

**COMPARING THE NUTRITIONAL COMPOSITION OF SOME EDIBLE INSECTS
AND SOME ANIMAL MEATS IN NORTH-WESTERN 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 variegatus*), Termite (*Macrotermes bellicosus*) and Cricket (*Gryllotapha Africana*), were collected alongside with meats from camel (*Camellus dromedaries*), Cow (*Bos indicus*), Ram (*Ovis aries*), Chicken (*Gallus gallus*), and Fish (*Clariaslazera spp.*). The insects were oven dried separately at 60^oc for 3-5hrs while the meats were dried at 60^oc for 48hrs. The dried contents of both the insects and the meats were grounded 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 Proteins and the Fibre do not differ 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 up with protein requirements of 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 (Richard, 1993). 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 (Paul and Sudipta, 2011). Insects have been reported to be an important source of protein, vitamins, minerals and fats in many countries (Bailey, 1999 and Defoliart, 1975). Insects are also described by Michael (1978) as tasty, nutritional and high protein source.

37 Ordinarily, insects are not only used as emergency food but are included as part of the diet
38 throughout the year or when seasonally available (Banjo, *et al.*, 2006). Different types of insects
39 are being eaten in different parts of the world, sometimes only the adults were eaten or larval
40 stages or just some parts of the insect's body (Ene, 1963 and Gene, 1988).

41 In many parts of the world today, insects are considered as stable food possibly because they are
42 good source of protein, easy to find, occupy a little space and have great nutritional value
43 (Bailey, 1999). Food supplies in many African countries are inadequate in quantity and quality
44 contributing to wide spread of malnutrition (Allotey, 2003). **Therefore insects could be used in**
45 **solving the problems of malnutrition in Africa.**

46 In Nigeria, reports have shown that eating insects has contributed significantly to the reduction in
47 protein deficiencies (Ashiru, 1988). Locusts, Grasshoppers, Termites, Beetles and Crickets are
48 variously reported as being consumed by different communities, ranging from stable food
49 sources to highly sought delicacies in different parts of Nigeria (Banjo, *et al.*, 2006). More than
50 1000 species of insects are safe to eat, some insects are distasteful or harmful and in some cases
51 people can even develop allergies to insect's materials (Mpunchare *et al.*, 1975).

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

54 **MATERIALS AND METHODS**

55 Insects for this study were collected from four **Local Government Areas** each, from Kaduna,
56 Kebbi, Niger, Sokoto and Zamfara states of North-Western Nigeria located between **longitude**
57 **10°N and 15°N and latitude 5°E and 10°E.**

58 From initial survey of edible insects within the study area conducted at the onset of the study, the
59 following insects were identified as the most preferred edible insects; Red Locust (*Nomadacris*
60 *septemfasciata*) Desert locust (*Schistocerca gregaria*) Variegated grasshopper (*Zenocerus*
61 *variegates*), Termite reproductive forms (*Macrotermes bellicosus*), Brown Cricket (*Gryllotapha*
62 *Africana*) and **Beetle (*Melolantha spp.*)**, out of which five were selected based on preference.

63 The selected insects were; Red Locust (*Nomadacris setemfasciata*), Desert Locust (*Schistocerca*
64 *gregaria*), Variegated Grasshopper (*Zenacerus variegates*), Termite *reproductive formes*

65 (*Macrotermes bellicosus*) and Brown Cricket (*Gryllotapha Africana*). These insects were then
66 oven-dried for 3-5hrs at 60^oc and grounded separately and placed in separate petri-dishes.

67 100g of the materials obtained were subjected to proximate analysis separately according to
68 official methods of analysis recommended by AOAC (2000). Moisture content, fibre, free
69 nitrogen extract, fats and mineral salts were determined and crude protein was obtained using the
70 **Kjeldahl technique**.

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

73 **RESULTS**

74 The mean nutrient composition of the insects and the meats were shown in Table 1. The highest
75 amount of carbohydrates was observed among the insects with *S. gregaria* having 14.17g per
76 100g, followed by *Z. variegatus* with 11.13g while *G. Africana* had the lowest content of 1.17g
77 per 100g. Generally, carbohydrates were observed to be in all the animal meats studied ranging
78 between 1.73g on *G. gallus* and 6.73g on *O. Aries*. Crude protein was higher on meats from the
79 animals than in the insect. The highest amount of the protein per 100g of the sample was
80 observed in *C. dromedarius* (70.57g) followed by *G.gallus* (65.77g). Fats were higher among
81 insects than the meats with *M. bellicosus* having the highest with 17.63g per 100g the *N.*
82 *setemfasciata* (13.33g). Among animal's meat, the meat from *B. indicus* with 11.3g had the
83 highest then *O. Aries* with 10g. The fibre content was almost the same in the animal meats but
84 was relatively higher in the insects, particularly, in *S. gregaria* with 18.33g and *N.*
85 *Septemfasciata* with 16.67g per 100g. *C. lazera* was observed to have the lowest values of the
86 components except for moisture content where it ranked the highest with 58.07g per 100g. **The**
87 ash was considerably low in all the organisms.

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96 **TABLE1: NUTRIENT COMPOSITION OF SOME EDIBLE INSECTS AND SOME ANIMAL**
 97 **MEATS**

98 (Each observation was based on three replicates)

Insects/Meat	Carbohydrates (g)	Crude Protein (g)	Fat (g)	Fibre (g)	Moisture (g)	Ash (g)
<i>N. septemfasciata</i>	9.23	18.80	13.33	16.67	36.97	5.00
<i>S. gregaria</i>	14.17	16.40	6.67	18.33	39.53	5.00
<i>Z. variegates</i>	11.13	25.13	6.67	11.67	42.07	5.00
<i>M. bellicosus</i>	6.27	12.93	17.63	6.67	51.63	5.00
<i>G. Africana</i>	1.17	57.07	13.30	5.00	11.77	10.00
<i>C. dromedaries</i>	3.90	70.57	8.33	5.00	14.50	2.70
<i>B. indicus</i>	5.87	62.30	11.33	5.00	16.00	5.00
<i>O. Aries</i>	6.73	61.47	10.00	5.00	16.90	5.00
<i>G. Gallus</i>	1.73	65.77	8.30	5.00	14.50	9.70
<i>C. Lazar</i>	6.10	18.87	8.33	5.00	58.07	8.40

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100 Sample ranging between 3.00 as the lowest observed on *C. lazar* and the highest amount of 25.
 101 75 mg in *G. Africana*. Phosphorus, sodium and potassium were considerably higher composition
 102 of mineral present in the entire samples while magnesium was variable among in all the samples

103 **TABLE 2: MINERAL CONTENTS OF SOME EDIBLE INSECTS AND SOMEANIMALS MEATS**
 104 (Each Observation was based on three replicates)
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Insects/Meat	Copper (mg)	Iron (mg)	Zinc (mg)	Phosp (mg)	Sodium (mg)	Calcium (mg)	Magnesium (mg)	Potassium (mg)
<i>N. septemfasciata</i>	1.17	9.00	0.34	80.43	271.70	30.80	65.00	1001.67
<i>S. gregaria</i>	0.67	4.92	0.41	92.80	163.00	17.07	32.58	490.27
<i>Z. variegates</i>	1.33	11.08	0.34	84.80	163.00	16.67	18.70	490.27
<i>M. bellicosus</i>	2.17	9.10	0.34	84.80	217.30	14.57	41.89	255.80
<i>G. Africana</i>	3.83	25.75	0.34	69.27	851.37	14.17	38.30	703.50
<i>C. dromedaries</i>	0.75	6.00	0.91	100.90	68.80	28.87	15.90	1278.80
<i>B. indices</i>	1.42	8.92	0.42	119.73	68.83	29.49	6.87	1278.80
<i>O. Aries</i>	1.08	7.00	0.34	67.27	14.50	25.33	22.00	1236.10
<i>G. Gallus</i>	1.17	6.00	0.29	83.43	18.10	23.27	38.30	959.10
<i>C. Lazar</i>	0.92	3.00	0.26	71.13	32.60	17.87	29.47	383.60

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107 Statistical comparison of the means was conducted and the results presented in table 3,

108 It indicated that were no significant differences between the means of proximate composition of
 109 insects and the animals meats on carbohydrates, protein, fibre, copper, iron, sodium, calcium,
 110 magnesium and potassium while only fats, moisture, ash, zinc and phosphorus differ at 5% level
 111 of significance.

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113 **TABLE 3: COMPARSION BETWEEN MEANS OF PROXIMATE ANALYSIS OF SOME**
 114 **EDIBLE INSECTS AND ANIMAL MEATS**

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Nutrients/Minerals (Means±SE)	Edible Insects (Means±SE)	Animal Meats
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	3.33E2±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	5.88E3±67.54	1.03E3±92.02

116 Values with asterisk (*) within the same row are significantly different at (P<0.05).

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119 **DISCUSSION AND CONCLUSION**

120 The proximate analysis of the edible insects conducted showed that the insects have almost all
 121 the nutrients required by human body. The organic compound observed from the analysis of the
 122 insects bodies were proteins, fats, and carbohydrates in varying amounts. Similar observations
 123 were made by Omotoso (2006), who showed that the larvae of *Cirina forda* contained high levels
 124 of protein with ash, moisture, fats and carbohydrates. **However, Omotoso (2006) indicated that**
 125 **fibre was not detected.** Vandky (2000) reported that large grasshoppers have 14.2 percent of
 126 protein, 3.3 percent fats, and 2.2 percent carbohydrates while termites have 14.2 percent protein,
 127 28 percent fats, 2.7 percent fibre and 44.5 percent moisture. The showed that fibre could be
 128 found in the nutrient content of insects despite the previous assertion by Omotoso (2006).
 129 However, Omotoso's finding could be related to the insect he worked with, being s Lepidopteran
 130 Larva. From the result, it was observed that meats from animals and insects both have nutritional

131 values that varied in minor respects. It was also observed that some insects have higher moisture
132 content and protein that are relatively similar to those found in animal meats. Insects therefore
133 can be consumed to obtain the body nutritional requirement as can be obtained from animal
134 meats. Therefore, where meat is not readily available or cannot be afforded, insect's diet can be
135 supplemented.

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