African Journal of Food Science and Technology (ISSN: 2141-5455) Vol. 4(1) pp. 9-12, January, 2013
Available Online http://www.interesjournals.org/AJFST

Full Length Research Paper

Comparative analysis on the nutritional values of crayfish and some insects

[1]S. M. Ahmad, [*1]U. A. Birnin-Yauri, [1]B. U. Bagudo and [2]D. M Sahabi

[1]Department of Chemistry, Usmanu Danfodiyo University, Sokoto.
[2]Department of Biochemistry, Usmanu Danfodiyo University, Sokoto.

Accepted January 16, 2013

The nutritional value of crayfish and some selected insects based on proximate and amino acid contents was determined. The results showed that crayfish have high moisture. Crayfish (10.33±0.29mg/100g), grub (6.17±0.58 mg/100g) grasshopper (1.83±0.29 mg/100g) winged termite (1.17±0.29 mg/100g). The grasshopper has high ash content (28.17±0.29%). Winged termite has high value of crude lipid (52.0±0.50%). grasshopper has high level of crude fibre (10.40±0.29%). Seventeen amino acids were analysed in the crayfish and three insects with glutamic acid, aspatic acid, arginine and leucine protein, being the predominant amino acids. lett is concluded that these insects could serve as a good nutritional supplement of balanced diet.

Keywords: Crayfish, nutritional and amino acids.

INTRODUCTION

The search for alternative source of food nutrient remains a perpetual event as human population growth is dynamic and ever increasing under – exploitation and under-utilisation of abundant alternative natural resources has now been recognised as one of the militating factors against nutrient glut as intended by the 'creator'. The consumption of selected insects in diverse forms is a positive response to this imperative. Yoloye (1988) has reported that insects are the most successful prolific group in animal kingdom, constituting about 76% of known species of surviving animals.

Insect and meat play the same role in the human body. As food, some insects are regular in the village but meat as 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 prejudices (Owen, 1973).

Crayfish sometime called craw fish are fresh water crustacean resembling small lobsters (procambarus clarkia).

*Corresponding Author Email: uabyauri@yahoo.com.

Winged termites, macrotermes bellicossus, are eaten in several parts of western Nigeria. The winged adults are usually caught while on their nuptial flight or collected the ground after they have shed their wings and then roasted for eating. Macrotermes bellicosis simply called "Termite" in most Nigerian communities is a gregarious insect, which in Nigeria, is commonest during the rainy season (Owen, 1973).

The Grasshopper, zonocerus variegatus (Linn.) (Orthoptera: pyrgomorphidae), which has a large dry season population in south-western Nigeria is reported eaten in the Akoko area of Ondo State (Fosoranti and Ajiboye, 1993). The Grubs, Rhynchophorus phoenicis are fried and eaten in several parts of western Nigeria and in Delta and Edo State, 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 (Saun ders, 1994).

MATERIALS AND METHODS

The Grubs and winged termites were obtained from the cow market at Yelwa in Yauri Local Government Area, Kebbi State, Nigeria. While the grasshopper and Crayfish were obtained from the central market of Sokoto town,

Sokoto State, Nigeria. All the samples were identified by Zoologists at the Zoology Unit of the Department of Biological Sciences, Usmanu Danfodiyo University Sokoto, Nigeria.

Sample treatment

The grub samples were washed with water and removed the head and manure from the body and then subjected to sun dry for a week. The dried body was ground into powdered with pestle and mortar and kept in polythene container ready for proximate and amino acid analysis. Winged termite were also subjected to sun for drying for at least a week. The wings was removed from the body after drying and then ground in to powder with pestle and mortar and kept in a container for the analysis. Grasshopper was bought in dried form from the market and wings was removed then ground in to powdered and kept in a container for analysis. Crayfish was also bought in dried form from the market and ground in to powdered and kept in a container for analysis.

Proximate analysis

Proximate analysis of the samples (Moisture content ash content, crude lipid content and crude fibre content) was carried out according to the standard methods as recommended by the Association of Official Analytical Chemists (AOAC, 1990).

Moisture content

2g of each sample were put into the crucible, dried in an oven (Leniscope, England) at 105^0c 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.

Crude fibre content

2.00g of each sample were used for estimating crude fibre by acid and alkaline digestion methods with 20% H_2SO_4 and NaOH solution.

Amino acid analysis

Amino acid determination carried out using amino acid analyser, TSM (Technicon Instruments Corporation, Dublin, Ireland) as reported in Adeyeye and Afolabi (2004). 2g of each sample defatted with petroleum ether using soxhlet extractor. The defatted sample was re-dried and milled into fine powder using porcelain pestle and mortar. 30mg sample were weighed in to a glass ampoules to which $5cm^3$ of 6mHcl and 5µmoles norcleucine were added.

The ampoule were evacuated by passing nitrogen gas (to remove oxygen so as to avoid possible oxidation of some amino acids during hydrolysis), sealed with Bunsen burner flame and hydrolyse in an oven at 110^0c for 24 hours. The ampoules were cooled, broken at the tip and the content filtered. The filtrate was evaporated to dryness at 40^0c under vacuum in a rotary evaporator. The residues were dissolved to 5µL (for acid and neutral amino acids) or 10µL (for basic amino acid) with acetate buffer, pH 2.2 and the solutions were dispensed in to the cartridge of TMS. The chromatograms (amino acid peaks) obtained from automatic pen recorder correspond to the quantity of each amino acid resent. Quantification was performed by comparing the peak area of each amino acid in the sample to the area of the corresponding amino acid standard of the protein hydrolysate.

RESULTS AND DISCUSSION

The overall results are as depicted in Tables 1 and 2 below.

Proximate analysis

Table 1 gives the percentage composition of the following parameters; moisture, ash, lipid and fibre for the three insects and crayfish studied.

The data in Table 1 shows that crayfish has the highest (10.33%) percentage moisture when compared with the values for the other sample (insects) studied, while winged termite has the least value of 1.17%. The moisture content of crayfish and Grubs are generally high which indicates that they cannot be preserved for a reasonable period of time without the risk of microbial deterioration and spoilage, while grasshopper and winged termite are generally low. This indicates they can all be preserved for a reasonable period of time without the risk of microbial deterioration and spoilage.

Ash content of grasshopper is higher than that of the other insects and crayfish and winged termite have the

Table 1. proximate analysis

Sample	Moisture %	Ash %	Crude Lipid %	Crude Fibre %
Grub	6.17±0.58	21.5±0.50	18.70±1.26	8.30±0.29
Crayfish	10.33±0.29	17.30±0.77	3.83±0.76	1.30±0.29
Grasshopper	1.83±0.29	28.17±0.29	24.70±0.75	10.2±0.29
Winged termite	1.17±0.29	4.67±0.29	52.0±0.50	1.17±0.29

Table 2 (a). concentration of protein (mg/100g)
(Essential Amino Acids)

Amino acid	SAMPLES			
Essential Amino Acid	Grub	Crayfish	Grasshopper	Winged termite
Lysine (LYS)	6.17	7.41	6.39	7.36
Threonine (THR)	3.55	4.49	3.94	5.00
Cystine (CYS)	1.19	1.19	1.19	1.32
Valine (VAL)	4.67	4.71	4.53	5.17
Methionine (MET)	2.29	2.97	2.34	2.66
Isoleucine (ILE)	3.26	4.27	3.33	3.70
Leucine (LEU)	8.13	7.30	8.73	3.26
Tyrosine (tyr)	3.22	3.54	3.22	3.54
Phenylalanine (PHE)	5.92	4.56	6.93	7.10

Table 2 (b). concentration of protein (mg/100g)
(Non-Essential Amino Acid)

Non-Essential Amino Acid	Grub	Crayfish	Grasshopper	Winged termite
Histidine (HIS)	3.95	1.82	4.32	5.20
Arginine (ARG)	6.64	7.83	7.83	8.17
Asparticacid (ASP)	8.97	9.72	10.35	10.10
Serine (SER)	3.67	3.99	4.26	4.37
Glutamicacid (GLU)	11.77	3.61	12.66	12.96
Proline (PRO)	3.19	3.99	3.40	3.40
Glycine (GLY)	6.86	7.78	3.94	4.13
Alanine (ALA)	3.94	4.25	4.02	3.94

lowest value. There is a consensus among researchers that ash content of a given sample correlates the minerals contents of the sample. It stands to suggest that the three insects and crayfish studied here give a fair source of mineral elements as earlier reported by Ene (1963).

Lipid provides the ready source of energy for the body. The crude lipid contents obtained for the studied insects and crayfish ranges from 52.0-3.83% with winged termite having the highest and crayfish the lowest. However the data in the study varied significantly among the three insects and crayfish. All the insects and crayfish can provide supplementary dietary fat in feed formulation for animal husbandry. The quality of this fat need to be ascertained in future research, since high density lipoprotein (HDL) is preferred to low density lipoprotein (LDL) in the prevention of heart arrest. Usually, an unsaturated fat has HDL while saturated fats are associated with LDL Ene (1963).

Crude fibre content in the crayfish and edible insects under study are 8.30 + 0.29 for Grub, 1.30 + 0.29 for crayfish, 10.2 + 0.29 for grasshopper and 1.17 + 0.29 for winged termite. 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). A low diet in fibre, could lead to constipation which might bring discomfort to the body system with running stool (Groff et al., 1999). Diet with high fibre content have been used for weight control and fat reduction, as they give a sense of satiety even when small food is eaten (Ekop, 2004).

Amino acids

The results for this determination are in Table 2 which shows seventeen amino acid analysed. The result shows that, glutamic acid, Arginine, leucine and aspartic acid

are the predominant amino acid. Histidine, glycine and phenylalanine show greater difference as appeared on the table.

CONCLUSION

As appeared from the table of the results of these analyses, it can be concluded that crayfish contain higher concentration of protein needed for body growth and repairs of damaged cells than the other insects which can be supplemented trough the addition of other supplements.

REFERENCES

Adedire CO, Aiyesanmi TF(1999). Proximate and mineral composition of the adult an immature forms of the variegated Grasshopper, Zonocerus variegatus (L) (Acridoidea: Pygonurphidae). *Bioscience Research Communications*, 11 (2), 121 -126

Adeyeye EI, Afolabi EO(2004) Amino acid composition of three different types of land snails consumed in Nigeria. *Food Chem.* 85,535 – 339

AOAC(Association of Official Analytical Chemists) Official methods of analysis, 14th edition, Association of Official Analytical Chemists, Washington DC (1990)

Apendi M, D Atmadilaga, HR Bird(1974). Indonesia fish meals as poultry feed ingredients. Effects of species and spillage. *World poultry Sci. J.* 30: 176 – 192

Ashiru MU(1988). The food value of the larva of anaphe venata butler (Lepidoptera: Notodontidae). *Ecol. and Food Nutr.* 22, 313 -320.

Banjo AD, Lawal OA, Songonuga EA(2006). The nutritional value of fourteen species of Edible insects in South Western Nigeria. *Afric. J. Biotechnol.* 5 (3), 298-301

Berg GM, Benet R, Asgard T(2004), Conjugated linolic acid in diet for Juvenile Atlantic Salmon (salmo solar). effects on fish performance, proximate composition, fatty acid and mineral content. *Aquaculture* 237 (1-4) 365.

Bligh EG, NJ Dyer(1959). A rapid method for total lipid extraction and purification. *Canadian J. Biochem. Physiol.,* 37:911 – 917

Blum MS(1978) Biochemical defences of insects. In: Biochemistry of

Cmelik SHW(1969). The nutritional lipids from various organs of the termite, *macrotermes bellicossus. Insect Physiology* 15:839-849

Davis JT (1918). Common white grubs. USDA Farmer's Bull. No., 940;28

Ekpo KE, Onigbinde AO(2007). Characterisation of lipids in winged reproduction of the termite, macrotermis bellicosus. *Pakistan J. nutr.* 6 (3) pp 247-251

Ekpo KE, Onigbinde AO(2005). Nutritional potentials of larva of Rhynchophorus phoenicis (F). *Pakistan J. nutr.*, 4c5), pp 287-290.

Essen E U(1995). Lipid content and fatty profiles of some lesser known Niger. food. *J. food biochem.* 19 (3): 153

FAO/WHO (2001). Human vitamin and Mineral Requirements. Rome: Food and Nutrition Division, FAO. Pp 98-102

Fasakin EA (2002). Nutritive value of four common species of aquatic plants as sources of protein in animal feed. Proc. 27th Ann. NSAP. Conf., 17 – 21. March , 2002, Akure. Nigeria, P: 122 – 124

Finke MD, Defoliar GR, Sundae ML(1985). An evaluation of the protein quality of mormon cricket (Anabrux Simplex H) when used as a high protein feed stuff for poultry. *Poultry Science,* 64, 708 – 712

Hassan,L. G., Sani, N. A and Faruq, U. Z (2002). Nutrient composition of cassia occidentalis (L) leaves. *J. Agric. and Environ.* 16. 399 – 403.

Kamis AB, Modu BS,Mwajim B(2004). Effect of ripening on the proximate and some biochemical composition of a local tomato cultiva (Nadeffere) grown at lake Alau region of Borno State. *Journal of Applied Sciences* 4. 424 – 426.

Ladron GO, Padilla P, Garcia L, Pino JM, Ramos Elorduy J(1995). Amino acid determination in some edible Mexican insects. *Amino Acids* 9, 161–173

Macbride, D. E., and Wyatt, C. J. (1983) evaluation of a modified AOAC determination for thiamine and riboflavin in foods. *J. Food Sci.* 48, 748

Matazu IK, Haroun A A(2003) The effect of drying method on the nutrient and non-nutrients composition of the fruits of Hibiscus esculentus (Okro). *Niger. J. Renewable Energy* 11.9 – 13.

Mba AU(1980). Chemical composition of some local source of protein foods, for man. *Niger. J. Nutr. Sci.* 1:142–147