Bioresources Development Conference (BDC26)
NABDA
Journal of Biotechnology Research
ISSN: 1119-0531
Special Issue Vol. 5(3): (2026)

Proximate Composition of Formulated African Catfish Fingerlings Feed with Graded Levels of Bambara Groundnut (*Vigna subterranea* L.) Meal as a Substitute for Fishmeal.

***Salisu, A. S., Yusuf, S. K., Danzaria, A., Yakubu, M., Saleh, T. and Remkyes, M. S.**

National Biotechnology Research and Development Agency, Billiri, Gombe State, Nigeria

Corresponding Author: drsylviajim@gmail.com

Article ID: NJBR-BDC26-C014 | Received: 13 May, 2026 | Accepted: 19 May, 2026

ABSTRACT

The proximate composition of formulated African catfish fingerlings feed with graded levels of Bambara groundnut (Vigna subterranea L.) meal as substitution for fishmeal was evaluated Five (5) feed was formulate where Bambara groundnut as substitute for fishmeal was included at; 0.0g/100g (T1), 5.00g/100g (T2), 10.00g/100g (T3), 15.00g/100g (T4) and 20.00g/100g (T5) graded levels, feed without Bambara groundnut (T1) served as the control. Feed was subjected to proximate analysis, and the data collected were subjected to analysis of variance (ANOVA) at a 95% probability level; where significant differences were detected, mean values were separated using Least Significant Difference (LSD). Proximate analysis indicated that the formulation of African catfish fingerlings feed with graded levels of Bambara groundnut meal as substitution for fishmeal employed in this study had no significant (p>0.05) effects on the values of crude protein, crude lipid, crude fibre, moisture, ash and carbohydrate of the feed. Bambara groundnut meal at the graded levels used in this study has the potential to substitute fishmeal in the formulation of African catfish feed

Keywords: Crude Lipid, Feed, Graded Levels, Moisture, Proximate.

Introduction

Feed is the key and most important input in an intensive aquaculture system and contributes approximately 70 – 80% of the variable cost of production, and it directly affects the growth rate of the fish (Ali *et al.,* 2025). High quality feed that meets fish requirements enhances the growth of quality fish with the corresponding great market value (Jamabo *et al.,* 2019). Fishmeal is an excellent source of protein in fish feed due to its balanced amino acid profile and high digestibility by fish (Ali *et al.,* 2024). Traditionally, fishmeal is the main dietary protein source in fish feed formulation. Aquaculture industries rely heavily on fishmeal, which is the most preferred protein source for fish owing to its excellent amino acid and fatty acid profiles (Salisu *et al.,* 2024). Limited supply and high cost are restricting its use for sustainable aquaculture (Adams and Nwangwu, 2023). The replacement of fishmeal with readily available plant or grain by - products is getting increasing attention for the development of low-cost fish feed (Mohammed *et al.,* 2024).

Various research has been conducted to evaluate the growth performance of African catfish fed supplemented plant - based diets, and Bambara groundnut (*Vigna subterranea* L.) is one of such candidates. The consideration of Bambara groundnut as one of the alternatives for protein supplements in commonly cultured fish species has become necessary for the possible formulation of nutritionally balanced and low - cost feed for improved fish growth.

Bambara groundnut (*Vigna subterranea*) is an underutilized leguminous grain (Adams and Nwangwu, 2023). This study evaluates the proximate composition of formulated African catfish fingerlings feed with graded levels of Bambara groundnut (*V. subterranea*) meal as a substitution for fishmeal.

Materials And Methods

The formulated feed contained fish meal (FM), Bambara groundnut meal (BGNM), soybean meal (SBM), yellow maize meal (YMM) and groundnut cake meal (GNCM). All the ingredients were ground into a fine powder using a hammer mill and sieved through a 0.25 mm sieve. Fish meal, soybean meal, groundnut cake meal, and yellow maize meal were obtained from commercial suppliers in Gombe. The vitamin/mineral premix, fish oil and chromic oxide (Cr_2O_3) were purchased from TTS Integrated Farms Nigeria Limited, Agege - Lagos. Five (5) diet were prepared according to Pearson's square method respectively for feeding African catfish fingerlings as recommended by Sogbesan (2014) was prepared, where Bambara groundnut as substitute for fishmeal was included at; 0.0g/100g (T1) 5.00g/100g, (T2), T3 (10.00g/100g), 15.00g/100g (T4) and 20.00g/100g (T5) feed graded levels, diet without Bambara groundnut (T1) served as the control diet (Table 1). Feed was subjected to proximate analysis as described by AOAC (2005) for crude protein, crude lipid, crude fibre, moisture, ash, and carbohydrate. Data collected were subjected to analysis of variance (ANOVA) at 95% probability level, and where significant differences were detected, mean values were separated using Least Significant Difference (LSD).

Table 1: Ingredient Percentage Composition (g/100g) of Experimental Diet with Graded Levels of Bambara Groundnut

Ingredients (%)	T1	T2	T3	T4	T5
Fish meal	20.00	15.00	10.00	5.00	00.00
BGN meal	**0.00**	**5.00**	**10.00**	**15.00**	**20.00**
Soybean meal	20.00	20.00	20.00	20.00	20.00
GNC meal	24.00	24.00	24.00	24.00	24.00
Yellow maize	30.00	30.00	30.00	30.00	30.00
Fish oil	1.00	1.00	1.00	1.00	1.00
Vegetable oil	1.00	1.00	1.00	1.00	1.00
Starch	1.00	1.00	1.00	1.00	1.00
Lysine	0.50	0.50	0.50	0.50	0.50
Methionine	0.50	0.50	0.50	0.50	0.50
*Vitamin/premix	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
Cr_2O_3	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00

Key: T1 – Bambara groundnut (0.0g/100g), T2 – Bambara groundnut (5.00g/100g), T3 – Bambara groundnut (10.00g/100g), T4 – Bambara groundnut (15.00g/100g), T5 – Bambara groundnut (20.00g/100g), BGN - Bambara groundnut and GNC - Groundnut cake.

Results

The proximate compositions of the formulated African catfish fingerlings feed with graded Levels of Bambara groundnut as substitution for fishmeal are shown in Table 2. Crude protein (12.28 – 17.88 %.), crude lipid (5.50 – 9.00%), crude fibre (0.1 – 0.2%), moisture (7.04 – 8.18%), Ash (3.03 – 4.81 %) and carbohydrate (63.91 – 70.68%) content of experimental diet indicated

that there was no significant (p>0.05) difference in the values of crude protein, crude lipid, crude fibre, moisture, ash carbohydrate of the feed.

Table 2: Proximate Composition of Formulated African Catfish Feed with Graded Levels of Bambara Groundnut as Substitution for Fishmeal

Proximate composition (%)	T1	T2	T3	T4	T5
Crude protein (%)	17.88	15.40	12.63	12.28	12.45
Crude lipid (%)	6.50	9.00	5.50	6.50	6.50
Crude fibre (%)	0.1	0.1	0.1	0.1	0.1 b
Moisture (%)	7.54	7.84	7.88	8.18	7.04
Ash (%)	4.02[d]	3.72	4.81	3.47	3.03
Carbohydrate (%)	63.96	63.91	69.08	69.47	70.68

Mean values are not significantly different (p>0.05).

Discussion

The crude protein content values, 12.28 – 17.88 % of the experimental diet were lower than the values, 40.31 – 40.82 % reported by Fakunle *et al.* (2014). Crude lipid content values (5.50-9.00%) were higher than the values of 4.79-7.06% reported by Agbabiaka *et al.* (2016). Crude fibre content values (0.1-0.2%) were lower than the values of 2.45- 3.34% reported by Elezuo (2016). Moisture content values, 7.04 – 8.18 % recorded from this study, were comparable with the values, 5.97 – 8.81% reported by Agbabiaka *et al.* (2016); these values were within the recommended level (<10.0%) for *C. gariepinus* diet. Ash content values, 3.03 – 4.81 % were lower than the values of 12.85- 13.20% reported by Elezuo (2016). Carbohydrate values, 63.91 – 70.68% were comparable higher than, the values (29.97-33.63%) reported by Agbabiaka *et al* (2016) and 30.81- 33.58% reported by Elezuo (2016), respectively.

Conclusion

The Bambara groundnut meal at the graded levels used in this study has the potential to substitute fishmeal in the formulation of African catfish feed, subsequently reducing expenditure on fish meal, which is the most expensive ingredient in fish feed, without compromising growth performance and feed utilization in African catfish.

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How to Cite This Article
Salisu, A. S., Yusuf, S. K., Danzaria, A., Yakubu, M., Saleh, T., and Remkyes, M. S.(2026). Proximate Composition of Formulated African Catfish Fingerlings Feed with Graded Levels of Bambara Groundnut (*Vigna subterranea* L.) Meal as a Substitute for Fishmeal. *NABDA Journal of Biotechnology Research*, 5(4), 122-125.