Original Research Article

COMPARING THE NUTRITIONAL COMPOSITION OF SOME EDIBLE INSECTS AND SOME ANIMAL MEATS IN NORTH-WESTHERN STATE OF NIGERIA

ABSTRACT

Five different edible insects from Kaduna, Kebbi, Niger, Sokoto and Zamfara States of North-Western Nigeria, namely; Red Locust *(Nomadacris setemfasciata),* Desert Locust *(Schistocerca gregaria),* Variegated Grasshopper *(Zonocerus wariegatus),* Termite *(Macrotermes bellicosus)* and Brown Cricket *(Gryllotapha Africana),* were collected alongside with meats from camel *(Camellus dromedaries),* Cow (*Bos indicus),* Ram (*Ovis aries),* Chicken *(Gallus gallus),* and Fish (*Clariaslazera).* The insects were oven dried separately at 60^{O}C for 3-5hrs while the meats were dried at 60^{O}C for 48hrs. The dried contents of both the insects and the meats were ground separately and each was subjected to proximate analysis. The results indicated the nutrient to have Carbohydrates ranging between 0.7g-12.1g in the insects and 0.4g-10.2g in the meats, Proteins ranging from 12.6g -57.3g in the insects and 18.1g – 70.4g in the meats, Fats, Fibre, Ash and Moisture having ranges between 5g-17.9g, 5g-20g, 4g -10g, 11.5g-53.6g, respectively in insects and 18.4g-70.4g Fats, 5g Fibre, 2.4g-10.4g Ash and 13.4g-59g moisture in the meats. Equally, the minerals showed varied in both the insects and the meats. Statistical comparison of the means of the results showed that the Carbohydrates, the Protein and the Fibre do not differ ($P<0.0$) significantly in both the insects and the meats. Similarly Copper, Iron, Sodium, Calcium, Magnesium and Potassium do not differ significantly in the two groups. This suggested that insects as diet when taken in required amount can meet the protein requirement of the human body and can therefore supplement animal meats in our diets.

Key words: Edible insects, Animal meat and nutrient composition.

INTRODUCTION

Insects have been used as food by man ever since his creation when he converted many available resources in the universe into food [1]. Insects are the cheapest source of animal protein, and their consumption has been encouraged due to the inability of low income people to afford fish or animal protein [2.3]. Insects have been reported to be an important source of protein, vitamins, minerals and fats in many countries [4, 5]. Insects are also described by [6] as tasty, nutritional and high protein source.

Ordinarily, insects are not only used as emergency food but are included as part of the diet throughout the year or when seasonally available [7]. Different types of insects are being eaten in

different parts of the world, sometimes only the adults were eaten or larval stages or just some parts of the insect's body [8, 9].

In many parts of the world today, insects are considered as stable food possibly because they are good source of protein, easy to find, occupy a little space and have great nutritional value [4]. Food supplies in many African countries are inadequate in quantity and quality contributing to wide spread of malnutrition [10]. Therefore insects could be used in solving the problems of malnutrition in Africa.

In Nigeria, reports have shown that eating insects has contributed significantly to the reduction in protein deficiencies [11]. Locusts, Grasshoppers, Termites, Beetles and Crickets are variously reported as being consumed by different communities, ranging from stable food sources to highly sought delicacies in different parts of Nigeria [7]. More than 1000 species of insects are safe to eat, some insects are distasteful or harmful and in some cases people can even develop allergies to insect's materials [13].

The present work compares proximate composition of five different edible insects with meats from five different animals commonly consumed in North –Western Nigeria.

MATERIALS AND METHODS

Insects for this study were collected from four Local Government Areas in five states each of North-Western Nigeria namely; Kaduna, Kebbi, Niger, Sokoto and Zamfara states respectively which are located between longitude $9^{O}\ 10^{1}$N and $13^{O}\ 50^{1}$N and latitude $3^{O}\ 35^{1}$E and $9^{O}\ 00^{1}$E and it covers an area of about 223,150.39 KM^2. The region has a projected population of 54,077,402.95 million people (National Population Commission [NPC], [14]

The survey of edible insects and vertebrate meats conducted in the study area, the following insects and vertebrates were identified as the most preferred edible insects and vertebrate meats; Red Locust (*Nomadacris septemfasiata)* Desert locust *(Schistocerca gregaria)* Variegated grasshopper *(Zenocerus variegatus),* Termite reproductive forms *(Macrotermes bellicosus),* Brown Cricket (*Gryllotapha africana)* and the beetle was not used for this study, while the vertebrates selected were *C. dromedaries, B. indicus, O. aries, G. gallus and C. lazar.*

Sample preparation: Separate samples were prepared for each insect collected. They were then oven-dried for 3-5hrs at 60^{O}C and ground separately using pestle and mortar in the laboratory and placed in Petri-dishes separately. Crucible, Petri-dishes and flasks were used in taking different samples for analysis.

Meats were collected fresh from the market (Sokoto central market). Sokoto State is located at the extreme of North Western part of Nigeria within the Sudan Savannah zone and lies between latitudes 12^{0} and 13^{0} 05'N and longitudes 4^{0} 8' and 6^{0} 4'E [14]. They were oven-dried for 48 hrs at 60^{O}C until properly dried. The meats were ground separately using pestle and mortar in the laboratory, crucibles, desiccators, Petri-dishes and flasks were the containers used in taking different samples for analysis of different parameters. Two grams of each sample was taken separately and analyzed for each parameters both insects and animal meats.

100g of the materials obtained were subjected to proximate analysis separately according to official methods of analysis recommended by [12]. Moisture content, fibre, free nitrogen extract, fats and mineral salts were determined and crude protein was obtained using the Kjeldahl technique [12].

The results obtained were tasted for significances between the composition in the insect's body and the animal meats using paired t-test with SPSS 16.0 for Windows statistical package.

RESULTS

The mean nutrient composition of the insects and the meats were shown in Table 1. The highest amount of carbohydrates was observed among the insects with *S. gregaria* having 14.17g per 100g, followed by *Z. variegatus* with 11.13g while *G. Africana* had the lowest content of 1.17g per 100g. Generally, carbohydrates were observed to be in all the animal meats studied ranging between 1.73g on *G. gallus* and 6.73g on *O. Aries.* Crude protein was higher on meats from the animals than in the insect. The highest amount of the protein per 100g of the sample was observed in C. *dromedarius (*70.57g) followed by *G.gallus* (65.77g). Fats were higher among insects than the meats with *M. bellicosus* having the highest with 17.63g per 100g the *N. setemfasciata* (13.33g). Among animal's meat, the meat from *B. indicus with* 11.3g had the highest then *O. Aries* with 10g. The fibre content was almost the same in the animal meats but was relatively higher in the insects, particularly, in *S. gregaria* with 18.33g and *N.*

Septemfasciata with 16.67g per 100g. *C. lazera* was observed to have the lowest values of the components except for moisture content where it ranked the highest with 58.07g per 100g. The ash was considerably low in all the organisms.

TABLE1: NUTRIENT COMPOSITION OF SOME EDIBLE INSECTS AND SOME ANIMAL MEATS
(Each observation was based on three replicates)

Insects/Meat	Carbohydrates (g)	Crude Protein (g)	Fat (g)	Fibre (g)	Moisture (g)	Ash (g)
N. septemfasciata	9.23	18.80	13.33	16.67	36.97	5.00
S. gregaria	14.17	16.40	6.67	18.33	39.53	5.00
Z. variegates	11.13	25.13	6.67	11.67	42.07	5.00
M. bellicosus	6.27	12.93	17.63	6.67	51.63	5.00
G. Africana	1.17	57.07	13.30	5.00	11.77	10.0
C. dromedaries	3.90	70.57	8.33	5.00	14.50	2.70
B. indicus	5.87	62.30	10.33	5.00	16.00	5.00
O. aries	6.73	61.47	9.00	5.00	16.90	5.00
G. gallus	1.73	65.77	8.30	5.00	14.50	9.70
C. lazar	6.10	18.87	8.33	5.00	58.07	8.40

Sample ranging between 3.00 as the lowest observed on *C. lazar* and the highest amount of 25. 75 mg in *G. africana*. Phosphorus, sodium and potassium were considerably higher composition of mineral present in the entire samples while magnesium was variable among in all the samples

TABLE 2: MINERAL CONTENTS OF SOME EDIBLE INSECTS AND SOMEANIMALS MEATS
(Each Observation was based on three replicates)

Insects/Meat	Copper (mg)	Iron (mg)	Zinc (mg)	Phosp (mg)	Sodium (mg)	Calcium (mg)	Magnesium (mg)	Potassium (mg)
N. septemfasciata	1.17	9.00	0.34	80.43	271.70	30.80	65.00	1001.67
S. gregaria	0.67	4.92	0.41	92.80	163.00	17.07	32.58	490.27

Z. variegates	1.33	11.08	0.34	84.80	163.00	16.67	18.70	490.27
M. bellicosus	2.17	9.10	0.34	84.80	217.30	14.57	41.89	255.80
G. Africana	3.83	25.75	0.34	69.27	851.37	14.17	38.30	703.50
C. dromedaries	0.75	6.00	0.91	100.90	68.80	28.87	15.90	1278.80
B. indices	1.42	8.92	0.42	119.73	68.83	29.49	6.87	1278. 80
O. aries	1.08	7.00	0.34	67.27	14.50	25.33	22.00	1236.10
G. gallus	1.17	6.00	0.29	83.43	18.10	23.27	38.30	959.10
C. lazar	0.92	3.00	0.26	71.13	32.60	17.87	29.47	383.60

Statistical comparison of the means was conducted and the results presented in table 3, It indicated that were no significant differences between the means of proximate composition of insects and the animals meats on carbohydrates, protein, fibre, copper, iron, sodium, calcium, magnesium and potassium while only fats, moisture, ash, zinc and phosphorus differ at 5% level of significance.

TABLE 3: COMPARSION BETWEENS MEANS OF PROXIMATE ANALYSIS OF SOME EDIBLE INSECTS AND ANIMAL MEATS

Nutrients/Minerals (Means±SE)	**Edible Insects (Means±SE)**	**Animal Meats (Means±SE)**
Carbohydrates	8.39±1.40	4.87±0.74
Proteins	26.07±4.24	35.79±5.02
Fats	11.52±1.24*	9.26±0.56
Fibre	11.67±1.52	5.00±0.00
Moisture	36.39±3.55*	23.99±4.56*
Ash	6.00±0.55*	6.16±0.69*
Copper	1.83±0.30	1.07±0.09
Iron	11.97±1.98	6.18±0.52
Zinc	0.36±0.01*	0.44±0.13*
Phosphorus	82.42±2.06*	88.49±5.27*
Sodium	3.332±70.5	40.57±6.91
Calcium	18.65±1.67	24.97±1.29
Magnesium	39.30±4.22	22.51±3.10
Potassium	5.882±67.54	1.033±92.02

DISCUSSIONS

The proximate analysis of the edible insects conducted showed that the insects have almost all the nutrients required by human body. The organic compound observed from the analysis of the insects bodies were proteins, fats, and carbohydrates in varying amounts. Similar observations were made by Omotoso (2006), who showed that the larvae of *Cirina forda* contained high levels of protein with ash, moisture, fats and carbohydrates. [15] reported that large grasshoppers have 14.2 percent of protein, 3.3 percent fats, and 2.2 percent carbohydrates while termites have 14.2 percent protein, 28 percent fats, 2.7 percent fibre and 44.5 percent moisture. They showed that fibre could be found in the nutrient content of insects despite the previous assertion by [16]. However, [16] finding could be related to the insect he worked with, being a Lepidopteran Larva. From the result, it was observed that meats from animals and insects both have nutritional values that varied in minor respects. It was also observed that some insects have higher moisture content and protein that are relatively no significant ($P>0.05$) difference compared to those found in animal meats. Though insects have good nutritional composition, in case of carbohydrate the highest percentage was found in insects (*S. gregeria*) with 14.17 compared to vertebrate meats (*0. aries*) which has 6.97. Whereas, highest percentage of protein was found in vertebrates (*C. dromedaries*) 70.57 compared to insects (*G. africana*) with 57.07.

CONCLUSION

In conclusion insects have moisture, good percentage of protein than other nutrients. Animal meat also reveals high protein content and other nutrients with little variations. Insects therefore when taken in required amount can supplement animal protein, particularly those that cannot afford animal protein because of the cost. These insects can be collected freely and everywhere without cost and have all the nutritional requirements needed by the body, they also don't have cholesterol which can be a problem to human health particularly in advance age. Therefore, where meat is not readily available or cannot be afforded, insect's diet can supplemented for animal protein.

AUTHORS' CONTRIBUTION

The research work was carried out in colorations with all Authors. Authors HAS designed the study, managed the literature searchers and wrote the protocol and the first draft of the manuscript. Authors QM, HMB, MMY and IA finished the design, protocol and check the draft report. All Authors read and approved the final manuscripts.

Competing interests

All Authors have declared that no competing interests exist.

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