

Proximate Composition and Mineral Content of Grasshoppermeal as an Alternative to Fishmeal for Fish Feed Production

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The purpose of this study is to determine the proximate composition and mineral content of grasshopper meal as an alternative feedstuff of animal source to substitute fishmeal in the production of fish feed. Grasshoppers were gotten from the market irrespective of size, they were de-winged and processed into powder. The biochemical content (proximate composition and mineral content) were analyzed. The proximate composition of edible grasshopper meal was assessed using A.O.A.C standard. The result obtained were 64.51%, 5.1%, 94.9%, 1.0%, 5.49%, 17.0% and 12% for crude protein content, moisture content, dry matter, ash, nitrogen free extract, crude fibre and ether extract respectively. The essential mineral content of grasshopper meal was also assessed and the result obtained were 0.55%, 0.12%, 0.1%, and 0.73% for calcium, phosphorus, sodium and potassium respective. The quality of nutrients and mineral composition of grasshopper meal makes it a good dietary supplement for fish and could be used in fish feed production.

Keywords: Proximate composition; grasshopper meal; fishmeal.

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1. INTRODUCTION

Fish feed accounts for between 60-80% of management cost in aquaculture and most fish farmers in Nigeria do not make use of standard fish feed due to its high price [1]. Fishmeal is the most extensively used protein source in fish feed because of its unrivalled nutritive value and biological value [1]. Fish utilizes both plants and animal proteins although animal proteins are nutritionally better than plant protein because the more closely the dietary protein meets the qualitative requirement of indispensable amino acid by the fish, the greater its utilization [2].

Edible grasshoppers include *Nomadacris septemfasciata*, *Kraussaria spp*, *Katantop spp*, *Anacridium spp*, *Cataloipus spp*, *Hieroglyphycus spp*, *Gelestorhinus spp*, *Locusta spp*, and *Schistocerca spp* which are the most common species found in Maiduguri and its surrounding environment [3]. Locust and grasshopper populations are known to fluctuate with season, because most hoppers lay their eggs towards the end of the rainy season and die; they pick up again at the beginning of the next rainy season. These insects are known for their voracious feeding habit on domesticated field crops causing serious threat to cereal crop production in Borno State [4,5,6]. These grasshoppers are as rich as the fishmeal in terms of its amino acid profile [7].

The search for alternative protein feedstuff of animal origin with least cost led to this study which was carried out to determine the proximate composition and mineral content of grasshopper meal so as to use it as a substitute to fishmeal in fish feed and other animal feed production.

2. MATERIALS AND METHODS

2.1 Preparation of Grasshopper Meal

Samples of grasshopper were collected from a nearby market irrespective of sizes and species. The samples were de-winged and all the appendages were removed. They were sundried and then crushed into powder using the milling machine.

2.2 Proximate Analysis

Grasshopper meal sample (powdered) was analyzed for dry matter, crude fibre, crude protein, ash and ether extract using standard methods [8]. The protein was measured by

calorimetric method (Vanado molybdale yellow method) with a varian 634UV visible spectrometer and the crude protein calculated as total Kjeldahl Nx 6.25. The fibre content was also assessed according to the methods of Cullison, [9]. The dry matter was determined by placing the sample in a hot oven at 60°C for 48hours and the dry matter content calculated as:

$$\frac{W1 \times 100}{W2}$$

Where,

W1=weight of sample after oven drying
W2= weight of sample before oven drying

The ash content was determined by placing the weighed sample (2g) into a crucible and dried at 105°C for 24hours, then cooled in the desiccators and reweighed. It was then charred at 600°C in muffle furnace for 3hours. The ash content was calculated as:

$$\% = \frac{\text{loss in weight}}{\text{Initial weight}} \times 100$$

The ether extract was determined through extraction with an organic solvent for 4hours and the remaining residue dried and weighed. The ether extract was calculated as:

Original sample weight – ether extract residue

2.3 Mineral Analysis

Samples of grasshopper meal was analyzed for calcium, phosphorus, sodium and potassium. Ash of the samples was digested using perchloric and nitric acid to determine the concentration of potassium and sodium. Readings was taken in the digital flame photometer/spectronic 20 [10]. Varido molybate chlorimetric method was used in the determination of phosphorous. The concentration of calcium was determined using buck 200 atomic absorption spectrophometer (Buck Scientific Nouwalk) [11] and absorption compared with absorption of standards of these minerals.

3. RESULTS AND DISCUSSION

The tables below show the proximate analysis and mineral content of grasshopper meal respectively in the percentage that makes up the grasshopper meal sample.

Table 1. Shows proximate analysis of grasshopper meal

Indices	%composition
Dry matter	94.9
Moisture content	5.1
Crude protein	64.51
Ether extract	12.0
Ash	1.0
Crude fibre	17.0
NFE	5.49

Table 2. Shows the Essential mineral content of grasshopper meal

Indices	%composition
Calcium	0.55
Phosphorus	0.12
Sodium	0.1
Potassium	0.73

The result of the nutrient composition in Table 1 shows that grasshopper meal has high crude protein of 64.51%. This is very high value that could completely replace fishmeal in fish feed and other animal feed production. The value compares favorably with the result obtained by Njidda and Isidahomen [12], which was 64.32%cp. This value is also close to that of fishmeal obtained from clupeids with 68.47% cp [7]. The ether extract was 12.0 and was closely related to that of Njidda and Isidahomen [12]. The value of the ether extract of grasshopper meal is greater than that of fishmeal making it good because it is a component of encapsulment of feed nutrients which prevent loss of water soluble nutrients [13]. The crude fibre content was high due to the fact that grasshopper has an exoskeleton made up of chitin [14]. The nitrogen free extract was 5.49 which is a small amount of carbohydrate that can be digested easily because of its solubility [15]. The dry matter of grasshopper meal is very high 94.9 with low moisture content of 5.1 compared to dry matter of fishmeal 90.0 with moisture content of 10% according to Eyo, [16]. This implies fast drying of the feed and therefore a good substitute for expensive fishmeal that is commonly being used. The calcium content is greater than those obtained from soybean meal, groundnut cake which are plants protein used to substitute fishmeal. It compares favorably with that of blood meal and less than that of fishmeal [17]. The phosphorus content is low due to low ash content. The sodium content is similar to that of soybean meal and yellow maize which has been used to replace fishmeal by different

researchers. The potassium content compare with that of fishmeal [17]. The above nutrients composition of grasshopper meal and its quality makes it a good dietary supplement for fish and could be used as a substitute for fishmeal.

SUMMARY AND CONCLUSION

A lot of research has been carried out on suitable substitutes for fishmeal in fish diet. Grasshopper meal has been shown to contain most of the essential amino acid similar to that of fishmeal and higher than that of blood meal, groundnut cake and soybean meal. This study has also shown that its proximate composition is closely comparable to that of fishmeal. Hence fishmeal can be completely substituted with grasshopper meal. More study is encouraged on other insects of economic importance for the growth of aquaculture industry in Africa and World at large.

DISCLAIMER

The product used for this research are commonly used in our area of research and country. There is absolutely no conflict of interest between the authors and products because we do not intend to use this product as an avenue for any litigation but for advancement of knowledge. The research was funded by the personal effort of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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