.7%). Palm weevil was the least consumed insect (0.3%). Plate 1 shows some of the insects and arachnid eaten by respondents.

Table 4. Types of insects/arachnids eaten by respondents based on 652 responses

Insect/Arachnid	Frequency	Percent
Bee larvae (a)	386	59.2
Shea tree caterpillars (b)	274	42.0
Cattle ticks / arachnid (c)	227	34.8
Termites (d)	174	26.7
Crickets (e)	16	2.5
Locust (f)	12	1.8
Palm weevil larvae (g)	2	0.3

Multiple responses (n = 1,091). Photos (a) to (g) are shown in Fig. 3.

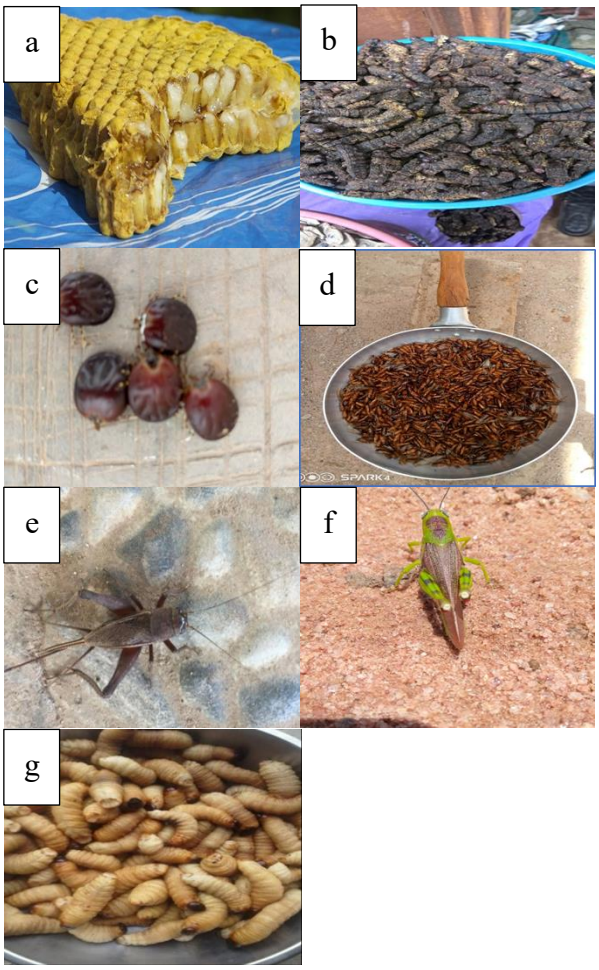


Plate 1. Some edible insects and arachnid eaten in the Upper West Region of Ghana

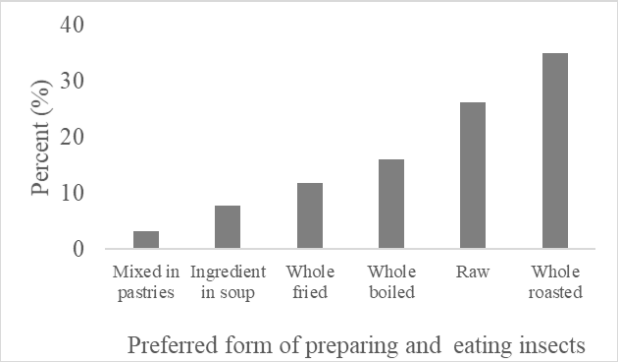
Labels a to g correspond to the labels in Table 4. Source: Field photos taken by researchers (caterpillars, cattle ticks, termites, crickets and locust), 2021; photo of bee larvae is by bugsfeed.com (https://www.mapotic.com/worlds-scariest-foods/111997-grilled-bee-honeycomb-with-larvae, accessed on 25th October, 2022); photo of palm weevil larvae is by Anankware JP, et al, [43].

Preferred form of preparing and eating insects (n = 652)

Figure 4 illustrates the preferred form of preparing and eating insects by respondents. Majority (39.9%) of respondents preferred roasted insects, followed by raw

insects (26.2%). About 16% of the respondents preferred whole boiled insects followed by whole fried (11.8%) and using insects as ingredients in soup (7.8%). The least preferred form of preparing and eating insects is to use it in pastries (3.2%).

Fig. 4. Preferred form of preparing and eating insects



Socio-economic variables influencing whether people eat insects or not

Table 5 shows the results of binary logit regression model with the estimated logistic regression estimates (β), standard errors (S.E.), Wald values and significance levels (ρ). Socio-economic predictors such as number of dependents, educational level, primary occupation, marital status, religion and ethnicity were not significant determinants of insects consumption at ($p < 0.05$). They were therefore removed from the set of predictors. There was 83.3% correct prediction and Nagelkerke R2 was 18.0%. The Hosmer and Lemeshow Test value (0.112) was not significant and thus suggesting a good model fit for the data.

Fig. 4. Preferred form of preparing and eating insects

Variable	B	S.E.	Wald	Sig.	Exp (B)
Age of respondents (continuous)	-0.069	0.010	46.864	<0.001	0.933
Gender of respondents	-0.966	0.204	22.510	<0.001	0.381
Constant	1.157	0.328	12.474	<0.001	3.180

Goodness of fit statistics:

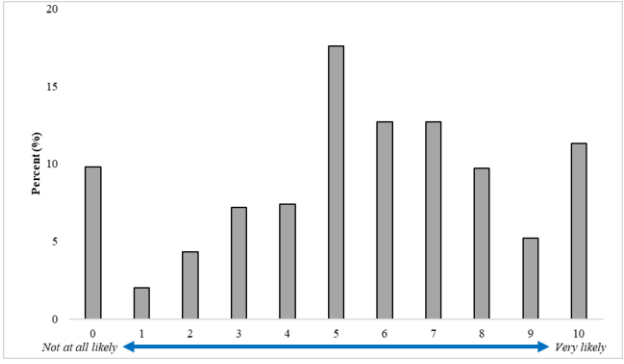
-2log likelihood ratio = 618.731; Hosmer and Lemeshow Test = 0.112

% Correct predictions = 83.3%; Nagelkerke R2 =18.0%

Recommending insect food to other people

Figure 5 shows how likely insect consumers would recommend insect food to other people on a ranking scale where 0 = not likely at all and 10 = extremely likely. About 52% of the respondents above point-five on the scale would very likely recommend insect food to other people.

Fig. 5. Recommending insect food to other people



DISCUSSION

The results of this study have useful information on entomophagy and alternative protein supply for the Ghanaian people. The age group was generally young with majority of them below the age of 60 years which is the retiring age for Civil Service and Public Service workers in Ghana. This finding on age group agrees with a report of insects' consumers in Ghana [43]. Majority of the respondents were from the Wa municipal which is the capital town of the Upper West Region while the least number of respondents were from Daffiamah-Bussie-Issah which is the youngest district in the region. Christians were the majority which is consistent with the 2020 population census of Ghana [44]. Most respondents were married and majority of respondents had less than five dependents. Greater number of respondents had formal education from basic to tertiary level. Similar results on education have been found on insects' consumers in Ghana [43]. The primary occupation for most respondents was farming which is contrary to the findings by Anankware JP, et al [43]. In this study, majority of the respondents were Dagaaba while Fulani, Frafra and Kasena constituted minor ethnic settlers.

Acceptance of insects as food and the gender that is more involved in insect collection in the Upper West Region of Ghana were graphed in Figure 2. The result shows that insects could easily be promoted as an alternative protein source. The respondents indicated that men were more involved in the collection of insects than women. This may be due to the inclusion of bee larvae which is harvested mainly by men.

Analyses on the means of 'it is convenient eating insects', 'insect foods are natural', 'my culture accepts edible insects', 'I have experience of eating insects', 'nutrients are higher in insect foods', 'insect foods are medicinal', and 'it is pleasurable eating insects food' on the Seven-Point Likert revealed lower means values than the overall mean value and therefore were the influential factors for the consumption of insects. Majority of respondents agreed that insect food is natural and therefore would eat it if available which corroborates a previous study [45]. Many naturalists agree that insects eat leaves and grasses and therefore are non-poisonous [46, 47]. This assertion is wrongly perceived since evidence of pesticides residues, bacterial and fungal contamination have been reported [46]. All the same, consumers will accept and patronize insect foods when they perceive naturalness in them [45,48]. Entomophagy has been a long traditional practice in Africa, Asia and Central America [14]. However, insect consumption has not been culturally accepted in many European countries [45, 49, 50, 51, 52]. In this study, culture plays a vital role for the acceptance of insects as food. Paoletti MG [53] and Choo J [54] reported that entomophagy is mainly practiced by the indigenous tribes in Africa, parts of Asia and the Americas. A study by on the purpose of insect husbandry or insect harvesting [43] on the purpose of insect husbandry or insect harvesting showed that many Ghanaians would practice insect husbandry or harvest them mainly for protein because it is culturally accepted as food. Familiarity of eating insects is a factor for acceptance of consumption [52, 55]. Thus, people who have had experience of eating insects are more likely to accept them as food, which

corroborates the findings of this study. There is enormous literature on the nutritional content of insect food. Studies show that insects contain higher nutrients composition [2, 36, 39, 56, 57, 58, 59] and health benefits [14, 37]. Insect consumers in Brazil and Colombia have revealed that insects have some medicinal properties apart from consuming them as food [60]. In Ghana, a similar reason has been reported by Anankware JP, et al [43]. Insects like locust, crickets and grasshoppers have been found to contain medicinal compounds such as sterol which can help eliminate bad fat and cancers in humans [61]. Although some studies have shown that entomophagy is associated with friendly environment [11, 15, 36, 37, 58, 63, 64] and hunger or starvation [69], such findings are contrary to the results of the current study. Also, respondents did not agree that collection of insects is easy. This may be due to the small size of insects requiring a lot of time to gather or harvest them. This finding agrees with that of Gahukar RT [46] who found that the small size of insects makes it difficult to collect and process.

The study was also analyzed to determine negative impressions for eating insect foods among respondents. Though majority according to the result did not receive negative impressions for consuming insects, about 43% of respondents had some negative impressions for consuming insects. Some of the negative impressions include ‘insect food is strange to eat’, ‘insect food is for the poor’, ‘insect food is poisonous’, ‘I fear to eat insect food’, ‘I will have low public image for eating insect food’ and ‘my culture does not accept insects as food’. Also, about 53% of the respondents had more than one negative impressions for consuming insect foods. Insect neophobia (the fear of eating insects) has been reported in several studies [38]. As stated by Deroy O et al, [70], acceptability of insects as food is largely based on perceptions. Therefore, one way of encouraging acceptability of entomophagy is to reduce the individual negative attitudes toward insect consumption [71].

According to the several reports [2, 21, 22], insects that are frequently eaten worldwide include beetles, caterpillars, wasps, grasshoppers, ants, locusts, crickets, cicadas, leafhoppers, planthoppers, scale insects, flies, termites, dragonflies and true bugs. Nine edible insects (beetle larvae, termite, grasshopper, shea tree caterpillar, palm weevil larva, ground cricket, house cricket, field cricket and locust) have been identified recently in Ghana and all except beetle larvae can be found in the Upper West Region [43]. Bee larvae were not considered as insects in their study. The large consumption of bee larvae (honey brood) maybe due to the enormous nutritional and medicinal properties in honey and honey brood which is corroborated by several studies. Honey brood contains several minerals, essential amino acids and the B-vitamins [72]. The medicinal properties of bee products include stress reduction, reduction of body weakness, improvement of sleep [73] and the ability to function as an antiemetic [74]. The minimal consumption of palm weevil in this study is at variance with a study by Anankware [43] who found that the most consumed insects among Ghanaians is the palm weevil. This may be due to limited geographical distribution for this insect since it inhabits the palm tree mostly found in the southern parts of Ghana.

The result in Figure 4 shows that eating insects raw is the second most preferred form of preparing and eating insects. The preference for the raw insects may be due to the inclusion of honey brood which is always eaten raw. The least preferred form of preparing and eating insects is to use it in pastries. Boiled, fried, raw and roasted insects are usually fully visible after preparation and serving. Tan HSG et al, [75] showed three different ways of serving insects. These included serving whole insects (fully visible), mixing with other food (partially visible) and used as ingredients in food (invisible). The result of this study corroborates that of Kennedy OP [76] who posited that majority of people who eat insects prefer them whole. The finding however opposes those of two reports [45, 77] which showed that many consumers would prefer insects as mixed ingredients to partially or visibly served insects.

The result of the binary estimation shows that the log odd of younger people eating insects is lower than older people. This result supports the findings of Dupont J [78] who posited that older people are more willing to accept insect-based food than younger people. This finding contradicts the results of Tan HSG [75] and Verbeke W [79] who observed that young people are more inquisitive to try new food such as insects than older people. Female was coded as the reference variable for gender and the result shows that males eat more insects than females. Based on the log odd ratios, the chance of males accepting insects as food was 61.9% compared to their female counterparts. This finding contradicts Muhammad R [80] who found that females were less insect neophobic and easily accept them as food than males. The result however supports the finding of the findings of Orkusz et al [81] indicating that the chance of men accepting insects in the diet was 92.0% than females.

The ten-point ranking scale for how likely respondents would recommend insect food to other people generally suggest that majority of respondents were very likely to tell other people to consume insects as food.

CONCLUSION

Entomophagy is a traditional dietary practice among all the ethnic groups in the Upper West Region. Six insects and one arachnid were identified as food sources in the region. Many factors influenced the consumption of insects in the region. The major factors were convenience of eating insects, the naturalness of insects, cultural acceptability, experience of eating insects, nutrients quality, medicinal characteristics of insects and the pleasure enjoyed from eating insects. Despite the fact that entomophagy is a traditional dietary practice in the region, consumers still receive negative impressions from non-consumers. The findings of this study provide useful information for governments, researchers and Non-governmental Organizations who are interested in nutrients diversity projects in the Upper West Region.

Limitation of the study

The study used a non-probabilistic sampling method which makes it difficult to generalize the results. Also, the study was limited by lack of studies on edible insects in North-western Ghana apart from Anankware JP [43] who also limited their study to only two

communities.

Conflict of interest

The authors of this study declare that there is no conflict of interest on this study with any organization.

Acknowledgement

We would like to thank the respondents who participated in this survey for their cooperation. This study was financially supported by Ajinomoto Foundation AIN program to GIfT.

Appendix: QUESTIONNAIRE

Title: An exploration study of entomophagy in North-Western Ghana for alternative and sustainable protein supply

The researchers kindly request that you complete this questionnaire regarding the types of insects you eat, factors that influence your consumption for edible insects and negative impressions for consuming insects. The data provided will be held confidential by the researchers. Your responses will be used for academic purposes only. This survey will take you less than ten minutes to answer.

Sincerely,

Titus S.S. Dery

0207452002 / 0246856786

SECTION A

Personal details of respondents (please tick where appropriate).

A. Demographics of respondents

1. Gender 1=Male
   2=Female
2. Age…….
3. Ethnicity…….
4. Home district in Upper West Region……
5. Religion 1=Christianity
   2=Muslim
   3=Traditional
   4=other (specify)
6. Marital status 1=single
   2=married
   3=separated
   4=divorced
   5=widowed
7. Number of dependents……..
8. Level of education
   1=none
   2=basic
   3=senior high
   4=tertiary

How best would you describe your occupation

1=farmer
2=educator
3=researcher
4=unemployed
5=student
6=self employed

B. Insect consumption experience

9. Do you eat any kind of edible insects such as termites, bees larvae, caterpillar, cow ticks etc.?

   1 = yes

   2 = no

10. What best describes your preferred form of eating insects

    1=Whole boiled

    2=mixed with flour products

    3=as an ingredient in soup

    4=raw

    5=whole fried

    6=whole roasted

C. Factors influencing entomophagy

On a 7 point Likert scale, what best describes your adoption of insects as food

1=strongly agree 2=agree 3=slightly agree 4=neutral 5=slightly disagree 6=disagree 7=strongly disagree	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. I accept insects food because it has higher nutrients							
2. I accept insect foods because some are medicinal							
3. I accept insects food because they are natural food							
4. I good experience of eating insect food							
5. I eat insects food because my culture eats it							
6. I eat insects food because it has a pleasant taste							
7. I eat insect food because of hunger due to poverty							
8. I eat insect food because it is easier to collect							
9. I eat insect food because it is convenient							
10. I eat insects food because it makes the environment safer							

1. Which gender is more involved in the collection of insects in your community?

   1=women 2=men

2. Do you have negative impressions from people for you eating insects?

   1=yes 2=no

3. What are the reasons for the negative impressions from people in question 13?

   1=insect food is for the poor

   2=insects food is strange to eat

   3=insect food is poisonous

   4=I will have low public image

   5=cultural barrier

   6=I fear to eat insect food

4. List the kinds of insects you consume……

   ……

On a scale of 0 to 10, how likely is it that you would recommend insects food to a friend or colleague, where

0 is "Not at all likely" and 10 is "Very likely"?

0=Not at all likely	1	2	3	4	5	6	7	8	9	10= Very likely

Thank you very much for your time

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