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Growth Performance, Feed Utilization and Cost-Benefit of Replacing Maize with Fermented Maize Cob Meal in the Diets of African Catfish (*Clarias gariepinus* Burchell, 1822)

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ABSTRACT

The study evaluated the growth performance, feed utilization, and cost-benefit of replacing maize with fermented maize cob meal (FMCM) in the diet of Clarias gariepinus fingerlings. One hundred and fifty (150) fingerlings were allocated to five dietary treatments (0 %, 10 %, 20 %, 30 %, and 40 % FMCM inclusion) in a completely randomized design with three replicates each and reared for 90 days. Fermented maize cob meal was produced by solid-state natural fermentation at 37 °C for 96 hours, oven-dried, and ground to fine powder. Experimental diets were formulated to 40% crude protein. Results showed that fish fed 10 % FMCM achieved the highest final weight (350.67 g), weight gain (312.67 g), specific growth rate (1.07 %/day), protein efficiency ratio (7.82), and the best feed conversion ratio (0.93). Fish fed 40 % FMCM recorded the lowest growth performance values. No significant differences (P > 0.05) in feed conversion ratio, relative growth rate, condition factor, and survival rate were observed across treatments. Economic analysis revealed that fish fed 10 % FMCM yielded the highest net profit (₦604.03), best benefit-cost ratio (1.51), highest profit index (2.06), and lowest incidence cost (0.83). The study concludes that FMCM can partially replace maize meal in Clarias gariepinus diets at up to 10 % inclusion level for optimum growth and economic returns.

Key words: African catfish, Fish feed, Growth performance, Cost-benefit, Aquaculture.

INTRODUCTION

Fish farming involves raising fish in tanks, earthen ponds, polyethylene ponds, cage ponds, or enclosures. The greatest challenges in aquaculture are the high cost of feed ingredients, which compels feed industries and farmers to compromise quality for availability and affordability (Irabor *et al.*, 2022). Fish feed manufacturing is an essential consideration in both subsistence and large-scale fish farming since it directly affects growth efficacy (Little *et al.*, 2016). Animal nutritionists are faced with the challenge of producing locally formulated aqua-feeds that are readily available and nutritionally adequate at a reduced cost (Geetanjali *et al.*, 2020). Fish is one of the most important sources of animal protein in developing countries (FAO, 2018). It has continued to be a source of hope towards solving the global problems of malnutrition due to its nutritive value above other animal sources of protein (Sogbesan *et al.*, 2016). African catfish (*Clarias gariepinus*) is an important fish species in both aquaculture and capture fisheries, contributing 22 % of animal protein in Sub-Saharan Africa and 40 % of animal protein consumed in Nigeria (Esther and Sogbesan, 2021). It is a rapidly cultured species that has contributed significantly to the economic growth and food security of the country (Irabor *et al.*, 2021a).

The species dominates cultured fish production in Nigeria owing to its tolerance of varying environmental conditions, high stocking densities, fast growth rate, disease resistance, acceptability of artificial feed, high fecundity, good taste and meal quality, ease of artificial breeding, and high market value (Eyo *et al.*, 2014). Maize cob is an agricultural waste product widely available at harvest season. It is generally considered a waste product but has been reported as a significant energy source owing to its carbohydrate content (45–55 %) and other nutritional characteristics, making it a potential substitute for expensive energy sources in animal feeds (Ahmad *et al.*, 2016; García-Alanis *et al.*, 2021). Maize cob is non-toxic, readily available in good quantities, and, as a waste material, is obtained at almost no cost (Girelli *et al.*, 2020). However, it has not yet been well utilized in aquaculture (Kanengoni *et al.*, 2015). Solid-state fermentation has been shown to enhance cereal protein content and improve digestibility (Anigboro *et al.*, 2020), thereby improving its suitability as a feed ingredient. The rising cost of maize and its accompanying scarcity have made its inclusion in fish feeds increasingly uneconomical. In an attempt to maximize aquaculture profit, it is imperative to consider fermented maize cob as a cheaper energy source to partially replace maize in the diet of *Clarias gariepinus*. This study therefore evaluated the growth performance, feed utilization, and cost-benefit of replacing maize with fermented maize cob meal in the diet of African catfish fingerlings.

MATERIALS AND METHODS

Study Area

The experiment was conducted at the Teaching and Research Fish Farm, Department of Fisheries, University of Maiduguri, situated between latitude 11°51'N and longitude 13°51'E. Maiduguri is characterized by a cold and dry climate from January to March; the warmest month is April, with a mean annual rainfall of 800 mm. The rainy season begins in June and ends in October, with a relative humidity of 5–54.5 % and atmospheric temperatures ranging from 38–40 °C during the day, dropping to 29–31 °C at night (Mohammed *et al.*, 2020).

Collection and Processing of Maize Cob

Maize cob was collected from maize sellers in Moduganari market. The cob was broken into smaller pieces using a pestle and mortar. The sample was wetted thoroughly in a plastic bowl and subjected to solid-state fermentation by covering it and keeping it in a dark place at room temperature (37 °C) for 96 hours to ferment naturally. After fermentation, the product was oven-dried at 50 °C and ground into fine powder.

Procurement and Processing of Other Feed Ingredients

Other ingredients, including fish meal, soya bean, maize, premix, salt, palm oil, lysine, methionine, and starch, were purchased in Maiduguri metropolitan. Soya beans were toasted for 10–15 minutes. Maize and toasted soya beans were milled and stored in airtight polythene bags prior to feed formulation.

Proximate Composition of Fermented Maize Cob Meal

Proximate composition of the fermented maize cob meal was determined using the methods described by AOAC (2010) for moisture content, crude protein (Kjeldahl method), ether extract (Soxhlet method), crude fibre, and ash content. Nitrogen-free extract (NFE) was calculated by difference.

Experimental Diets and Feed Formulation

Diets containing 40 % crude protein were formulated using fish meal, soybean meal, maize, fermented maize cob meal (FMCM), premix, methionine, lysine, palm oil, salt, and starch. All ingredients were processed and milled into a fine powder and sieved through a 2 mm sieve. Ingredients were weighed and mixed to homogeneity, then pelleted using a pelleting machine with a 0.2 mm diameter die. Pellets were air-dried at room temperature and stored

in polythene bags. Five isonitrogenous diets were formulated, replacing maize with FMCM at 0 % (control), 10%, 20%, 30%, and 40% inclusion levels, as shown in Table 1.

Experimental Fish and Design

One hundred and fifty (150) *Clarias gariepinus* fingerlings were purchased from Maravi fish farm in Maiduguri, transported to the Hatchery Complex, Department of Fisheries, University of Maiduguri, and acclimatized for 24 hours. Initial total length and body weight were recorded. A completely randomized design (CRD) was used; fish were allocated to five treatments, each replicated three times (10 fish per replicate). Fish were reared for 90 days in hapas (1.5 m × 1.0 m × 1.0 m) inserted into a polyethylene-lined pond, and fed experimental diets twice daily at 5 % body weight (09:00 am and 04:00 pm). Biweekly weighing and feed adjustment were performed throughout the trial.

Table 1: Percentage Composition of Experimental Diets (% inclusion of fermented maize cob meal)

Ingredient	0% FMC	10% FMC	20% FMC	30% FMC	40% FMC
Fish Meal (FM)	33.11	33.11	33.11	33.11	33.11
Soybean Meal (SBM)	33.11	33.11	33.11	33.11	33.11
Maize Meal (MM)	27.78	25.00	22.22	19.44	16.66
Fermented Maize Cob Meal (FMCM)	0.00	2.78	5.56	8.34	11.40
Premix	2.00	2.00	2.00	2.00	2.00
Lysine	0.50	0.50	0.50	0.50	0.50
Methionine	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Palm Oil	1.50	1.50	1.50	1.50	1.50
Starch	1.00	1.00	1.00	1.00	1.00
Total	100	100	100	100	100

FM = Fish meal; SBM = Soybean meal; MM = Maize meal; FMCM = Fermented maize cob meal

Growth Performance and Feed Utilization Parameters

Growth performance and feed utilization were assessed using the following formulas (Nwachi and Irabor, 2015; Jimoh *et al.*, 2022):

Weight Gain (WG) = Final weight (W2) – Initial weight (W1)
Relative Growth Rate (RGR) = (W2 – W1) / T
Specific Growth Rate (SGR) = [(Ln W2 – Ln W1) / T] × 100
Feed Conversion Ratio (FCR) = Dry feed consumed (g) / Weight gain (g)
Protein Efficiency Ratio (PER) = Weight gain (g) / Protein fed (g)
Condition Factor (K) = [W / L^3] × 100
Survival Rate (SR) = [(Initial no. – Mortalities) / Initial no.] × 100

Cost Benefit Analysis

Economic evaluation was carried out to estimate the cost of feed required to produce a kilogram of fish, assuming all other operating costs were equal across treatments. The economic indices were calculated using the method of Sogbesan and Bashir (2018):

Net Profit (NP) = Total Sales (₦) – Total Expenditure (₦)
Profit Index (PI) = Net profit (₦) / Weight of fish produced (g)
Incidence of Cost (IC) = Cost of feed (₦) / Weight of fish produced (g)
Benefit Cost Ratio (BCR) = Total sales (₦) / Total expenditure (₦)

Statistical Analysis

The data obtained were subjected to one-way analysis of variance (ANOVA) using Microsoft Excel. Least Significant Difference (LSD) was used for mean separation at 95 % confidence level.

RESULTS

Growth Performance and Feed Utilization

The growth performance and feed utilization results are presented in Table 2. The highest final weight (350.67 g) and weight gain (312.67 g) were recorded in fish fed 10 % FMCM, while the lowest final weight (271.00 g) and weight gain (233.33 g) were observed in fish fed 40% FMCM. There were no significant differences ($P > 0.05$) in final weight between the control and 10 % FMCM groups, or between fish fed 20 % and 30 % FMCM; however, these groups differed significantly from fish fed 40 % FMCM. The highest specific growth rate was 1.07 %/day (10 % FMCM) and the lowest was 0.94 %/day (40 % FMCM); significant differences ($P < 0.05$) were observed among treatments. The highest protein efficiency ratio (7.82) was obtained in fish fed 10 % FMCM and the lowest (5.83) in fish fed 40 % FMCM. The feed conversion ratio, relative growth rate, condition factor, and survival rate showed no significant difference ($P > 0.05$) among treatments. Initial weight, initial length, and final length also showed no significant differences ($P > 0.05$).

Table 2: Growth performance and feed utilization of Clarias gariepinus Fed Fermented Maize Cob Meal

Parameters	0%	10%	20%	30%	40%	SEM
Initial weight (g)	38.33^{a}	38.33^{a}	38.67^{a}	38.67^{a}	38.33^{a}	0.49^{ns}
Mean initial length (cm)	7.81^{a}	8.42^{a}	7.83^{a}	8.32^{a}	8.25^{a}	0.21^{ns}
Mean final length (cm)	24.33^{a}	23.22^{a}	22.99^{a}	23.88^{a}	24.33^{a}	0.56^{ns}
Final weight (g)	344.00^{a}	350.67^{a}	325.33^{ab}	283.33^{ab}	271.00^{b}	22.51^{s}
Weight gain (g)	292.67^{ab}	312.67^{a}	287.33^{ab}	245.33^{ab}	233.33^{b}	23.28^{s}
Specific growth rate (%/day)	1.06^{ab}	1.07^{a}	1.03^{ab}	0.96^{ab}	0.94^{b}	0.04^{s}
Feed conversion ratio	1.01^{a}	0.93^{a}	1.02^{a}	1.01^{a}	1.12^{a}	0.07^{ns}
Protein efficiency ratio	7.32^{ab}	7.82^{a}	7.18^{ab}	6.13^{ab}	5.83^{b}	0.85^{ns}

Means with the same superscript in the same row are not significantly different ($P > 0.05$); ns = not significant; s = significant; SEM = Standard error of the mean

Cost Benefit Analysis

The cost-benefit analysis results are presented in Table 3. The highest total cost was recorded in the control diet (₦1,228.22/kg), followed by 20% FMCM (₦1,190.57/kg). The lowest total expenditure was for the 40% FMCM diet (₦1,068.22/kg). Fish fed 10% FMCM recorded the highest benefit cost ratio (1.51), the best incidence cost (0.83), the highest profit index (2.06), and the highest net profit (₦604.03). The lowest net profit (₦291.70) and lowest profit index (1.82) were recorded for fish fed 30% FMCM.

Table 3: Cost-Benefit Analysis of Replacing Maize with Fermented Maize Cob Meal in the Diet of Clarias gariepinus

Parameters	0%	10%	20%	30%	40%
Total cost (₦/Kg)	1228.22	1184.37	1190.57	1153.30	1068.22
Total Sales (₦/Kg)	1686.40	1788.40	1659.20	1445.00	1377.00
Incidence Cost (₦)	0.92	0.83	0.89	1.25	1.75
Net Profit (₦)	458.18	604.03	468.63	291.70	308.78
Profit Index	1.85	2.06	1.89	1.82	1.83
Benefit Cost Ratio	1.37	1.51	1.39	1.25	1.29

Prices of ingredients (June 2023): Soybean meal = ₦700/kg; Fish meal = ₦1,650/kg; Maize meal = ₦500/kg

DISCUSSION

Growth Performance and Feed Utilization

The best growth performance in this study was recorded at 10% FMCM inclusion, with the highest final weight (350.67 g), weight gain (312.67 g), and specific growth rate (1.07%/day). These results indicate that fermented maize cob can partially replace maize in the diet of *Clarias gariepinus* at low inclusion levels without compromising performance. The specific growth rate observed in this study was not in agreement with Irabor *et al.* (2022), who documented the highest weight gain (25.64 g) and specific growth rate (2.48 %/day) in fish fed 40% maize cob meal. This discrepancy may be attributable to differences in inclusion levels, duration of culture, and method of processing.

The results of weight gain were also at variance with findings of Klahan (2016), who recorded the best weight gain (57.66 g) at 8 % maize cob inclusion in Nile tilapia (*Oreochromis niloticus*). This may be due to species differences and varying processing methods. Similarly, Igbang et *al.* (2022) reported maximum weight gain (130.83 g) and specific growth rate (3.65 %/day) at 75 % inclusion of maize offal in *Clarias gariepinus* diets, which contradicts findings of the present study. These differences may be explained by differences in the plant parts used and inclusion levels.

The highest protein efficiency ratio (7.82) observed at 10 % FMCM indicates efficient protein utilization, attributable to the high weight gain (312.67 g) achieved at this level. This value exceeded the protein efficiency ratio of 2.89 reported by Putra *et al.* (2022) at 15 % fermented rice bran inclusion, and also surpassed the 1.80 reported by Umanah *et al.* (2019) for *Heterobranchus bidorsalis.* Differences may be attributed to fish species, processing methods, and plant parts used.

The best feed conversion ratio (0.93) was obtained at 10 % FMCM inclusion, suggesting superior feed-to-flesh conversion efficiency compared to other treatment groups. This agreed with the findings of Aderolu *et al*. (2016), who reported an FCR of 0.87 at 15 % ripe plantain peel inclusion. However, it was lower than the FCR of 1.65 reported by Klahan (2016) for Nile tilapia fed 8 % maize cob, and contradicted the FCR of 2.21 observed by Irabor *et al*. (2022) at 40 % maize cob inclusion. These discrepancies may relate to differences in feed intake, fish weight, and processing methods.

Cost-Benefit Analysis

The benefit-cost ratio at 10 % FMCM inclusion (1.51) was lower than the 1.79 reported by Aderolu *et al.* (2016) for 15 % ripe plantain peel inclusion, but higher than the 0.65 documented by Igbang *et al.* (2021) for maize offal in *Clarias gariepinus* diets, and also higher than 0.18 reported by Abdullahi *et al.* (2022) at 100 % sweet potato peels. Differences in ingredient costs and input levels used in each study likely account for these variations.

The highest net profit (₦604.03) at 10 % FMCM indicates the economic advantage of this inclusion level. The net profit values observed in this study were broadly comparable to those reported by Abdullahi *et al*. (2022). The highest profit index (2.06) at 10 % FMCM was lower than the 4.37 and 5.6 reported by Aderolu *et al.* (2016) and Abdullahi *et al.* (2022), respectively, possibly reflecting differences in fish selling prices and the quantities of fish produced. The optimal economic performance at 10 % FMCM may be attributed to the lower cost of feed combined with the higher weight gain achieved at this inclusion level.

CONCLUSION AND RECOMMENDATIONS

This study demonstrated that fermented maize cob meal can partially replace maize meal in the diet of *Clarias gariepinus* fingerlings up to a 10 % inclusion level. At this level, the best growth performance was achieved (final weight: 350.67 g; weight gain: 312.67 g; SGR: 1.07%/day; FCR: 0.93; PER: 7.82) alongside the most favorable economic outcomes (net profit: ₦604.03; BCR: 1.51; profit index: 2.06; incidence cost: 0.83). Inclusion levels beyond 10% resulted in declining growth performance and economic returns. It is therefore recommended that 10 % fermented maize cob meal be adopted as a partial maize replacer in *Clarias gariepinus* diets for maximum growth and economic benefit. Future research should investigate other processing methods (e.g., soaking, enzyme treatment), explore different fish species and culture systems, and examine inclusion levels between 0 % and 100 % to further optimize the replacement rate.

REFERENCES

1. Abdullahi, I. A., Bawa, S. B., & Abdullahi, A. S. (2022). Effect of Dietary Replacement of Maize with Sweet Potato Peels in the Diet of African Catfish (*Clarias gariepinus* Burchell, 1822). *Journal of Fisheries Science,* 4(2), 15-24.
2. Aderolu, A. Z., Lawal, & Simbiat, S. (2016). Replacement Value of Maize with Ripe and Unripe Plantain Peels in the Diet of Juvenile Catfish (*Clarias gariepinus*Burchell, 1822). *Journal of Agriculture Research and Development,* 15(1), 24-35.
3. Ahmad, Y., Syamsaddin, H., Asmuddin, N., & Budiman, N. (2016). The Effect of Different Forms of Corn Cob Based Complete Feed on the Consumption, Characteristics, and Ruminal Fermentation in Ruminants. *International Journal of Sciences Basic and Applied Research*, 30(5), 75-86.
4. Anigboro, A. A., Aganbi, E., &Tonukari, N. J. (2020). Solid State Fermentation of Maize (Zea mays) Offal by *Rhizopus oligosporus* Under Acidic and Basic Conditions. *Journal of Scientific Research*, 12(4), 751-756.
5. AOAC (2010). Association of Official Analytical Chemists International. Official Method

of Analysis, 17th edition. AOAC International, Gaithersburg, MD, USA, 24-28.
6. Esther, K., & Sogbesan, O. A. (2021). Evaluation of Hematological and Biochemical Changes in Catfish (Clarias gariepinus) Fed Ginger Additive Meal Diets. *International Journal of Oceanography and Aquaculture,* 5(3), 1-7.
7. Eyo, V. O., Ekanem, A. P., & Jimmy, U. U. (2014). A Comparative Study of Gonadosomatic Index (GSI) and Gonad Gross Morphology of African Catfish (*Clarias gariepinus*) Fed Unical Aqua-Feed and Coppens Commercial Feed. *Croatian Journal of Fisheries*, 72, 63-69.
8. FAO (2018). The State of World Fisheries and Aquaculture: Opportunities and Challenges. Rome: FAO. 223pp.
9. García-Alanis, K. G., Castillo, S., Rodríguez, A., Bautista-Villareal, M., García-Solano, N., Gallardo, C. T., Báez-González, J. G., & Sánchez-García, E. (2021). Rheological and Nutritional Characterization of Sweet Corn By-Product (Cob) to Develop a Functional Ingredient Applied in Dressings. *Frontiers in Nutrition*, 8, 178.
10. Geetanjali, Y., Dharmendra, K. M., Amiya, K. S., Basanta, K. D., & Ramkrishna, S. (2020). Effect of Valorization of Microbial Biomass for the Production of Nutritional Fish-Feed Supplement. *Journal of Cleaner Production,* 243, 0959-6526.
11. Girelli, A. M., Astolfi, M. L., & Scuto, F. R. (2020). Agro-Industrial Wastes as Potential Carriers for Enzyme Immobilization: A Review. *Chemosphere*, 244, 125368.
12. Igbang, S. K., Bekeh, A. F., & Ncha, O. S. (2021). Influence of Including Maize Offal in Diets on Growth, Carcass Composition and Economics of *Clarias gariepinus*. *Biological and Pharmaceutical Sciences*, 14(03), 027-35.
13. Irabor, A. E., Ekokotu, P. A., Obakanurhie, O., Adeleke, M. L., Obugara, J. E., & Ayamre, E. U. (2021). Moringa oleifera Meal as a Partial Replacement of Soya Bean Meal in Diets of *Clarias gariepinus* Juveniles. Livestock Research for Rural Development, 33. http://www.lrrd.org/lrrd33/8/33100obaka.html.
14. Irabor, A. E., Ekokotu, P. A., & Adeleke, M. L. (2022). Growth performance and feed utilization of *Clarias gariepinus* Fed Maize Cob Meal Diets. *Journal of Aquaculture Research*, 4(1), 12-18.
15. Jimoh, W. A., Ayeloja, A. A., Yusuf, F. O., Lanre-Bhadmos, H. I., Ashaolu, E. T., & Omiyale, A. F. (2022). Growth, Haematology, Nutrient Retention and Histology of African Catfish, *Clarias gariepinus* Fingerlings fed larvae *Musca domestica*. *Ife Journal of Agriculture*, 34(1), 122-142.
16. Kanengoni, A. T., Chimonyo, M., Ndimba, B. K., & Dzama, K. (2015). Potential of Using Maize Cobs in Pig Diets – A Review. *Asian Australasian Journal of Animal Sciences*, 12, 1669-1679.
17. Klahan, R. (2016). Utilization of Corncob as Feedstuff on Growth Performance, Feed Utilization and Carcass Composition of Nile Tilapia (*Oreochromis niloticus L.*). *International Journal of Environmental and Rural Development*, 7(2), 1-6.
18. Little, D. C., Newton, R. W., & Beveridge, M. C. M. (2016). Aquaculture: A Rapidly Growing and Significant Source of Sustainable Food Status, Transitions and Potential. *Proceedings of the Nutrition Society*, 75, 274-286.
19. Mohammed, Z. B., Mohammed, A., Mohammed, U. M., Yunusa, I., & Ahmed, Y. (2020). Growth Performance of African Catfish (*Clarias gariepinus* Burchell, 1822) Following Direct Infection with Bagrusbayard Genome DNA. *International Journal of Agricultural Science and Technology*, 8(4), 8-15.
20. Nwachi, O. F., & Irabor, A. E. (2015). The Response of Catfish *Heterobranchus bidorsalis* to cultured zooplanktons and decapsulated artemia in the Niger Delta, Nigeria. International Journal of Fisheries and Aquatic Studies, 3, 104-107.
21. Putra, N. A., Syamsunarno, B. M., Rohayati, D., Sarah, M. Y., & Matien, A. G. (2022). Evaluation of Fermented Rice Bran to Replace Soybean Meal in the Diet of Clarias sp. Fingerlings. *Journal Akuakultur Indonesia*, 21(12), 142-157.

22. Sogbesan, O. A., Adedeji, H. A., Mohammed, H., & Idowu, T. A. (2016). The Growth Performance of *Clarias gariepinus* (Burchell, 1822) Fingerlings Fed Varying Levels of Soaked Plantain Peels Diets. *International Journal of Scientific Research in Agricultural Sciences*, 3(2), 035-038.
23. Sogbesan, O. A., & Bashir, S. Y. (2018). Utilization and Cost-Benefit Analyses of *Oreochromis niloticus* Fed Fermented Cassava (*Manihot esculenta*) leaf meal supplemental diets. *Journal of Aquaculture and Marine Biology,* 7(4), 199-204.
24. Umanah, S. I., George, E. W., & David, G. S. (2019). Growth performance and feed utilization of *Heterobranchus bidorsalis* Fed with Flamboyant Seed Meal Substituted for Wheat Offal. Asian *Journal of Biological Science*, 12: 842-850.

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