



**NUTRITIVE EVALUATION OF SELECTED ENERGY,  
PROTEIN AND FIBRE FEEDSTUFFS**

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**ABSTRACT**

The study was conducted to evaluate the proximate composition of selected energy, protein (plant and animal origin) and fibre feedstuffs for poultry feeding. The feedstuffs were obtained from *Muda Lawal* market in Bauchi town and were cleaned, milled and screened to fine particle size of less than 250µm. All the feedstuffs were subjected to proximate analysis for the determination of dry matter, crude protein, ether extract, crude fibre and ash while nitrogen free extract and metabolizable energy were computed using mathematical relationships. The results revealed that energy sources are generally higher in metabolizable energy with values ranging from 2830.50-3359.97kcal/kg in *Dauro* millet and yellow maize, respectively which were however, mostly low in crude protein (8.64 vs 11.67%). Of the plant protein sources, groundnut cake contains the highest crude protein (43.21%) closely followed by full fat soya bean (41.68%). The lowest crude protein was obtained on Bambara nut (22.61%). Blood meal contains the highest protein (70.62%) followed by industrial fish meal (64.55%) and local fish meal (59.19%). For fibre feedstuff, wheat offal contained the highest crude protein (16.24%) while the lowest value of 6.49% was obtained in rice offal. Rice offal had the highest crude fibre value of 31.23%. The local maize offal and millet offal are richer in energy (2250vs2275kcal/kg). It recommended that major ingredients of feeds (energy, protein, fibre) must be analyzed for nutrients, availability and density before incorporation into poultry feeds.

**Keywords:** Proximate, Analysis, Feedstuffs, Nutrient, Ingredients, Metabolizable

**INTRODUCTION**

In order to enhance livestock production, improve food security, and reduce the level of poverty in developing countries such as Nigeria, a search for cheap locally available feedstuffs is required. Feed play a major role in livestock viability and profitability. Generally, it is agreed that feed cost accounts for between 60-85% of the total cost of livestock production (Craig, 2002). Livestock feed, particularly for non-ruminants are becoming prohibitively costly in the developing countries because of the increasing competition between man and livestock for food. One of the ways of increasing animal protein production in the developing countries such as Nigeria is through the use of cheap and readily available feed ingredients in the diets of livestock. Although, there are rooms for enhancing livestock production in Nigeria through improvements in the overall production system, in genetics and general farm management principles, the desired growth of livestock which is necessary in order to meet the increasing demand for protein is only achieved through cost-effective and high quality feed (Gabriel *et al.*, 2007). Locally produced feed reduces the cost of production and hence, cheaper means of meeting the protein and energy requirements improve food security and reduce the level of poverty in developing countries, thus inexpensive and locally available feedstuffs are to be identified. The search for alternative protein and energy sources is to be focused on by-products and materials which are not suitable for direct human consumption (Hoffman *et al.*, 1997). However, in Nigeria, a number of by-product from agricultural processing are available, which are usually not utilized for human consumption, but may have a high potential for small-scale farming. It is anticipated that the transformation of locally available by-products low in nutrients into high quality feed, can be a major contribution of improving the protein and energy supply for the local human population. Several agricultural and agro-industrial by-products available in Nigeria have been evaluated for their production potential in poultry and livestock feed (Ajebu, 2010). However, only few data are available which cover the suitability of this resource (Adamneh *et al.*, 2007 and Ashagrie *et al.*, 2008). Development of a feed for production involves evaluation of proximate composition of



feed components, digestibility and performance efficiency as well as cost implications and conditions of application. Grain legumes are important in human nutrition, where they contribute substantially to total protein intake. The proteins of grain legumes contain relatively more of the essential amino-acids lysine and tryptophan, and so usefully complement the amino-acids supplied by cereals in which the contents of lysine and tryptophan are relatively small. According to recent estimates, malnutrition contributes to more than one-third of all child deaths worldwide. Particularly, child malnutrition was associated with 54% of death in children in developing countries. This can be mainly as a result of the consumption of high cereal-based meal, which is bulky, high energy and less nutritive. Legumes along with cereals can be considered as main plant sources of energy and good quality protein. Oilseed cake and legume seeds are considered suitable as alternative dietary protein sources and are available in Sub-Saharan Africa on a large scale (Fagbenro *et al.*, 2003). Soya bean meal (SBM) is one of the most nutritious of all plant protein sources (Levander, 1990). Due to its high protein content, high digestibility and relatively well balanced amino acid profile, it is widely used as feed ingredient for many livestock (Storebakken *et al.*, 2000). It is currently the most commonly used plant protein source while maize is considered the most used energy source (El-sayyed, 1900). Lim and Alonso *et al.* (2000) reported that soya bean products and maize have been used as major ingredients in formulation with nutritional, environmental and economic benefits. However, wider utilization and availability of this conventional sources is limited by increasing demand for human consumption and by other animal feed industries (Storebakken *et al.*, 2000), hence the need to focus on using less expensive and readily available plant protein and energy sources to replace soya bean meal and without reducing the nutritional quality of the feed becomes imperative (Brand *et al.*, 2004). Therefore, there is great need to know the proximate composition of these feedstuffs so as to increase their utilization and efficient usage. Due to variability in climate, soil profile, there is need to constantly evaluate the nutritive value of each ingredient before incorporating into complete feed. This study is aimed at the nutritive evaluation of selected energy, protein and fibre feedstuffs.

## **MATERIALS AND METHODS**

### **Study Area**

The study was conducted in Bauchi, Bauchi State. Bauchi State occupies a total land area of 49,119km square, representing about 5.3% of Nigeria's total land mass and is located between latitudes 9° 3' and 12° 3' North and longitudes 8° 50' and 11° east. The rainfall in Bauchi State ranges between 1300mm per annum in the south and only 700mm per annum in the extreme North.

### **Selection, Acquisition and Processing of Feedstuffs**

Selection of the feedstuffs was done based on regional and seasonal availability as well as prices as at of the study area. Samples were collected during a period of one month. Feedstuffs for the analysis of chemical composition were obtained from commercial markets across Bauchi town, Bauchi State. The feedstuffs were first cleaned from foreign materials, milled and screened to fine particle size (<250µm) before samples were taken for proximate analysis in the Department of Animal Production.

### **Proximate Composition Analysis**

Dry matter, crude protein, ether extract, crude fibre, ash content, nitrogen free extract and metabolizable energy were determined according to the method of the Association of Official's Analytical Chemists, AOAC (1990).

## **RESULTS AND DISCUSSION**

### **Proximate Composition of Selected Energy Feedstuffs**

Proximate composition of selected energy feedstuffs is presented in Table 1.

**Table 1:** Proximate Composition of Selected Energy Feedstuffs

Feedstuffs	DM (%)	CP (%)	EE (%)	CF (%)	Ash (%)	NFE (%)	ME (kcal/kg)
Yellow maize	91.60	11.19	2.73	1.73	2.04	73.91	3259.97
White maize	91.62	8.64	2.41	1.84	1.36	77.36	3325.25
Red sorghum	91.61	11.21	2.40	1.92	3.42	72.66	3101.07
Yellow sorghum	91.01	10.61	1.59	1.39	1.16	75.81	3305.27
White sorghum	91.61	10.51	2.01	1.98	2.11	75.00	3207.28
Pearl millet	92.19	10.59	2.51	5.29	2.43	71.37	2818.12
Dauro millet	92.60	11.67	3.64	4.21	2.63	70.48	2830.50

DM: Dry Matter; CP: Crude Protein; CF: Crude Fibre; EE: Ether Extract; NFE: Nitrogen Free Extract; ME: Metabolizable Energy

Pauzenga (1985):  $ME = (37 \times \%CP) + (81 \times \%EE) + (35.5 \times \%NFE)(kcal/kg)$

The result of the proximate composition of yellow maize, white maize, red sorghum, yellow sorghum, white sorghum, pearl millet and *Dauro* millet are dry matter (91.01 vs 92.60%), crude protein (8.64 vs 11.67%), ether extract (1.59 vs 3.64%), crude fibre (1.39 vs 5.29%), ash (1.16 vs 3.42%), nitrogen free extract (70.48 vs 77.36%) and metabolizable energy (2818.12 vs 3325.25kcal/kg). The dry matter, crude protein, ether extract and crude fibre were slightly higher on the millet varieties (*Dauro* and Pearl millet) than the values observed on maize and sorghum varieties. Similarly, the nitrogen free extract and metabolizable energy were slightly higher on the maize and sorghum varieties and lower on the millet varieties. The proximate composition values of these energy sources were comparable to the reports of Olomu (1995) and Aduku (2005) in some Nigerian feedstuffs, similar observations were reported by Usman *et al.* (2021) on millet, sorghum and maize. Generally, energy feedstuffs are low in crude protein.

#### Proximate Composition of Selected Plant Protein Feedstuffs

The nutritive values of some plant protein feedstuffs are shown in Table 2.

**Table 2:** Proximate Composition of Plant Protein Feedstuffs

Feedstuffs	DM (%)	CP (%)	EE (%)	CF (%)	Ash (%)	NFE (%)	ME (kcal/kg)
Groundnut cake	90.13	43.21	9.11	3.81	5.52	28.48	3347.72
Egusi melon cake	89.66	29.62	16.11	6.21	2.78	34.95	3441.21
Sorrel seed meal	89.89	28.14	1.81	2.61	6.12	51.21	2995.50
Bambara nut meal	92.34	22.61	4.16	5.63	4.42	55.52	3122.50
Soya bean (full fat)	92.63	41.68	11.19	2.12	2.67	34.97	3360.80

DM: Dry Matter; CP: Crude Protein; CF: Crude Fibre; EE: Ether Extract; NFE: Nitrogen Free Extract; ME: Metabolizable Energy.

The result of the nutritive values of the plant protein feedstuffs are dry matter (89.66 vs 92.63%), crude protein (22.61 vs 43.21%), ether extract (1.81 vs 16.11%), crude fibre (2.12 vs 6.21%), ash (2.78 vs 6.12%), nitrogen free extract (28.48 vs 55.52%) and metabolizable values of 2995.50 and 3347.72kcal/kg found on sorrel seed meal and groundnut cake respectively. The values observed in this study were similar to those reported by Aduku (1993, 2005) and Mohammed (2022) on chemical composition of selected Nigerian feedstuffs.

#### Proximate Composition of Animal Protein Feedstuffs

The proximate composition of animal protein feedstuffs is presented in Table 3.



**Table 3:** Proximate Composition of Animal Protein Feedstuffs

Feedstuffs	DM (%)	CP (%)	EE (%)	CF (%)	Ash (%)	NFE (%)	ME (kcal/kg)
Local fish meal	90.16	59.19	5.25	0.94	16.31	8.47	3020.15
Industrial fish meal	92.61	64.55	5.49	0.93	18.29	3.35	2830.52
Grasshopper meal	92.09	39.11	9.23	0.19	3.76	39.80	3254.22
Cray fish	90.61	43.19	2.11	0.82	3.50	40.99	3345.60
Blood meal	91.61	70.62	0.80	0.16	3.46	16.05	2780.44

DM: Dry Matter; CP: Crude Protein; CF: Crude Fibre; EE: Ether Extract; NFE: Nitrogen Free Extract; ME: Metabolizable Energy.

The nutritive values of animal protein feedstuffs are dry matter (90.16 vs 92.61%), crude protein (39.11 vs 70.62%), ether extract (0.80 vs 9.23%), crude fibre (0.16 vs 0.94%), ash (3.46 vs 18.29%), nitrogen free extract (3.35 vs 40.99%) and metabolizable energy (2780.44 vs 3345.60kcal/kg). the values obtained in this study were similar to the reports of Aduku (2005) and Olomu (1995) on the nutritive values of Nigerian feedstuffs.

#### **Proximate Composition of Selected Fibre Feedstuffs**

The proximate composition of selected fibre feedstuffs is shown in Table 4.

**Table 4:** Proximate Composition of Selected Fibre Feedstuffs

Feedstuffs	DM (%)	CP (%)	EE (%)	CF (%)	Ash (%)	NFE (%)	ME (kcal/kg)
Wheat offal	92.51	16.24	1.12	11.23	0.93	57.99	1879.20
Maize offal	92.20	10.74	1.89	11.98	1.72	65.87	2250.00
Millet offal	91.24	12.03	5.04	5.63	0.93	67.61	2275.00
Rice offal	92.11	6.49	4.06	31.23	5.23	45.10	1655.00

DM: Dry Matter; CP: Crude Protein; CF: Crude Fibre; EE: Ether Extract; NFE: Nitrogen Free Extract; ME: Metabolizable Energy.

The proximate composition of selected fibre feedstuffs showed that the dry matter (91.24 vs 92.51%), crude protein (6.49 vs 16.24%), ether extract (1.12 vs 5.04%), crude fibre (5.63 vs 31.23%), ash (0.93 vs 5.23%), nitrogen free extract (45.10 vs 67.61%) and metabolizable energy (1655.00 vs 2275.00kcal/kg) observed in this study were comparable to the values reported by Aduku (1993) and Olomu (1995) in fibre sources.

## **CONCLUSION AND RECOMMENDATIONS**

Energy feedstuffs are generally high in metabolizable energy and low in protein and ether extract. Protein feedstuffs for both animal and plant origins are rich in crude protein with the highest value on blood meal (70.62%CP). Fibre feedstuffs are generally high in crude fibre with the highest value of 31.23% on rice offal. Maize and sorghum varieties are recommended as energy sources in poultry feeds with the yellow varieties as the best, being rich sources of vitamin A. Fish meal, soya bean meal and groundnut cake are the most suitable protein sources for poultry feeding in Nigeria. It can be recommended that feed experts should ascertain the nutritive value of each ingredient before inclusion in poultry feeds.

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