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Research Article

Effect of Processed *Sesamum indicum* Seed Meal on the Growth Performance of *Clarias gariepinus* (Burchell, 1822)

***Saidu, A.[1], Gwarzo, A. S.[1] and Tanimu, M. D.[2]**

[1]Department of Applied Biology, Kaduna Polytechnic, Kaduna, Nigeria
[2]Department of Biological Sciences, Kaduna State University, Kaduna, Nigeria
****Corresponding Author's email*: ameensaeed9935@gmail.com; Phone: +2348031523186**

ABSTRACT

Sesamum indicum is a tiny, flat, oval-shaped seed cultivated due to its culinary and nutritional value for thousands of years. Fish feed is the single most expensive factor in aquaculture production due to inflated prices and unavailability of fishmeal. The effect of processed *Sesamum indicum* seed meal on the growth performance of *Clarias gariepinus* was evaluated for ten weeks of feeding trials. The seeds were sourced from the station market, Kaduna State and taken to the Department of Biological Sciences, Kaduna State University, for identification and Authentication. Specimen number KASU/BSH/778 was assigned and documented. The seeds were washed, rinsed, air dried for 7 days and pulverised to obtain *Sesamum indicum* seed meal (SISM) used to replace fishmeal at 10% and 20% inclusion levels. Two formulated diets and a commercial feed (control) were used in the experiment labelled T1, T2, and T3, respectively. Mixed sexes of *Clarias gariepinus* fingerlings of average weight of 7.33±2.08 were used. Nine rubber tanks (25-liter capacity) were used at a 10-fish-per-tank stocking density, with three replications. Feeding was twice in the morning and evening at 5% body weight. The control (commercial feed) and the experimental diets fed with 20% inclusions of SISM recorded the highest weights of 24.3±1.40 and 23.9±3.17, respectively. However, there is a significant difference between the controls and the experimental diets at p-value (<0.05). The study shows that processed SISM can be incorporated into Catfish diets without adversely affecting their performance.

Keywords: Clariid fish; Fingerlings; Fishmeal; Growth; Processed; Sesame

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INTRODUCTION

Sesamum indicum is a flowering plant in the genus *Sesamum*, also called Benne with a wide distribution of wild relatives primarily occurring in Africa and a smaller number in India. It is widely cultivated across tropical regions for its edible seeds, which are contained within pods, and is one of the oldest known oilseed crops, having been domesticated over 3,000 years ago (Hussain et al., 2023).

Sesamum has many other species, most being wild and native to sub- Saharan Africa and notably grown in India and exhibits remarkable drought tolerance, thriving in conditions where other crops may fail. Sesame seeds are characterized by their high oil content, one of the highest among seeds, and are valued for their nutty flavour. These seeds are commonly used in culinary applications worldwide, particularly in baking, confectionery, and as a garnish. In addition to their culinary uses, sesame seeds are a rich source of essential nutrients, including copper, manganese, calcium, phosphorus, magnesium, iron, zinc, selenium, vitamin B1, and dietary fibres (Singh et al., 2022).

However, like other nuts and foods, the crop is highly drought tolerant, grows well in most kinds of soils, regions and is well suited to different crop rotations. In reality, sesame is mostly grown under moisture stress

with low management input by smallholders. However, the sesame production is below expectation and the potential could be considerably higher (Wei et al., 2022).

Recently, plant-based protein products have gained significant interest as functional ingredients in food systems globally. These plant proteins are increasingly recognized not only for their nutritional value but also for their functional properties, which enhance food quality and offer potential biological benefits. In developed countries, plant proteins are now considered versatile functional components rather than merely essential nutrients (Aschemann-Witzel et al., 2021; Langyan et al., 2022; Tan et al., 2023).

In the context of aquaculture, the formulation of cost-effective, nutritionally balanced fish feed using locally available agro-industrial by-products become a priority. Fishmeal, traditionally a primary protein source in aquaculture, has become prohibitively expensive (Sangavi & Betsy, 2020). Research has demonstrated the successful partial replacement of fishmeal with alternative plant protein sources, such as soybean meal, in the diets of various fish species. As fish farming continues to expand, the need for more affordable and sustainable feed options has become urgent. Replacing fishmeal with plant-based ingredients can mitigate rising feed costs and improve the sustainability of aquaculture operations. Moreover, the broad spectrum of amino acids present in fishmeal contributes to its high cost, further underscoring the need for cost-effective alternatives (Jahan et al., 2021; Oliva-Teles et al., 2022).

African Catfish scientifically called *Clarias gariepinus* is a widely farmed air-breathing species known for its fast growth rate and adaptability to suboptimal water conditions. It has the potential to reach large sizes, with maximum reported lengths of up to 170 cm and weights of 60 kg. As an omnivorous species, *Clarias gariepinus* is highly valued for its rapid growth and hardiness, making it an ideal candidate for studies exploring alternative feed ingredients (Dogah, 2020)

The aim of this research was to evaluate the growth performance of catfish fed processed *Sesamum indicum* seed meal for ten weeks feeding trial.

MATERIALS AND METHODS

Study Area

The research was conducted at the Biological Garden of Applied Biology Department, Kaduna Polytechnic, Kaduna, Nigeria at coordinates 10.568° N latitude and 7.452° E longitude (Aminu & Ibrahim, 2022).

Source of *Sesamum indicum* Seeds

Ten kilogram (10 Kg) of *Sesamum indicum* seeds were sourced from Station Market within Kaduna metropolis, and taken to the Biological Sciences Department, Kaduna State University for identification and authentication. The specimen was assigned the reference number kasu/bsh/778. This method was adopted by Aminu and Ibrahim (2022).

Experimental fish

One hundred mixed-sex of *Clarias gariepinus* fingerlings, with an average initial weight of 7 g and length of 6 cm, were sourced from the Applied Biology Department of Kaduna Polytechnic. The fish were acclimatized for two weeks and fed 2mm commercial feed called "Ala Aqua" before the experiment commenced. Prior to the feeding trial, the fish were starved for 24 hours. This method was adopted by Cui et al. (2024).

Preparation and Processing of *Sesamum indicum* Seed Meal

The *Sesamum indicum* seeds were manually sorted, soaked in water, rinsed to remove foam, and air-dried at room temperature for seven days. The dried seeds were then ground into a fine meal using mortar and pestle to obtain *Sesamum indicum* seed meal (Saidu et al., 2023).

Feed formulation of the experimental diet

The experimental diets were formulated using the Pearson□s Square Method, incorporating maize as an energy source, groundnut cake and fishmeal as protein sources, and *Sesamum indicum* seed meal as a partial fishmeal replacement at inclusion levels of 10% and 20%. Other ingredients, including premix, wheat offal, rice bran, methionine, lysine, and water, were also added. The mixture was pelleted to a size of 3 mm using a local pelleting machine at Uyama Agro Nigeria Limited, Kaduna. This method was described by Afia et al. (2020)

Experimental Design

The experiment consists of three treatments each representing 10 and 20 percent inclusions of *Sesamum indicum* seed meal to replace fishmeal in diet T1 and T2 which were formulated. Each of these treatments was replicated thrice. The controls (T3 or commercial feed) have no inclusion of *Sesamum indicum* seed meal. 9 tanks (25-liters capacity) were used at the stocking density of 10 fish per tank. Feeding was twice a day at 5% body weight throughout the experimental period, in the morning around 9:00 am, and evening around 4:00 pm. The water was changed every 24 hours to avoid stressing the fish throughout the ten-weeks experimental period as described by Afia et al. (2020)

Growth performance

Weight and length of the experimental fish were taken using weighing balance and metre rule respectively once every two weeks to determine the total weight gain (TWG) and total length gain as adopted by Aminu and Ibrahim (2022).

Performance evaluation

During the experiment, fish performance was based on productivity indices on growth performance and nutrient utilization efficiencies as described by Aminu and Ibrahim (2022)

Total feed intake (TFI)

Total feed intake was estimated by summing the weekly feed intakes during the period of the experiment (Sun et al., 2022).

Total weight gain (TWG)

Total weight gain was obtained as the difference between the initial weight and the final weight gained of the experimental fish using the formula below:

Total weight gain (TWG) = final weight initial weight (Al Sulivany et al., 2024)

Total percentage weight gain (TPWG %)

Total percentage weight gain was calculated using the formula below:

TPWG = Total weight gained **/** Initial weight x 100% (Al Sulivany et al., 2024).

Feed Conversion Ratio

From the feed consumed by each group of fish and weight gained, the feed conversion ratio (FCR) was calculated using the expression adopted by

FCR = Feed Intake / Net weight gain (Elvy et al., 2022).

Protein Efficiency Ratio

Protein Efficiency Ratio (PER) was calculated from the weight gain obtained from the test subject divided by its intake of a particular feed protein during the test period. Hence

PER = Gain in body mass (g)/ Protein intake (g) (Hoskin, 2023).

Data Analysis

Analysis of Variance (ANOVA) was used to evaluate significant differences among experimental fish fed different inclusions of *Sesamum indicum* and the controls. P-value < 0.05 was considered to be significant. The statistical package used was Statistical Analysis System (SAS) version 9.4.

RESULTS

Growth Performance of the Experimental Fish Fed with *Sesamum indicum* Seed Meal for Ten Weeks Feeding Trials

Initial Weight of the Experimental Fish

At the start of the experiment, the average initial weight of the experimental fish ranged from 7.30 to 7.33 g. Statistical analysis ($p > 0.05$) revealed no significant difference in the initial weights of the fish across all treatments, indicating a uniform distribution of fish at the beginning of the study (Table 1).

Final Weight Gain of the Experimental Fish

Table 1 shows that the final weight gain of the experimental fish at the end of ten weeks feeding trials with inclusion levels of Sesame seed was 22.57±0.25 in treatment-1, followed by treatment-2 that yield 23.9±3.17. The highest weight gain of 24.3±1.40 was produced by treatment-3. At p-value >0.05, the least significant difference (LSD) indicated that there was significant difference between the treatments and the control (commercial feed) groups.

Average Initial Length of the Experimental Fish

The average initial length of the experimental fish was between 6.63±1.5 and 6.67±1.5. Table 2 shows that there was no significant difference ($p<0.05$) among the treatments indicating complete random distribution of the individual fish in each of the treatment groups (Table 2).

Final Length of the Experimental Fish

Analysis of variance indicates that the least final length of the experimental fish at the end of the ten-weeks feeding trials with *Sesamum indicum* seed meal (SISM) was 19.10±1.20 which was recorded in treatment-2. It was followed by treatment-1 that recorded 19.7±0.20. The higest length gain of 19.8±1.20 was recorded in treatment-3. The least significant difference shows that there was significant difference at p-value <0.05 (Table 2).

Survival Rate of the Experimental Fish

The survival rate of the fish fed the experimental diets throughout the experimental period ranged from 90-100 with the highest obtained in T1 and T3, followed by T2. There was no significant difference between the fish fed the commercial feed of the experimental diets (Table 3).

Nutrient utilization parameters

Treatment-1 (10%) produced the best result for the Feed Conversion Ratio (FCR) of 1.76, it was followed by Treatment 2 (20%) which yielded 1.89. The least value was observed in Treatment 3 (control). However, result of analysis of variance shows that the feed conversion ratio of the treatments was significantly different with that of the commercial feed (Table 3).

Treatments 1 and 2 (10%) gave the highest value of 1.09±0.34 and 0.51±0.14 respectively for the Percentage Efficiency Ratio (PER). It was followed by Treatment 3 (commercial feed) that produced 0.09±0.04. (Table 3).

Table 1. Average Body Weight of *C. gariepinus* Fed with Sesame Seed Meal for Ten Weeks Feeding Trials

Week	T1	T2	T3
2	7.30±1.00[a]	7.33±2.08[a]	7.33±3.09[a]
4	9.60±0.30[c]	10.46±0.65[b]	11.60±0.40[a]
6	14.40±0.10[c]	14.80±0.60[b]	15.27±0.75[a]
8	17.70±0.20[c]	17.90±1.20[ab]	18.8±3.62[a]
10	22.57±0.25[c]	23.9±3.17[ab]	24.3±1.40[a]

Values are given as mean ± standard deviation. In each row**,** values with the dissimilar superscripts have a statistically significant difference ($p < 0.05$). T1: Treatment 1 (10%), T2: Treatment 2 (20%), T3: Treatment 3 (control)

Table 2. Average Body Length of *C. gariepinus* Fed with Sesame Seed Meal for Ten Weeks Feeding Trials

Week	T1	T2	T3
2	6.67±1.52[a]	6.63±1.52[a]	6.63±1.05[a]
4	9.86±0.35[a]	9.80±0.20[a]	9.30±0.70[b]
6	11.47±0.15[ab]	11.00±0.80[b]	11.67±1.05[a]
8	15.10±0.35[b]	15.80±0.40[a]	15.80±1.45[a]
10	19.7±0.20[a]	19.10±1.20[b]	19.8±1.20[a]

Values are given as mean ± standard deviation. In each row, values with the dissimilar superscripts have a statistically significant difference ($p < 0.05$). T1: Treatment 1 (10%), T2: Treatment 2 (20%), T3: Treatment 3 (control)

Table 3. Nutrient Utilization Parameters of the Experimental Fish Fed Processed *Sesamum indicum* Seed Meal for Ten Weeks Feeding Trials

Parameters	Treatments		
	T1 (10%)	T2 (20%)	T3 (Control)
Final weight (g)	22.57±0.25[c]	23.9±3.17[ab]	24.3±1.40[a]
Initial weight (g)	7.30±1.00[a]	7.33±2.08[a]	7.33±3.09[a]
Total weight gained (g)	18.27±0.75[a]	16.57±1.09[a]	16.97±1.69[a]
Percent gain in weight (%)	62.7±30.2[a]	56.0±25.0[a]	88.5±48.0[a]
Final length (cm)	19.7±0.20[a]	19.10±1.20[b]	19.8±1.20[a]
Initial length (cm)	6.67±1.52[a]	6.63±1.52[a]	6.63±1.05[a]
Total length gained (cm)	13.03±1.32[a]	12.47±0.32[b]	13.17±0.15[c]
Percent gain in length (%)	62.7±30.2[a]	76.1±46.4[a]	139.6±86.2[a]
Feed intake (g)	32.2	32.2	32.2
Protein intake (g)	14.49	14.49	14.49
FCR	1.76	1.94	1.89
PER	1.26±0.34	1.14±0.14	1.17±0.40
Survival Rate (%)	100	90	100

Values are given as mean ± standard deviation. In **each row**, values with the dissimilar superscripts have statistically significant difference ($p < 0.05$). T1: Treatment 1 (10%), T2: Treatment 2 (20%), T3: Treatment 3 (control), PER: Protein Efficiency Ratio, FCR=Feed Conversion Ratio

DISCUSSION

The growth performance of the *Clarias gariepinus* fingerlings fed different inclusions of *Sesamum indicum* seed meal revealed that, the average initial weight at the onset of the feeding trials. This also indicated that all the treatments and the control were given an equal chance to compete in attaining a particular weight gain. While the mean weight gain at the end of the feeding trials conforms with result of Hekmatpour et al. (2023) who worked on replacement effects of soybean meal with sesame seed cake on growth, biochemical body composition, and economic efficiency of *Cyprinus carpio* formulated diet and concluded that comparable growth performance and measured physiological responses indicated that Soy bean meal could be replaced by 75 to 100% Sesame seed cake in the formulated diet of *Cyprinus carpio* juveniles. This result also agreed with that of Effiong and Yaro (2020) who worked on the fatty acid composition of fillets of C*larias gariepinus* fed with various oil-based diets and revealed that fish fed with different vegetable oil such as olive, sunflower and sesame oils in the diets of fish resulted in positive growth responses. The result is also consistence with that of Aminu and Ibrahim (2022), who worked on

growth performance of *Clarias gariepinus* fed processed *Moringa oleifera* seed meal for an eight-weeks feeding trial. They concluded that *Moringa oleifera* seed meal can be used to replace fishmeal up to 25% inclusion levels.

The survival rate of *Clarias gariepinus* fingerlings fed *Sesamum indicum* seed meal suggested that all diets including the control were suitable for the fish and met its nutritional requirement which may be due to the processing method applied to the seed as emphasized by Aminu and Ibrahim (2022).

CONCLUSIONS

This study investigated the effects of replacing fishmeal with *Sesamum indicum* seed meal at different inclusion levels in clariid fish diets. The results showed that the growth performance, feed utilization, and fish health were comparable to the control (fishmeal-based) diet, indicating that sesame seed can effectively serve as a partial substitute for fishmeal without negative effects.

REFERENCES

Afia, O. E., David, G. S., & Umoren, I. U. (2020). Varying feeding levels and the growth response of North African catfish. *South Asian Res. J. Agric. Fish*, *2*, 56-62.

Al Sulivany, B. S., Hassan, N. E., & Mhammad, H. A. (2024). Influence of Dietary Protein Content on Growth Performance, Feed Efficiency, Condition Factor, and Length-Weight Relationship in Cyprinus carpio during the Summer Season. *Egyptian Journal of Aquatic Biology & Fisheries*, *28*(2).

Aminu, S., & Ibrahim, B. (2022). Growth Performance of Clarias gariepinus (Burchell, 1822) Fed Processed Moringa oleifera (LAM.) Seed Meal. *International Journal of Science for Global Sustainability*, *8*(2), 7-7.

Aschemann-Witzel, J., Gantriis, R. F., Fraga, P., & Perez-Cueto, F. J. (2021). Plant-based food and protein trend from a business perspective: Markets, consumers, and the challenges and opportunities in the future. *Critical reviews in food science and nutrition*, *61*(18), 3119-3128.

Cui, X., Huang, X., Chen, X., Li, H., Wu, Y., Yang, Z., Liu, Z., Feng, R., Xu, J., & Wei, C. (2024). Influence of Starvation on Biochemical, Physiological, Morphological, and Transcriptional Responses Associated with Glucose and Lipid Metabolism in the Liver of Javelin Goby (Synechogobius hasta). *Animals*, *14*(18), 2734.

Dogah, W. (2020). *Studies on aspects of the biology of clarias gariepinus and heterobranchus longifilis from river Offin: Towards their culture development in Ghana* University of Cape Coast].

Effiong, M. U., & Yaro, C. A. (2020). Fatty acid composition of fillets of African catfish, Clarias gariepinus fed with various oil-based diets. *Aquaculture Studies*, *20*(1), 29-35.

Elvy, J. E., Symonds, J. E., Hilton, Z., Walker, S. P., Tremblay, L. A., Casanovas, P., & Herbert, N. A. (2022). The relationship of feed intake, growth, nutrient retention, and oxygen consumption to feed conversion ratio of farmed saltwater Chinook salmon (Oncorhynchus tshawytscha). *Aquaculture*, *554*, 738184.

Hekmatpour, F., Amiri, F., Yooneszadeh Fashalami, M., Nazemroaya, S., Sadr, A., Mousavi, S., Mortezavizadeh, S., Kianersi, F., Ahangarzadeh, M., & Houshmand, H. (2023). Replacement effects of soybean meal with sesame seed cake on growth, biochemical body composition, and economic efficiency of Cyprinus carpio formulated diet. *Iranian Journal of Fisheries Sciences*, *22*(3), 678-700.

Hoskin, J. M. (2023). Improved Performance of the Reference Casein Control Group in AOAC Official Method SM 960.48 (Protein Efficiency Ratio, Rat Bioassay) for Determining the Biological Quality of Protein in Infant Formula. *Journal of AOAC International*, *106*(1), 1-5.

Hussain, M., Ul-Allah, S., & Farooq, S. (2023). Sesame (Sesamum indicum L.). In *Neglected and Underutilized Crops* (pp. 733-755). Elsevier.

Jahan, H., Tumpa, I. J., Qasem, W. A., Moniruzzaman, M., Pervin, M. A., Akter, R., Omri, A., Min, T., & Hossain, Z. (2021). Evaluation of the partial replacement of dietary fish meal with fermented or untreated soybean meal in juvenile silver barb, Barbonymus gonionotus. *Frontiers in nutrition*, *8*, 733402.

Langyan, S., Yadava, P., Khan, F. N., Dar, Z. A., Singh, R., & Kumar, A. (2022). Sustaining protein nutrition through plant-based foods. *Frontiers in nutrition*, *8*, 772573.

Oliva-Teles, A., Enes, P., Couto, A., & Peres, H. (2022). Replacing fish meal and fish oil in industrial fish feeds. *Feed and Feeding Practices in Aquaculture*, 231-268.

Saidu, A., Abdulrahman, A., & Imam, Z. (2023). Effect of processing methods on the proximate and phytochemical constituents of Moringa Oleifera (Lamarck, 1785) leaves. *Science World Journal*, *18*(2), 272-275.

Sangavi, S., & Betsy, C. J. (2020). Non-conventional Feed Ingredients for Aquaculture with Special Reference to Palm Kernel Meal-a Review. *Journal of Aquaculture in the Tropics*, *35*(1-4), 27-39.

Singh, M., Chahar, S., Avtar, R., Singh, A., & Kumar, N. (2022). Advances in Classical and Molecular Breeding in Sesame (Sesamum indicum L.). *Accelerated Plant Breeding, Volume 4: Oil Crops*, 491-529.

Sun, H., Chen, D., Cai, H., Chang, W., Wang, Z., Liu, G., Deng, X., & Chen, Z. (2022). Effects of fermenting the plant fraction of a complete feed on the growth

performance, nutrient utilization, antioxidant functions, meat quality, and intestinal microbiota of broilers. *Animals*, *12*(20), 2870.

Tan, M., Nawaz, M. A., & Buckow, R. (2023). Functional and food application of plant proteins□a review. *Food Reviews International*, *39*(5), 2428-2456.

Wei, P., Zhao, F., Wang, Z., Wang, Q., Chai, X., Hou, G., & Meng, Q. (2022). Sesame (Sesamum indicum L.): A comprehensive review of nutritional value, phytochemical composition, health benefits, development of food, and industrial applications. *Nutrients*, *14*(19), 4079.