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The nutritional value of fourteen species of edible insects in southwestern Nigeria

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Seventeen species of edible insects representing nine families from south western Nigeria were analyzed for nutrient composition. They include the orders of Orthoptera, Lepidoptera, Coleoptera, Hymenoptera, and Isoptera. *Analeptes trifasciata, Rhynchophorus phoenicis* and *Zonocerus variegatus* has the highest crude protein content (29.62, 28.42 and 26.8%, respectively). The Ether Extract content ranged from 1.50 to 31.40%, and the highest amount was found in *R. phoenicis* (31.4%), *Macrotermes bellicosus* (28.2%) and *Macrotermes notalensis* (22.5%). The nitrogen free extract content ranged from 38.5 to 85.3%, with highest values in *Brachytrypes* spp. and *Oryctes boas*. The insect richest in Vitamin A, B_2 and C was *Apis mellifera* (12.44 ug/100 g, 3.24 mg/100g and 10.25 mg/100 g, respectively). Highest calcium and phosphorus contents of 61.28 mg/100g and 136.4 mg/100g were found in *Analeptes trifasciata*. Iron was found highest in M.notalensi and magnesium in *Zonocerus variegatus.* These insects which are sources of delicacy are also pests of certain crops at developmental stages of their life. Despite this they constitute a significant component of diet among the people of south western Nigeria.

Key words: Nutrition, insects, Nigeria.

INTRODUCTION

A number of insect or their products were used as food in some parts of Nigeria and to a large extent eaten as tit-bits or exclusively by children (Ene 1963). Insects have played an important part in the history of human nutrition in Africa, Asia, and Latin America (Bodenheimer, 1951). Hundreds of insect species have been used as human food, some of the more important groups include grass-hopper, caterpillars, beetle grubs and sometimes adults, winged termites (some of which are very large in the tropics), bee, wasp and ant brood (larvae and pupae) as well as winged ants, cicadas, and a variety of aquatic insects. Ordinarily, insects are not used as emergency food during shortages, but are included as a planned part of the diet throughout the year or when seasonally available.

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Among the numerous examples that could be cited, the Yukpa people of Colombia and Venezuela preferred certain of their traditional insect foods to fresh meat, as do the Pedi of South Africa, (Quin, 1959). Insects and meat play the same role in the human body. As food, Caterpillars are regulars in the village but meat is a stranger (Muyay, 1981). Most people in tropical Africa collect insects for food. The habit is especially well developed among the cultivators of the forest region. It is uncertain whether these insects are eaten because of their nutritional qualities. The aversion to insects as human food among Europeans is nothing more than custom and prejudice (Owen, 1973).

Grubs of the palm weevil, *Rhynchophorus phoenicis* Fabr. (Coleoptera: Curculionidae), are fried and eaten in several parts of western Nigeria and in Delta and Edo States, where active marketing of the fried grubs takes place. *Imbrasia belina* is the emperor moth. In its caterpillar stage, it is known as the Mopane worm and is a popular part of diets in Botswana, Northern South Africa, Zimbabwe and Namibia. Probably too popular for its own good, the worm is being eaten into extinction by

Table 1. Commonly eaten insects in south western Nigeria.

Order	Family	Scientific name	English name	Local name	Consumption Stage
Isoptera	Termitidae	*Macrotermes bellicosus*	Termites	Esusu	Wing adults, queen
Isoptera	Termitidae	*Macrotermes notalensis*	Termites	Esusu	Wing adults, queen
Orthoptera	Gryllidae	*Brachytrypes spp.*	Crickets	Ire	adults
Orthoptera	Pyrgomorphidae	*Zonocerus variegatus*	Grasshopper	Tata	adults
Orthoptera	Acrididae	*Cytacanthacris naeruginosus unicolor*	Short horned grasshoppers	Tata	adult
Coleoptera	Scarabaeidae	*Analeptes trifasciata*	Rhinoceros beetle	Ipe	larvae
Coleoptera	Scarabaeidae	*Oryctes boas*	Scarab beetles	Ogongo	larvae
Coleoptera	Curculionidae	*Rhynchophorus phoenicis*	Snout beetles	Munimuni	larvae
Hymenoptera	Apidae	*Apis mellifera*	Honeybee	Oyin	Eggs, larvae, pupae
Lepidoptera	Notodontidae	*Anaphe infracta*	Caterpillars	-	larvae
Lepidoptera	Notodontidae	*Anaphe recticulata*	Caterpillars	Ekuku	larvae
Lepidoptera	Notodontidae	*Anaphe spp*	Caterpillars	-	larvae
Lepidoptera	Notodontidae	*Anaphe venata*	Caterpillars	-	larvae
Lepidoptera	Saturniidae	*Cirina forda*	Caterpillars	-	larvae

the people of southern Africa (Saunders, 1994). In Uganda, the larvae of many species of the larger beetles are sought and eaten but are not as important as termites and grasshoppers in the diet. *Chaoborus* spp., adult lake fly, cakes are eaten and are possibly an important source of protein in Uganda (Owen, 1973). Termites, *Macrotermes bellicossus*, are eaten in several parts of western Nigeria. The winged adults are usually caught while on their nuptial flight or collected from the ground after they have shed their wings and then roasted for eating.

The variegated grasshopper, *Zonocerus variegatus* (Linn.) (Orthoptera: Pyrgomorphidae), which has a large dry season population in southwestern Nigeria is reported eaten in the Akoko area of Ondo State (Fasoranti and Ajiboye, 1993). The larvae and pupae of honeybees, *Apis mellifera* (Hymenoptera: Apidae), have a very high protein content. In southwestern Nigeria, edible insects are conceived as food and source of nutrient. Among the traditions and the customs that persist, is the consumption of various insects and usage of insects for rituals and medicinal purposes.

The objective of this study is to determine some of the nutrient composition of the commonly eaten insects in Southwestern Nigeria.

MATERIALS AND METHODS

Sampling

Insect specimens previously determined as edible were collected using entomological nets, by hands and suction pumps in different parts of Lagos, Ogun, Osun, Ondo, Oyo and Ekiti States (Southwestern Nigeria). This study was conducted for a period of 12 months. The adult stages samples were preserved dry while the immature stages of insects were kept in vial containing 70% alcohol. All the samples were taken to the Entomological laboratory Olabisi Onabanjo University, Ago-iwoye, Nigeria, and Entomology laboratory of Cocoa Research institute of Nigeria for taxonomic identification.

Chemical analysis

The specimens were oven-dried and grounded for analysis at the Livestock laboratory of the Institute of Agricultural Research and Training, I. A R. and T, Moor Plantation, Ibadan. Each insect sample was analyzed chemically according to the official methods of analysis recommended by the Association of Official and Analytical Chemists (A. O. A. C., 1975). Determinations were performed for water content, crude fiber (structural carbohydrates), fat, free nitrogen extract and mineral salts. The crude proteins were determined using Kjeldahl technique. Determination of Vitamin B_2 this was performed using the method reported by the Association of Official Analytical Chemists (1980).

RESULTS

The common and scientific names and the edible developmental stages of 14 species of edible insects collected in Southwestern Nigeria are recorded in Table 1. Among the insect collected are 2 species of Isoptera (*Macrotermes bellicosus* and *Macrotermes notalensis),* 3 species of Orthoptera (*Brachytrypes* spp., *Zonocerus variegates* and *Cytacanthacris aeruginosus unicolor),* 3 species of Coleoptera (*Analeptes trifasciata, Oryctes boas* and *Rhynchophorus phoenicis),* one species of Hymeptera (*Apis mellifera)* 4 species of Lepidoptera *(Anaphe infracta, Anaphe recticulata, Anaphe spp, Anaphe venata* and *Cirina forda*).

Table 2. Proximate analysis (%) of commonly eaten dried insects in south western Nigeria.

Insects	Crude protein	Ether extract	Ash	Crude fibre	Dry matter	Moisture	Nitrogen free extract
Macrotermes bellicosus	20.4	28.2	2.90	2.70	90.6	2.82	43.3
Macrotermes notalensis	22.1	22.5	1.90	2.20	89.5	2.98	42.8
Brachytrypes spp.	6.25	2.34	1.82	1.01	96.59	3.41	85.3
Cytacanthacris aeruginosus unicolor	12.1	3.50	2.10	1.50	90.80	2.56	60.5
Zonocerus variegatus	26.8	3.80	1.20	2.40	92.18	2.61	63.2
Analeptes trifasciata	29.62	18.39	4.21	1.96	97.81	2.19	43.6
Anaphe infracta	20.0	15.20	1.60	2.40	90.40	2.73	66.1
Anaphe recticulata	23.0	10.20	2.50	3.10	88.92	3.21	64.6
Anaphe spp	18.9	18.60	4.10	1.68	92.56	2.52	46.8
Anaphe venata	25.7	23.21	3.20	2.30	90.50	3.34	55.6
Cirina forda	20.2	14.20	1.50	1.80	68.44	4.40	66.6
Apis mellifera	21.0	12.30	2.20	2.00	91.30	3.82	73.6
Analeptes trifasciata	20.1	2.10	1.50	3.30	90.12	2.65	70.7
Oryctes boas	26.0	1.50	1.50	3.40	94.70	1.91	38.5
Rhynchophorus phoenicis	28.42	31.40	2.70	2.82	89.90	2.74	48.6

Table 3. Vitamin and mineral contents of commonly eaten insects in south western Nigeria.

Insects	Vitamin A (ug/100 g)	Vitamin B_2 (mg/100 g)	Vitamin C (mg/100 g)	Ca (mg/100 g)	P (mg/100 g)	Fe (mg/100 g)	Mg (mg/100 g)
Macrotermes bellicosus	2.89	1.98	3.41	21	136	27	0.15
Macrotermes notalensis	2.56	1.54	3.01	18	114	29	0.26
Brachytrypes spp.	0	0.03	0	9.21	126.9	0.68	0.13
Cytacanthacris aeruginosus unicolor	1.00	0.08	1	4.40	100.2	0.35	0.09
Zonocerus variegatus	6.82	0.07	8.64	42.16	131.2	1.96	8.21
Analeptes trifasciata	12.54	2.62	5.41	61.28	136.4	18.2	6.14
Anaphe infracta	2.95	2.00	4.52	8.56	111.3	1.78	1.01
Anaphe recticulata	3.40	1.95	2.24	10.52	102.4	2.24	2.56
Anaphe spp	2.78	0.09	3.20	7.58	122.2	1.56	0.96
Anaphe venata	3.12	1.25	2.22	8.57	100.5	2.01	1.56
Cirina forda	2.99	2.21	1.95	8.24	111.0	1.79	1.87
Apis mellifera	12.44	3.24	10.25	15.4	125.5	25.2	5.23
Oryctes boas	8.58	0.08	7.59	45.68	130.2	2.31	6.62
Rhynchophorus phoenicis	11.25	2.21	4.25	39.58	126.4	12.24	7.54

Table 2 shows the chemical composition of each insect. The highest amount of protein (29.62 %) found in *Analeptes trifasciate* and highest amount of dry matter (97.81%) in *Analeptes trifasciate*. Twelve species have protein content of 20.0% and above. *R. phoenicis* have the highest value of ether extract (31.40%) and least value is found in *O. boas.* Nine of the insects had nitrogen free extracts above 50%. Table 3 shows the quantities of the vitamin and mineral contents of each identified insect species. *Analeptes trifasciata* found to have the highest values in vitamin A, phosphorus and calcium. *Brachytrpes* spp. had no trace of vitamins A and

C as well as the least value of vitamin B_2 (0.03 mg/100 g). *M. notalensis* has the highest amount of Fe (29 mg/10 0g), followed by *M. bellicosus* (27 mg/100 g). *Cytacanthacris aeruginosus unicolor* has the least amount of Fe (0.35mg/100g). Magnesium is present in all the insects with highest contents in *Z. variegates* (8.21mg/100 g), *R. phoenicis* (7.54 mg/100 g), *O. boas* (6.62 mg/100 g) and *A. trifasciata* (6.14 mg/100 g).

DISCUSSION

This study revealed that some of the insects which are pests also have high nutritional qualities. Protein content of insects especially caterpillars has been studied from Central Africa (Richards, 1939), South Africa (Quinn, 1959; Dreyer, 1982) and South America (Dufour, 1987). The result of the proximate analysis of *Analeptes trifasciata* from this study is similar to that obtained by Aduku (1993), Cmelik (1969), Bedford (1980) and Magdalena Sinao (1976). The ether extract, crude fibre, dry matter, moisture, nitrogen free extract and ash content level obtained generally agree with those reported by other authors investigating different insects from several parts of the world. However, the values of the proximate analysis for *Brachytrypes* sp. are low compared with those obtained by Chavunduka (1975). These differences may be due to variations in the dietary habits of the insects or as a result of different ecotypes. Differences may also be due to the age of the insects.

The results of this study confirm the fact that insects are indeed a good source of protein and other nutrients. The consumption of non-toxic insects therefore, should be encouraged. Insects are traditional foods in most cultures, playing an important role in human nutrition and have much nutrient to offer. They can be reared for their high nutritional qualities and sold to the populace that regards them as delicacies. Edible insects constitute an important part of the daily diet of a large proportion of the population in southwestern Nigeria. These insect provide high quality of proteins and supplements (minerals and vitamins) even when dried. Some of the sought after species, especially those with high nutritional content, ought to be cultivated with modern techniques to increase their commercial values and availability.

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