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Proximate, mineral and fatty acids composition of sugar ant (*Componotus consubrinus*) from paikoro local governvent, Niger state, Nigeria

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ABSTRACT

The proximate, minerals and fatty acids composition of sugar ant (Coponotus consubrinus) was conducted. The results showed that it contained high amounts of protein 31.86±0.24%) with moisture, ash, crude fibre, crude fat, carbohydrate levels and energy level being 2.95±0.09%, 4.24±0.11%, 6.49±0.87%, 13.29±0.39%, 41.16±1.55% and 1733.07±0.21KJ/ 100g respectively. The insect was found to be a good source of minerals which contained high proportions of Na, K, P, Ca, Zn and Fe as 121.45±0.45, 83.40±0.45, 107.87±1.50, 18.60±0.58, 15.53±1.03, 15.13±2.64 and 98.27±2.08mg/100g respectively. The results of fatty acids compositions revealed that sugar ant contain 1.08% TUFA/TSFA ratio which indicated that, this insect have lowest desirable level of cholesterol with reduced coronary heart problem. The results of this finding revealed that, this insect could serve as an alternative source of protein, crude fat, carbohydrate and essential minerals needed for a well balanced nutritional diet for humans and as a feed supplement.

Introduction

Insects are the most successful group of animals constituting about 76% of known species (Omotoso, 2005). They affect man either as destroyers of man's valuable materials and crops or as sources of his nutrients. Globally, the use of insects as an alternative source of animal protein has been appreciated, especially for the rural populace; where meat from either domesticated or wild animals is very scarce or expensive (Mwizenge, 1993). In fact, it has been asserted that an increase of about 10% in the production and consumption of edible insects in the world is capable of decreasing the pressure on the protein demand of man from other animal source (Agbidye and Tyokever, 2009). In this vein, selected insects have been employed for direct consumption by man as nutritive supplements or used as feeds for animals like fish and poultry (Paoletti, 2003). The high cost of animal protein, which is beyond the reach of the poor has greatly encouraged entomophagy (the practice of eating insects). According to Hema, *et al*. (2007), insects are also believed to have a higher proportion of protein and fat than beef and fish with a high energy value. Depending on the species, caterpillars are rich in minerals such as potassium, calcium, magnesium, zinc, phosphorus and iron, as well as various vitamins. Research shows that 100 grams of insects provide more than 100% of the daily requirements of the respective minerals and vitamins.

Sugar ant (*Componotus consobrinus*) also known as the banded sugar ant, is a relatively large ant identifiable by its orange-brown body with a black head bearing a protruding pair of mandibles. It belongs to the family of insects called Formicidae. It is known by various names like *Kantikanti* in Nupe, *Shazumamu* in Hausa, *Era-sugar* in Yoruba and *Ahuhu-ocha* in Igbo (Kirton and Brown, 2003). Although the sugar ant's name comes from its liking for sugar, it is also attracted to other savoury foods. Although this insect is commonly referred to as a pest, it has been reported to have a painless bite (Kirton and Brown, 2003). Contrary to popular belief, the sugar ant is not related to the bulldog ant, although they share similar coloration, like the red and black sections of their bodies. This insect is found in many parts of the world, including Nigeria. It forms one of the largest groups of ants in Australia and US with varying species having different shapes, sizes and colours.

There is limited literature data on the nutritional composition of these popular insects among the communities. This study reports the proximate, mineral and fatty acids composition of this insect.

Materials And Methods

Sample collection:

The Sugar ants (Componotus consobrinus) were harvested from several anthills between the months of April and June, 2012 at Paiko village in Paikoro Local Government Area in Niger State, Nigeria. They were washed with distilled water, sun-dried for about 48 hours and finally ground into powder and stored in air-tight containers for further analyses.

Methods

Moisture content

2g of each sample were put into the crucible, dried in an oven (Leniscope, England) at 1050c overnight. The dried samples were cooled in a dessicator for 30 minute and weighed. The percentage loss in weight was expressed as percentage moisture content (AOAC, 1999).

Ash content

2.00g of each of the grounded samples were placed in each crucible and ashed in a muffle furnace (Lenton Furnaces, England) at 600^0C for 3 hours. The hot crucibles were cooled in a dessicator and weighted. The percentage residual weighed was expressed as ash content (AOAC, 1999).

Crude lipid content

2.00g of each sample were used for determining crude lipid by extracting lipid from it for 5 hours with petroleum ether in a soxhlet extractor.

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Crude fibre content

2.00g of each sample were used for estimating crude fibre by acid and alkaline digestion methods with 20% H2SO4 and NaOH solution.

Carbohydrate determination

Available carbohydrate (%), = 100 – (protein (%) + Moisture (%) + Ash (%) + Fibre (%) + Fat (%)).

Metabolisable energy

The metabolisable energy was calculated in Kilojoules (kJ) by multiplying the crde fat, protein and carbohydrate values by Atwater factors of 37, 17 and 17 respectively.

Minerals analysis

Sodium and potassium were determined using Gallenkamp Flame analyzer, while calcium, magnesium, iron, manganese, zinc and copper were determined using Buch Model 205 Atomic Absorption Spectrophotometer. Phosphorus level was determined using the phosphovanado molybdate colorimetric techniques on JENWAY 6100 Spectrophotometer Pearson (1976).

Fatty acids compositions

The fatty acid analysis was carried out at the NIRRECT laboratories, in Zaria Kaduna state, Nigeria.The oil was first methylated by dissolving 0.2 g of the oil in a quickfit conical flask with 6 cm^3 of methanolic NaOH (2 g NaOH in $100cm^3$ methanol) and refluxed for 10 minutes. The methylated oil was dissolved in pure hexane and introduced into the injector of a GC/MS gas chromatographic system at an injection temperature of 250^0C using Helium as the carrier gas at a pressure of 100.2 kPa. The fatty acids were eluted as peaks whose retention times were measured by the spectrometer detector and compared with those of known standards of the Wiley library.

Results and discussion

Table 1. Proximate Composition (%) of Sugar ant (*Componotus consobrinus*)

Parameters	Concentration
Moisture	2.95±0.09
Ash	4.24±0.11
Crude protein	31.86±0.24
Crude fat	13.29±0.39
Crude fibre	6.49±0.87
Total carbohydrate	41.16±1.55
Energy value (kJ/100g)	1733.07±0.21

Values are means±SD of three determinations.

Table 2. Mineral Composition of Sugar ant (*Componotus consobrinus*)

Parameters	Concentration (mg/100g)
Na	121.45±0.48
K	83.40±0.45
P	107.87±1.50
Ca	18.60±0.58
Zn	15.53±1.03
Mg	15.13±2.64
Cu	6.33±1.80
Fe	98.27±2.08
Mn	18.53±0.70

Values are means±SD of three determinations.

The result of the proximate chemical composition of the *C. consubrinus* is presented in Table 1. The moisture content was 2.95±0.09%. This value was low compared with that of *Macrotermes bellicosus* -48.45±0.90% (Agomuo, 2011) and Palm beetle (*Orytes rhinoceros*)-16.70% (Onyeike, *et al.* 2005) which may be advantageous in view of the sample's shelf life. The ash content of *C. consubrinus* (4.24±0.11) was high, indicating that they could be a good source of mineral elements. This value was high compared with that of the larvae of dung beetle-2.74±0.10 (Paiko, *et al.*, 2012) but low compared with that of *C. Folda*-10.26±0.01% (Omotoso, 2006). The crude protein value of 31.86±0.24% recorded for *C. consubrinus* in this study showed that sugar ant could be a good source of protein and this value was high compared with the 22.42±0.10% reported for the dung beetle (Paiko, *et al.*, 2012). Similar high crude protein content has been reported (35.18±0.10, 33.41±0.20 and 36.45±0.02% in *l. belina*, *M. bellicosus* (Ekop *et al.*2010) and *O. monoceros* (Ifie and Emeruwa, 2011) respectively. The high protein content of this sample indicates that *C. consubrinus* could contribute significantly to the daily protein requirement of 23-56g for humans as recommended by National Research Council (NRC, 1974). Thus *C. consubrinus* could be a good source of protein for growing children, pregnant and nursing mothers as well as all those at risk of protein deficiency. Fats play a vital role in maintaining healthy skin and hair, insulating body organs against shock, maintaining body temperature and promoting healthy cell functions. It is also essential in diets as they increase the pleasant tastes of food by absorbing and retaining their flavours (Omotoso, 2006). The crude fat content of 13.29±0.39% recorded for *C. consubrinus* in this study was similar the 17.65±3.24% reported for *Z. Variegates* (Subhachai, *et al.* 2010) but lower than the 30.50±1.20% reported for the dung beetle (Paiko, *et al.*, 2012). The physiological role of crude fibre in the body is to maintain an internal distension for proper peristaltic movement of the intestinal tract (Oduor *et al*., 2008). The crude fibre content of *C. consubrinus* (6.49±0.87%) can be used to complement animal roughages. These results were lower than the respective 26.40±1.40 and 28.12±0.20% reported for edible black ants and dung beetle by Subhachai *et al*. (2010) and Paiko *et al*. (2012). They were however, higher than the 3.00% reported for yam beetle or the 2.56% reported for palm weevil by Adesina (2012). Diets with high fibre contents have been used for weight control and fat reduction as they give a sense of satiety even when small food is eaten (Ekop and Onigbinde, 2004).

Table 6. Fatty Acid Composition of the lipids Extracted from Componotus consubrinus

S/N	Fatty acid	Trivial name	Composition (%)
1	1-Methyl-2,3-dihydroindene		5.50
2	Azulene	Azumamic	5.23
3	Naphthalene		4.03
4	dodecanoic acid	lauric acid	2.48
5	Methyl tetradecanoate	myristic acid	3.57
6	9-Hexadecenoic acid	palmitoleic acid	9.55
7	Hexadecanoic acid	palmitic acid	5.21
8	9-Octadecenoic acid		13.34
9	Octadecanoic acid		5.30
10	8,11-Octadecadienoic acid		5.30
11	Eicosanoic acid	arachidic acid	3.11
12	Docosanoic acid	behenic acid	3.86
13	TUFA		42.95
14	TSFA		39.83
15	TUFA/TSFA		1.08

Therefore, these insects can be conveniently used to control human weight in nutrition. A human adult needs about 400-500g carbohydrate intake as starch (NRC, 1980). The total carbohydrate content of 41.16±1.55% obtained for *C. consubrinus* was higher than the 27.70±0.50% reported for *O. rhinoceros* and the 35.60±0.90% value reported for *R. pheonicis* (Onyeike, *et al.* 2005). The calculated energy value of 1733.07±0.21 kJ/100g of *C. consubrinus* were lower than the 2172-2600 kJ/100g reported for the larva of edible stink-bug by Teffo *et al*. (2007). They were however similar to the 1731.83 kJ/100g for edible larva of dung beetle reported by Paiko *et al*.

(2012). The differences in energy values between the study insect and that of literature could be attributed to differences in species of samples, the fat contents and other calorific components of each sample.

The mineral contents of the study insect were as presented in Table 2. These values showed that this insect contained appreciable amounts of iron, sodium, potassium, phosphorus, calcium, magnesium and zinc.

Potassium plays an important role in the human body and sufficient amounts of it in the diet protect against heart disease, hypoglycaemia, diabetes, obesity and kidney dysfunction. Adequate intake of this mineral from the diets has been found to lower blood pressure by antagonizing the biological effects of sodium (Einhorn and Landsberg, 1988). The level of Iron is high (98.27±2.08 mg/100g) and this was higher than the 30.85±0.31 mg/100g value obtained for the edible dung beetle and the 5.34±0.11 mg/100g for *C. forda* larvae by Paiko *et al*. (2012) and Omotoso, (2006). Since *C. consubrinus* is rich in iron, the blood building element, it would be desirable for consumption by humans and other animals. The amount of phosphorus was 107.87±1.50 mg/100g which was similar to the131.20±0.01 mg/100g value reported for the edible dung beetle Paiko *et al*. (2012). This value was however; lower than the 215.54±0.21 mg/100g reported for *C. forda* by Omotoso, (2006). The sodium and potassium contents of 121.45±0.45 and 83.40±0.45 mg/100g respectively were obtained in this study. Potassium intake has been found to lower blood pressure by antagonizing the biological effect of sodium (Einhorn and Landsberg, 1988). Zinc content of 15.53±1.03 mg/100g was obtained in this study which was higher than the 3.81±0.01 mg/100g reported for the red ant (Dunkel, 1996). Calcium content of 18.60±0.58 mg/100g was obtained and this was higher than the 11.72±0.02 mg/100g reported for the edible larva of dung beetle by Paiko *et al*. (2012). Calcium is a mineral that is essential to teeth and bone development thus this insect could be a good source of this element. The magnesium content of 15.13±2.64 mg/100g was found in this study while the copper content was found to be the least (6.33±1.80 mg/100g. The manganese content of 18.53±0.70mg/100g was obtained and all these values indicated that this insect can be consumed along with other foods rich in essential minerals for proper supply of these nutrients. The major saturated fatty acids in *C. consubrinus* (Table 3) were lauric, myristic, palmitic, behenic, arachidic and stearic acids, while the major unsaturated fatty acids were azumamic and other compounds whose trivial names were not identified. While the saturated fatty acids accounted for 39.83% of the total fatty acids, the unsaturates accounted for 42.95%. The ratios of the total unsaturated fatty acids to the total saturated fatty acids (TUFA/TSFA) of *C. consubrinus (*1.08%) is expected to have the lowest desirable level of cholesterol with reduced coronary heart problem (Mann, 1993). This value was higher than a TUFA/TSFA ratio obtained for the dung beetle (0.86%) reported by Paiko *et al. (*2012). Therefore this oil is expected to have the potential of being used in the dietetic management of certain coronary heart diseases.

Conclusion

The results obtained from this study shows that *C. consubrinus* is a good source of protein and other essential minerals such as sodium, potassium, iron, phosphorus and calcium. The higher TUFA/TSFA ratio of *C. consubrinus* suggest that the oil obtained from this insect could be exploited in industry especially in the production of paints, emulsions, plastics, drying agents, lubricants and as additives in pharmaceutical as well as drug productions.

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