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# EVALUATION OF THE NUTRIENT COMPOSITION OF SOME UNCONVENTIONAL FEEDSTUFFS

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ABSTRACT
A trial was carried out to evaluate the nutrient composition of some unconventional feedstuffs to ascertain their suitability for incorporation into fish feed. Pawpaw seed, mudskipper meal, water melon seed, almond kernel and groundnut husk were processed and analyzed for their proximate and mineral composition using internationally established procedure. The results obtained showed that the experimental feed stuffs had percentage crude protein that ranged from 7.38% to 55.85%. The highest level (55.85%) was found in mudskipper meal while the lowest (7.38%) was found in groundnut husk. The experimental feed stuffs had appreciable levels of calcium, potassium and phosphorus ranging from 0.29% to 1.87%, 0.17 to 1.26 and 0.06 to 0.97 respectively. Almond kernel can be used to replace soybean meal in aqua feed. Also, mudskipper meal can be used to replace fish meal in order to produce a cheaper fish feed; but it was recommended that feeding trials should be conducted to ascertain the inclusion level at which they can be effectively incorporated. The potentials of some of these feedstuffs in fish feed formulation seem high.

KEYWORDS: Unconventional feedstuffs, proximate composition, mineral composition, fish feed, nutrient composition.

## INTRODUCTION

Quality fish is a ready source of protein and can be got through the practice of aquaculture. Aquaculture is the most rapidly expanding sector of agri-business today and has shown continuous growth for the last 20 years, contributing an important input with regards to global fisheries production (Ayinla, 2005). With the increasing demand for food fish and the decline in capture fisheries production, aquaculture in Nigeria is heading towards intensification. This shift from low density to high density culture is leading to an unprecedented rise in the demand for feed (Ayinla, 2005).

The fish feed industry is still very dependent on fish meal and fish oil from the industrial fishing operations. These important ingredients provide a balanced dietary protein source, essential poly-unsaturated and primary energy sources for intensive fish production (Webster *et al*., 1999). Fish meal is a major protein source in aqua feeds. However, its supply is not growing worldwide (Tacon, 1994) and it depends entirely on landings from the capture fisheries. Moreover, the price of fish meal is often high. These necessitated replacing fish meal with cheap protein sources (Ayinla, 2005). Considerable research has been conducted to evaluate the suitability of various feed ingredients as an alternative protein source for fishmeal (Solomon and Sadiku, 2005).

This study was undertaken to analyze the nutrient composition of some unconventional feed stuffs namely: Muddskipper (*Periophthalnus babarus*) meal, groundnut (*Arachis hypogeal*) husk, pawpaw (*Carica papaya*) seed, tropical almond (*Terminalia catappa*) kernel and water melon (*Citrullus vulgaris*) seed. The results obtained from this study could help provide a possible alternative to conventional fish feed ingredients.

## OBJECTIVES OF THE STUDY

- To determine the proximate composition of the experimental feed stuffs namely mudskipper meal, groundnut husk, pawpaw seed, almond kernel and water melon seed.
- To evaluate their mineral composition.

## MATERIALS AND METHODS

Sample Collection and Preparation:
Groundnut husk was obtained from groundnut hawkers at bar beach, Victoria Island, Lagos. Fresh pawpaw seeds and water melon seeds were procured from commercial fruit sellers at Obalende, Lagos. Almond fruits

were harvested from Almond trees at Buckner Estate, Ejigbo, Lagos State. The mudskippers were procured from fishermen in Apa Village, Badagry, Lagos State. The mudskippers were put into a sack bag and killed by dipping them into hot water for a few minutes.

All the samples were sundried for five days and ground into a meal using a hand milling machine.

Analytical Procedure:
The experimental samples were subjected to proximate analysis in accordance with Standard methods described by the Association of Official Analytical Chemist (A.O.A.C), 2005. All analysis were done in duplicates.

Crude protein was determined by the routine semi-micro Kjeldahl procedure. The percentage crude protein was calculated by multiplying the total nitrogen by a factor of 6.25. %Nitrogen (N) = Titre value x atomic mass of Nitrogen x Normality of HCl used x 4.

Crude fat was determined by subjecting the samples to a continuous extraction with petroleum ether using soxhlet apparatus as described by A.O.A.C. (2005)

Ash content was determined by subjecting the oven dried samples with known weight to ignition in a muffle furnace set at 550ºC and left for about four hours after which the samples were cooled in a desiccator and weighed. The percentage ash was calculated from the formula:

$$\text{Ash content} = \frac{\text{Weight of ash}}{\text{Original weight of sample}} \times 100$$

Crude fibre was determined as loss on ignition of dried lipid- free residues after digestion with 0.255N $H_2SO_4$ and 0.313 NaOH. 10ml of acetone was added to dissolve any organic constituent.

The percentage fibre was obtained by the formula:

$$\% \text{ Fibre} = \text{Weight of residue - Weight of ash} \times 100 / \text{Weight of sample}$$

Dry matter and moisture content were determined by oven drying known weight of the samples at 100□C to dry to a constant weight for 24 hours. The samples were cooled in a desiccator for ten minutes before weighing.

$$\% \text{ Dry matter} = W3 - W0 \times 100/ W1 - W0$$

Where:
W0 = weight of empty crucible
W1 = Weight of crucible + sample
W3 = Weight of crucible + oven dried sample

Nitrogen-free extract was determined by subtracting sum of (Moisture % + % Crude protein + % crude fat + % crude fibre + Ash) from 100.

The mineral elements were determined using the method of AOAC (2005) by flame emission spectrophotometry using Jenway digital flame photometer (P7P model) after being digested with 2m HCl. They were later filtered using the filter corresponding to each mineral element. The concentration of each element was calculated using the formula:

$$\% \text{ mineral} = \text{Metre reading} \times \text{Slope} \times \text{dilution factor}/ 10000$$

RESULTS

The proximate composition of the five unconventional feedstuffs is presented in Table1. Table 2 shows the mineral composition of almond kernel, water melon seed, groundnut husk and pawpaw seed.

Table 1: Proximate Composition of the Unconventional Feedstuffs.

| Experimental Sample | % Crude Protein | % Crude Fat | %Crude Fibre | % Ash | % Dry Matter | % Moisture | %NFE |
|---|---|---|---|---|---|---|---|
| Almond Kernel | 29.65 | 36.81 | 2.67 | 6.92 | 94.06 | 5.94 | 14.01 |
| Water Melon Seed | 16.95 | 21.33 | 2.26 | 5.94 | 93.87 | 6.13 | 47.39 |
| Groundnut Husk | 7.37 | 1.18 | 49.96 | 4.28 | 92.39 | 7.61 | 29.60 |
| Pawpaw Seed | 16.86 | 11.16 | 3.21 | 4.86 | 90.88 | 9.12 | 54.79 |
| Mudskipper Meal | 55.87 | 5.12 | 1.07 | 18.26 | 89.65 | 10.35 | 9.33 |

Legend
NFE = Nitrogen-free extract

Table 2: Mineral Composition of the Experimental Feed stuffs evaluated.

| Experimental Sample | % Calciun | % Iron | % Magnessium | % Sodium | % Potassium | % Phosphorous | Zinc (Mg/kg) |
|---|---|---|---|---|---|---|---|
| Almond Kernel | 0.50 | 0.163 | 0.16 | 0.23 | 1.26 | 0.68 | 76.8 |
| Water Melon Seed | 0.34 | 0.526 | 0.24 | 0.16 | 1.08 | 0.31 | 61.8 |
| Groundnut Husk | 0.23 | 0.032 | 0.15 | 0.48 | 0.97 | 0.06 | 42.6 |
| Pawpaw Seed | 0.29 | 0.087 | 0.27 | 0.19 | 0.97 | 0.42 | 44.5 |

DISCUSSION

The results of this study showed that mudskipper meal has the highest crude protein content of 55.87% followed by almond kernel (29.65%), watermelon seed (16.95%), pawpaw seed (16.86%) whereas groundnut husk had the least crude protein content of 7.37%. The crude protein content of almond kernel obtained from this study (29.65%) was similar to that of Ezeokonkwo and Dodson, 2004 (25.81%). The value obtained for mudskipper meal (55.87%) was in line with the value obtained by Ojewola and Udom, 2005 (54.82%). The value obtained for water melon seed (16.95%) was lower than the value obtained by Essien *et al*; 2009 (24.51%). Pawpaw seed had a lower protein content (16.86%) compared to 30.08% obtained by Bolu *et al*; 2009. This might be due to the different varieties of water melon and pawpaw used, seasonal variation or perhaps the stage of ripening of the water melon and pawpaw.

Almond Kernel had the highest crude fat content of 36.81% followed by water melon seed (21.33%), pawpaw seed (11.16%), mudskipper meal (5.12%) whereas groundnut husk had the lowest value of 1.18%. The fat content of pawpaw seed (11.16%) was lower than that of Bolu *et al*., 2009 (34.80%). Water melon seeds also had a low crude fat content (21.33%) compared to the result gotten by Essien *et al*., 2009 (40.00%). The reason for this variation might be due to the different species of water melon and pawpaw or the ripening stage at which they were harvested.

Groundnut husk had the highest crude fibre content of 49.96%, followed by pawpaw seed 3.21%, and almond kernel 2.67% whereas mudskipper meal had the lowest value of 1.07% followed by water melon seed (2.26%). The crude fibre content for mudskipper meal was within the range projected by Ojewola and Udom, 2005 (1.16%). The value obtained for water melon seed (2.26%) was also similar to that of Essien *et al*., 2009 (2.10%).

The moisture content for the experimental feedstuffs ranged from 5.94 – 10.35% with mudskipper meal having the highest value of 10.35% and almond kernel having the lowest value of 5.94%

The nitrogen-free extract for the experimental feedstuffs ranged from 9.33 to 54.79% with pawpaw seed having the highest value (54.79%) followed by water melon seed (47.39%). Mudskipper meal had the lowest nitrogen free extract value of 9.33%. The high carbohydrate content and fair levels of protein present in pawpaw seed and water melon seed suggests that they can be used as basal feedstuffs to replace grains such as maize in aqua feed.

Minerals are important in maintaining physiological processes, are constituents of the teeth, bones, tissues, blood, muscle and nerve cells in animals (Sonni, 2002). The mineral content of mudskipper meal was not analyzed because the focus was on the possibility of using it as a protein concentrate to possibly replace fishmeal since it has a very high protein content. The experimental feedstuffs analyzed had appreciable levels of minerals ranging from 0.23% to 1.87% for calcium, 0.15% to 0.61% for magnesium, 0.16% to 0.48% for sodium, 0.17% to 1.26% for potassium, 0.06% to 0.97% for phosphorus, 27.0 – 76.8mg/kg for zinc.

## CONCLUSION AND RECOMMENDATIONS

Almond kernel meal could be used to partially replace soya bean meal to produce a cheaper fish feed. Mudskipper meal could also be used to replace fish meal to produce a cheaper fish feed. The potentials of some of these feedstuffs in fish feed seem high. However, it is recommended that feeding trial, be carried out using feeds formulated with these feedstuffs to determine their efficiency and inclusion levels in aqua feed.

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