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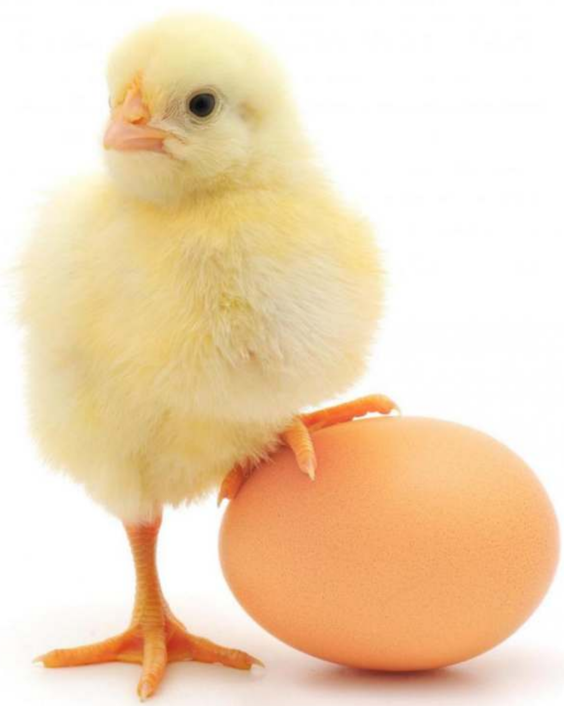

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Chemical Evaluation of the Nutrient Composition of Some Unconventional Animal Protein Sources

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Abstract: A trial was conducted to assess the nutrient composition of some novel feed ingredients so as to enhance livestock development and human protein intake. Ten (10) unconventional protein sources which include fish, crayfish, frog, shrimps, crabs, squilla, toads and grasshopper were harvested, processed and analyzed for their proximate and mineral (macro) composition using internationally established procedures. The results showed that the samples had percent crude protein that ranged from 28.14 (crab) to 61.38 (local fish meal). Frog, toad, squilla, crayfish, pellonula and crab respectively recorded appreciable percent ether extract (EE) values of 9.14, 8.74, 7.21, 6.32, 6.26 and 6.02. The gross energy (kcal/g) value was highest for squilla (2.97), followed closely by crayfish (2.87), Pellonula (2.85), mudskipper (2.84) while the others were below 2.0kcal /g. The crab gave the highest percent ash content (39.11) while the local fish meal gave the least value (5.96). Local fishmeal had the highest percentage of calcium (2.56%) followed by Pellonula (1.94%) and Mudskipper (1.89%) while the others had values that were lower than 1%. Percent Phosphorus followed a similar trend as calcium with local fishmeal recording the highest value of 1.92%. The results of this study showed that all the samples possess an appreciable quantities of all the dietary elements tested for, which, more or less could make them partial or complete substitutes for the conventional feed sources.

Key words: Nutrient composition, unconventional animal protein, live stock industry

Introduction

The ultimate goal of any livestock industry is the attainment of sustainable livestock production with minimum costs in the shortest time possible (Eruvbetine *et al.*, 2002). This has proved difficult in the developing nations because of the dependency on some conventional ingredients that are either imported and or expensive where they locally exist. For instance, fishmeal, an essential dietary animal protein component of poultry feed is usually imported from Denmark, America and some other European Countries. Soybean meal, groundnut cake and some other plant protein sources have also become too expensive. This is as a result of the excessive demand for them, thus leading to a disproportionate increase in the costs of poultry feed. It is also a known fact that, in the face of teaming population of the developing nations, the conventional protein and energy ingredients being used in feed production or livestock represent products that are better taken advantage of in human nutrition (Ardon *et al.*, 1998).

Aquatic animals are common features in many fresh and marine bodies in the tropics (Fasakin, 2002). Such aquatic materials can constitute a natural resource pool from where dietary animal protein can be sourced (Mercer, 1992). Such aquatic animals include fish, crayfish, shrimps, crabs, squilla and toads. Often-time, by-products such as local fish meal, crayfish waste meal, shrimp waste meal, frog waste meal among others are prepared by the local people and are incorporated into animal feed as protein supplements so as to replace the aforementioned high cost conventional protein feed stuffs.

Another unconventional protein source being considered in recent times are the arthropods. Anthropoids are insect groups that are known to be rich in crude protein and minerals (Aduku, 1993; Ojewola *et al.,* 2003; Ojewola and Annah, 2005). Some few research works have been carried out with some of these products and their by-products (Oduguwa *et al.,* 2004; Agunbiade *et al.,* 2004; *Ojewola et al.*, 2003; Ojewola and Annah, 2005). Beyond what these scientists have done, there is the need for further identification and exploitation of these and other novel animal protein supplements that have comparative nutritive value, but cheaper than the conventional protein sources.

It is against this background that the present study was undertaken to evaluate the nutritive content of some unconventional animal protein sources.

Materials and Methods

Sample collection: Samples such as frog, crayfish, squilla, shrimps, crabs, toad, mudskippers and pellonula were obtained from fishing trawlers, fresh and wet from marine water environment of Ikot Abasi, Akwa-Ibom State Nigeria. These materials were separated into individual bags. They were killed by dipping each bag containing each of these materials in hot water.

Table 1: Chemical composition of the test materials used

Test Material	Ash (%)	Crude Protein (%)	Ether Extrac (%)	Crude Fibre (%)	Dry Matter (%)	Gross Energy (Kcal/g)
Frog	17.94	47.31	9.14	1.65	90.36	1.668
Crayfish	13.86	58.14	6.32	1.28	89.92	2.874
Squilla	28.85	46.24	7.21	1.34	89.86	2.974
Local Fish Meal	5.96	61.38	5.52	1.23	91.14	1.828
Shrimps	16.8	53.47	3.42	1.18	91.27	1.312
Crabs	39.11	28.14	6.02	1.73	92.07	1.644
Toad	18.45	45.72	8.74	1.54	92.42	1.767
Grasshopper	9.97	29.17	4.18	2.38	91.67	1.618
Mudskippers	17.65	54.82	4.89	1.16	89.74	2.836
Pellonula	15.94	56.12	6.25	1.12	90.41	2.850

Table 2: Mineral (macro) composition of the test materials used

Test Material	K (%)	Na (%)	Ca (%)	Mg (%)	Zn (%)	Fe (%)	P (%)
Frog	0.13	0.16	0.19	0.014	0.0012	0.0018	0.28
Crayfish	1.11	0.97	0.86	0.26	0.0091	0.0023	0.94
Squilla	0.15	0.63	0.53	0.19	0.0073	0.0031	0.36
Local Fish Meal	0.19	0.47	2.56	0.28	0.0018	0.0043	1.92
Shrimps	0.14	0.29	0.74	0.017	0.0015	0.0028	0.31
Crab	0.16	0.26	0.93	0.013	0.0021	0.0015	0.63
Toad	0.24	0.19	0.21	0.018	0.0017	0.0011	0.38
Grasshopper	0.11	0.32	0.13	0.15	0.0010	0.0013	0.11
Mudskippers	0.17	0.35	1.89	0.21	0.0025	0.0037	0.98
Pellonula	0.13	0.41	1.94	0.25	0.0031	0.0035	0.87

They were briefly (24hrs) sun dried and later oven-dried at about 70-80°C for 48 hrs.

An already processed local fish meal and grasshopper meal were respectively purchased from a major commercial producer, at Akwa-Ibom and Jibia, Katsina State, Nigeria. They were then ground into powdery form and each (1kg) stored in a clean dry bottle ready for the laboratory determination of the proximate and mineral composition.

Evaluation of the proximate and mineral composition of the text ingredients: All (10) the prepared samples were subjected to chemical analysis for proximate composition using standard procedures as described by AOAC (2000). Ether extract was determined by the soxhlet technique using diethyl ether (Harold *et al.*, 1981). Ash from each of the samples was analyzed for mineral composition. Sodium, potassium, and calcium were determined by flame emission spectrophotometry using lan way flame photometer (AOAC, 2000). Analysis of Magnesium, Zinc and Iron were by atomic absorption spectrophotometer. Phosphorous was determined by the vanadomdybdate calorimetric method. Each of these parameters was analyzed twice and result expressed as average of each element.

Results and Discussion

The chemical composition of the test materials are as shown in Table 1. The crude protein (CP) content of samples ranged from 28.14 (crab) to 61.38% (Local fish meal). Of all the samples evaluated, the local fish meal gave the highest percent crude protein (61.38%). This was closely followed by the crayfish (58.14%), penonulla (56.12%), mudskippers (54.82%) and shrimps (53.47%) while the others were below 40%. The crude protein value of this local fish meal is within the same range (63.11% and 65.0%) reported by Aduku (1993). It however, differed from the result (404.80g/kgDM) obtained by Ojewola *et al.* (2003). The crude protein values obtained for Mudskipper, crayfish and Pellonula were respectively lower than the figures (62.4%, 60.0%, 60.1%) recorded earlier by Olomu and Nwachukwu (1977). The obtained crude protein content of squilla in this trial was higher than the value (33.97%) observed by Ravinder *et al.* (1996). Appreciable C P values were also recorded for frog (47.31%) and Toad (45.75%) respectively. Grasshopper meal (29.17%) and crab meal (28.14%) respectively exhibited the lowest crude protein levels. Earlier reports by Ojewola *et al.* (2003) and World Poultry Magazine (1982) indicated higher values for grasshopper meal (357.60gkg^{-1}) and crab meal (31.30%) respectively.

Frog, toad, squilla, crayfish, Pellonula and crab respectively recorded appreciable ether extract (EE) values of 9.14%, 8.74%, 7.21%, 6.32%, 6.26% and 6.02%. This is an indication that these samples can supply sufficient energy in diets of livestock to prevent protein utilization as energy source. The percent EE value of crayfish (6.32%) agrees with the value (7.14%) obtained by Ojewola *et al.* (2003) while that of squilla (7.21%) differed greatly from the findings (1.86%) of Ravinder *et al.* (1996).

The crude fibre content was generally low in all the samples with the highest value (2.38%) observed in grasshopper meal. A similar trend was observed by Ojewola *et al.* (2003).

The GE (Kcal/g) value was highest for squilla (2.974), followed closely by crayfish (2.874), Pellonula (2.85), mudskipper (2.836) while the others were below 2.000kcal/g. The crab gave the highest ash content (39.11%) while the local fish meal gave the least value (5.96%).

The mineral content of the samples are summarized in Table. 2.

Local fishmeal had the highest percentage of calcium (2.56%), followed by Pellonula (1.94%) and Mudskipper (1.89%) while the others had values that were lower than 1%. Percent Phosphorous followed a similar trend as calcium with local fishmeal recording the highest value of 1.92%. The squilla gave calcium and Phosphorous values that are at variance with the findings of Ravinder *et al.* (1996) which reported values of 7.28% (Ca) and 1.72% (P) respectively. Calcium and phosphorous are essential for proper bone formation and their deficiency can lead to bone malfunctioning. Generally, the proximate and mineral composition of some or all these test samples are comparable to earlier findings by Olomu and Nwachukwu (1977); Ravinder *et al.* (1996); Rosenfeld *et al.* (1997) and Ojewola *et al.* (2003). However, source, habitat, feeding, mode of harvesting, habits, processing method, storage and even stage of development of species may have accounted for the differences observed in composition and gross energy content of all the test samples (Ojewola *et al.* 2003; Apendi *et al.*, 1974).

In conclusion, there is a clear indication that all the samples showed appreciable quantities of all the dietary elements tested for, which, more or less make them practical or complete substitutes for the conventional feed sources. Therefore, their utilization in feed formulation should be encouraged, though, feeding trials still need be conducted to establish levels of inclusion, productive and economic efficiency of using these unconventional materials.

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