



Cost - Benefits of *Clarias Gariepinus* Hatchlings Fed Mandrake Root Powder as a Phyto Additive

*¹Yusuf, Z.A., ²Watafua, H., ³Atteh, A.P., ⁴Dauda, I., Bala, H., and Barnabas, B.

¹Department of Fisheries and Aquaculture, Federal University of Lafia, Nasarawa State, Nigeria.

²National Biotechnology Research and Development Agency, Michika, Adamawa State, Nigeria.

³Department of Agricultural Economics and Extension, Federal University of Lafia, Nasarawa State, Nigeria.

⁴National Biotechnology Research and Development Agency, Tunari, Taraba State, Nigeria.

Corresponding Author: zecology@yahoo.com.

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ABSTRACT

A cost-benefit analysis of *Clarias gariepinus* hatchlings fed mandrake root powder as a phyto-additive was carried out. Mandrake root powder was incorporated into Coppens fish feed (0.2- 0.5 mm) with 49% protein at 0.0 g (MR₀, i.e., control), 0.25g (MR₁), 0.5g (MR₂), 0.75g (MR₃), and 1.0g/100g feed (MR₄). Feed was fed to hatchlings ($n = 1,500$, $0.25 \pm 0.0g$) for 28 days in 15 hatchery tanks ($n = 100$) at a fixed feeding rate of 10% body weight 6 times daily between the hours of 07:00 and 23:00 at regular interval. Cost - benefit was estimated for each diet. Mean net profit value (₦11.56), profit index value (2.61) were better, along with the least (best) incidence of cost value (₦2.39) and the highest (better) benefit-cost ratio value (1.67) in hatchlings fed diet MR₃, while the least mean net profit value (₦11.25) was recorded in hatchlings fed MR₀. The profit index value (2.53), the highest (poor) incidence of cost value (₦2.44), and the lowest (poor) benefit-cost ratio value (1.62) were all recorded in hatchlings fed MR₄. This shows that the incorporation of mandrake root powder as Phyto additive into *C. gariepinus* hatchlings' feed increased the profits. Mandrake root powder could be incorporated into *C. gariepinus* hatchlings' feed for higher profit generation.

Keywords: Incorporated, Hatchlings, Mandrake, Phyto-additive, Profits.

INTRODUCTION

The cost - benefit analysis of fish farming is a topic that has garnered significant attention in recent years (Sogbesan and Bashir, 2018). Cost-benefit analysis (CBA), also called benefit-cost analysis (BCA) is a practical approach to estimate the strengths and weaknesses of the ways used to make a decision about the freedom of choice, which gives the ideal focus to successfully bring an advantage or profit while preserving savings – for instance, in transactions, activities, and functional business necessity (Ali *et al.*, 2024). A CBA can be used to evaluate the complete or likely causes of actions, or to approximate (or assess) the value against the cost of a resolution, program, or strategy (Mohammed *et al.*, 2020). It is often utilized in commercial transactions, business or in the course of decision-making (especially public policy), and project investment. CBA is associated with and regulated by the time value of money; all flows of benefits and costs over time are demonstrated on a common basis in terms of their net present value, regardless of whether they are incurred at different times (Ali *et al.*, 2024). Other related techniques include cost-utility analysis, risk-benefit analysis, economic impact analysis, fiscal impact analysis, and social return on investment (SROI) analysis (Umar *et al.*, 2019). Therefore, this study is focused on the cost-benefit of *C. gariepinus* hatchlings fed mandrake root powder as a phyto-additive

MATERIALS AND METHODS

Study Area

The study was carried out at the Lay-Joy fish farm, Billiri. Billiri Local Government Area (LGA), Gombe State. Billiri LGA lies within latitudes 9°50' and 11°09'N and longitudes 9.833 ° and

11.150°E. It covers an area of 737km² and is 50 km away from Gombe, the capital city. The hatchlings for the experiment were bred at the hatchery room of the farm. The hatchlings were 4 days old at the commencement of the feeding trial.

Experimental Diets

Coppens fish feed (0.2-0.5 mm) was used as the basal diet for this study and was obtained from feed suppliers at Gombe, while the dietary mandrake root powder was purchased from Bon - Amour Pharmacy Limited Lagos, Nigeria, imported from Piping Rock Health Products, Ronkonkoma, New York, USA. Experimental diets was prepared by incorporating dietary mandrake root powder at four graded levels: 0.25 g, 0.5g, 0.75g and 1.0g/100g feed into Coppens fish feed (0.2 - 0.5mm), while the diet without dietary mandrake root powder i.e. 0.0g/100g feed served as the control diet and was coded as MR₀ (control), MR₁, MR₂, MR₃, and MR₄, respectively. The dietary mandrake root powder was included at the measured quantity for each diet and was diluted into 5 ml of warm water (35°C) to form a solution. The solution was sprayed onto the Coppens fish feed (0.2 - 0.5mm), fish oil was added to the experimental diet with mandrake root powder to reserve the mandrake root powder. The Coppens fish feed (0.2 - 0.5mm) with dietary mandrake root powder was prepared in 100g each time. The proximate composition of the Coppens fish feeds (0.2 - 0.5mm) fed to the *C. gariepinus* hatchlings is presented in Table 1. The diet contained 49% crude protein, 12% crude lipid, 6.0% crude fibre, 8.0% ash, 1.5% calcium, 8.0% moisture and 1.5% phosphorus.

Table 1: Proximate Composition of Coppens *C. gariepinus* Hatchlings Feed (0.2 - 0.5 mm) used for the Study

Nutrients	Percentage (%)
Crude protein	49
Crude lipid	12
Crude fibre	6.0
Ash	8.0
Calcium	1.5
Moisture	8.0
Phosphorus	1.5

Source: Field Survey (2023).

Experimental Design

Each of the treatment diets was fed to *C. gariepinus* hatchlings (n = 1,500; 0.26±0.0g) in triplicate, making a total of 15 plastic hatchery tanks (semi-flow-through system), i.e., (n = 100 per tank). Water quality parameters such as pH, dissolved oxygen (DO), temperature, and ammonia were monitored weekly. Hatchlings were fed 6 times daily between the hours of 07:00 and 23:00 at regular intervals for a period of 28 days at a fixed feeding rate of 10% body weight as recommended by Ukwe *et al.* (2018). The quantity of feed was adjusted accordingly after every two (2) weeks of sampling for growth performance and survival rate (mean body weight and mortality). Water temperature, pH, dissolved oxygen, and ammonia were measured at the beginning of the experiment after which they were measured weekly throughout the period of the experiment. Water temperature, dissolved oxygen and pH were measured using a Horiba U-22 XD multi-parameter water quality checker, while ammonia was measured using freshwater aquaculture test kit (Model AQ - 2, Code 3633 - 03, Lamotte, USA). Data on cost - benefit analysis was collected.

Cost - Benefits of *C. gariepinus* Hatchlings Fed Mandrake Root Powder as Phyto Additive

The cost - benefit of *C. gariepinus* hatchlings fed mandrake root powder as a phyto-additive was calculated using the method of Sogbesan and Ekundayo (2014) as follows:

Investment cost analysis (ICA) = cost of feed (₦) + cost of fish stocked (₦)

Profit index (PI) = net profit (₦)/cost of feed (₦)

Incidence of cost (IC) = cost of feed (₦)/weight of fish produce (g)

Benefit cost ratio (BCR) = net profit (₦)/investment cost analysis

Cost-benefit analysis was based on the following:

- A major assumption was that all other operating costs for the *C. gariepinus* production remained the same for all the dietary treatments. Thus, cost of feed was the only economic criterion (expenditure) considered in this study.
- Cost of feed was based on the prevailing market prices of the *C. gariepinus* fingerlings feed as at the time of purchase (that is, the time of commencement of the experiment).
- Value of *C. gariepinus* produced (cost of fish cropped) depends on the selling price of *C. gariepinus* per g (10/g) in the markets around Gombe as at the end of the experiment.
- Cost of producing graded levels of mandrake root powder depended on the cost of obtaining the mandrake root powder.
- Total weights of *C. gariepinus* fingerlings produced were obtained from the total weight of fish recovered at the end of the feeding trial.

Data analysis

The data collected were analyzed using the cost - benefit analysis models as described by Ali (2022).

RESULTS

Results of the cost-benefit analysis of *C. gariepinus* hatchlings fed mandrake root powder as phyto additive is shown in Table 2. The highest mean net profit value (₦11.56) was recorded from the fish fed diet MR₃, while the least value (₦11.25) was recorded from the fish fed control diet (MR₀). The highest profit index value (2.61) was recorded from the fish-fed diet MR₃, while the lowest value (2.53) was recorded from the fish-fed diet MR₄. The lowest (best) incidence of cost value (₦2.39) was recorded from the fish fed diet MR₃, while the highest (worst) value (₦2.44) was recorded from the fish-fed diet MR₄. Also, the results indicated that fish fed diet MR₃ had the highest benefit cost ratio value (1.67), while the fish fed diet MR₄ had the lowest value (1.62).

Table 2: Cost-Benefit of *C. gariepinus* Hatchlings Fed Mandrake Root Powder as Phyto Additive

Parameters	MR ₀	MR ₁	MR ₂	MR ₃	MR ₄
Mean final weight (g/fish)	1.81	1.82	1.84	1.85	1.83
Mean cost of feed/g (₦)	4.35	4.38	4.41	4.44	4.47
Cost of hatchlings (₦/fish)	2.50	2.50	2.50	2.50	2.50
Investment cost analysis (₦)	6.85	6.88	6.91	6.94	6.97
Cost of fish/g (₦)	10	10	10	10	10
Mean yield cost/fish (₦)	18.10	18.20	18.40	18.50	18.30
Mean net profit (₦)	11.25	11.32	11.49	11.56	11.33
Profit index	2.58	2.59	2.60	2.61	2.53
Incidence of cost (₦)	2.40	2.41	2.40	2.39	2.44
Benefit cost ratio (BCR)	1.64	1.64	1.66	1.67	1.62

Key: MR₀ - mandrake root powder (0.0g/100g), MR₁ - mandrake root powder (0.25g/100g), MR₂ - mandrake root powder (0.5g/100g), MR₃ - mandrake root powder (0.75g/100g) and MR₄ - mandrake root powder (1.0g/100g).

DISCUSSION

The mean net profit values, ₦11.25 - ₦11.49 recorded from this study were comparable with the values, ₦10.90 - 13.90 reported by Ali *et al.* (2023) for *C. gariepinus* fry fed dietary β - glucan. Sogbesan and Bashir (2018) reported that the dietary treatment with the highest weight gain also produced fish with the highest profits. The profit index values, 2.53-2.61, recorded from this study were higher than the values, 1.83 - 3.20 reported by Nababa *et al.* (2024) for *C. gariepinus* fry fed baker's yeast, egg yolk, and milk powder. The profit index values recorded from this study revealed that more profit was generated, this finding further buttresses the fact that the diets were better utilized which was in support of the findings of Mohammed *et al.* (2020). The incidence of cost values, ₦2.39 - ₦2.44, recorded from this study was comparable with the values, ₦1.67 - ₦2.37, reported by Ali *et al.* (2024) for *C. gariepinus* fry fed a dietary betaine hydrochloride-based diet. The least (best) incidence of cost value recorded from the fish-fed diet MR₃ indicated that the use of mandrake root powder at 0.75g/100g produced the most cost - effective diet. The benefit-cost ratio values, 1.62 - 1.67 recorded from this study were comparable with the values, 1.41-1.55, reported by Umar *et al.* (2019) for *O. niloticus* fed camel testicles - based diet. Wambua (2018) stated that when the benefit-cost ratio value is greater than one or equal to one, it indicates profitability, but less than one indicates lack of viability or unprofitability of the venture. However, since the benefit-cost ratio values in all the diets were greater than one, it indicated that incorporation of mandrake root powder as a phyto-additive into *C. gariepinus* hatchlings is economically efficient and beneficial; over the study duration, the stream of benefits exceeds the costs incurred.

CONCLUSION

Findings from this study revealed that the incorporation of mandrake root powder as Phyto additive into *C. gariepinus* hatchlings' feed increased the profits. Therefore, mandrake root powder could be incorporated into *C. gariepinus* hatchlings' feed for higher profit generation.

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