ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 6, Issue 1, pp: (30-37), Month: January - March 2019, Available at: www.paperpublications.org

Comparative Assessment of Growth Potential of Low-cost Formulated Diet for Catfish (*Clarias gariepinus*) Production

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Abstract: **A comparative assessment of growth potential of low-cost formulated diet for catfish production was conducted using a low-cost formulated diet and commercial fish feed (Multifeed). An experiment was carried out to determine the effect of the locally-formulated feed and the commercial feed on the weight and length of catfish samples at 3% body weight (b.w) and 5% body weight (b.w) respectively. Forty (40) juvenile catfish samples, with average weight of 8.07g and average length of 10.01cm, were stocked at the rate of 10 fishes per tank (4 tanks in all and 2 tanks per group). Each group has 2 treatments (3% b.w and 5% b.w) for weight and length respectively. 1 group was used for the actual treatments, while the other group was used for control treatments. The fishes in the actual treatments were fed with the low-cost formulated diet while the fishes in the control treatments were fed with commercial fish feed (Multifeed). The duration of the experiment was eight weeks. Results indicated that the average weight of the fishes for control treatments increased from 7.14g – 55.10g for treatment A_1 (3% b.w), from11.43g – 56.60g for treatment A_2 (5% b.w). The mean values for actual treatments for weight of fishes ranged from 6.57g – 32.3g for treatment B_1 (3% b.w) and from 7.14g – 34.50g for treatment B_2 (5% b.w) respectively. The mean values of control treatments of A_1 (3% b.w) and A_2 (5% b.w) for the length of the fishes increased from 10.08cm –19.71cm and 10.93cm – 20.20cm. The treatments B_1 (3% b.w) and B_2 (5% b.w) produced a corresponding increase from 9.54cm – 17.00cm and 9.50cm – 17.80cm respectively. Comparatively, the commercial fish feed showed greater growth potential than the locally-formulated diet for catfish production.**

Keywords: **Aquaculture, Body weight, Catfish, Commercial fish feed, Fish farming, Local fish feed.**

I. INTRODUCTION

Aquaculture is the cultivation of aquatic plants, fish and other aquatic animals under controlled or semi-controlled conditions using inexpensive equipment and simple techniques. Fish farming/culture is the growing of fish in a controlled environment such as ponds (concrete or earthen), vats (wooden or fibre glass) and plastics [1]. The importance of fishery as an important food production sub-sector, a great source of almost 20% of the world's protein supply, and for other economic and social benefits has been studied [2], [3]. One of the major expenses in any fish culture operation is the cost of feeds for the fish, and the profitability of many operations is frequently tied to the cost of feed. A review of fish culture and economics is done to enable fish culturist plan effectively before involving in fish culture and practices. The primary constraint to commercial catfish production has been the lack of reliable, cost-effective methods for producing large

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quantities of fish for commercial practice [4]. To ensure the maximum production of fish, it is necessary to produce suitable, complete and supplemental cost effective diets for use in hatcheries and nursery ponds. Cost effective but quality feed from indigenous ingredients will increase the quality of seed, which is the prerequisite to boost the aquaculture [5]. Comparative assessments, analyses and evaluations of different growth potentials of low-cost formulated diets/feeds have been conducted for various reasons, e.g. to observe the effects of floating and sinking pelleted supplementary feeds on the growth performance of major carps such as *Labeo rohita, Cirrhinus mrigala, Catla catla* and Chinese carps such as *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella* [6]. The growth performance and economics of production of *Clarias gariepinus* fingerlings in ponds and tanks have been compared [7]. Similar studies have been carried out to determine the effect of organic fertilizer and formulated feed on the growth performance and condition factor of *Clarias gariepinus*♂ and *Heterobranchus longifilis*♀ hybrid [8], [9].

The high cost of catfish feed is a deterrent in catfish farming because of the types of feeds required in different stages involved in catfish rearing/farming. At each stage, from fry stage to adult stage, a catfish farmer spends great amount of money in feeding the fishes. It is essential that the feed provides maximum production efficiency at a minimum cost. The relative importance of growth rate and feed conversion efficiency will depend upon the quality and cost of feed in relation to the market value of the farmed product. The unit cost of various types of feed and cost of fish production using each of this feed as well as the unit profitability of each system of fish production must be compared before one type of feed is selected [10]. Aquatic nutritionists are considering alternative protein sources due to the increasing price of animal protein supplements. In an attempt to find cheaper, affordable, available alternative fish feed to imported commercial fish feeds, comparative studies and various local fish feeds have been formulated from different varieties of sources [11], [12]. Various researchers formulated low cost fish feeds using alternative supplements, such as azolla [13], [14]; fermented groundnut [15]; earthworm meal [16], cassava, sweet potato, cocoyam and their by-products [17]. Other researchers also studied the growth responses, performance and cost benefit analysis of *Clarias gariepinus* fed with different commercial and compounded feeds, the feed utilization and growth rate in *Heteroclarias* and the growth response of *Clarias gariepinus* fed varying inclusions of ripe plantain peel meal [18], [19].

The formulation of low-cost well-balanced fish diet using locally available agro-industry byproducts is necessary even in commercial fish farming. It is therefore imperative to develop low cost formulated diet for catfish farmers in Nigeria and fish farmers in general. Low cost formulated diet is therefore aimed at reducing the feeding cost in catfish production and to serve as alternative to commercial fish feeds. Plate 1 shows a bag of commercial fish feed (Multifeed); while a ground sample of low-cost formulated fish feed is shown in Plate 2.

Plate 1: A15-kg bag of commercial fish feed, 2mm (Multifeed).

Plate 2: A ground sample of low-cost formulated diet.

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A sample of pelleted sample of commercial fish feed (Multifeed) is shown in Plate 3. A pelleted sample of low-cost formulated fish feed is shown in Plate 4.

Plate 3: A pelleted sample of commercial fishfeed,2mm (Multifeed).

Plate 4: A pelleted sample of low-cost formulated diet.

II. MATERIALSANDMETHODS

A low-cost diet for catfish production was formulated in collaboration with Bonitas Farms at Enugu-Adazi community in Adazi-ani town, Anaocha LGA of Anambra state of Nigeria. The estimated cost of formulating a 20.21kg bag of the low-cost diet was two thousand nine hundred and sixty naira (₦2,960); whereas the cost of a 15kg bag of commercial fish feed (Multifeed) was four thousand eight hundred naira (₦4,800). In addition, the quantity of the low-cost formulated diet was greater than the commercial fish feed and lower in cost. The formulation for the low-cost diet is given in Table1.

Table 1: Formulation for low-cost fish feed for catfish production.

Material	Weight (g)	Cost (₦)
Maize	8000	640
Soya	6000	980
GNC	2000	290
Fish meal	2000	320
PKC	500	25
Wheat	500	30
Bone	250	50
Limestone	500	50
Premix fish	100	100
Lysin	100	100
Methionine	100	150
Salt	60	25
Superliv aqua	50	100
Detoxizine	50	100
Total	**20, 210**	**2, 960**

A. Experimental Procedure

Forty (40) juvenile fishes having an average weight of 8.07g and an average length of 10.01cm were bought at St. Paul's Seminary, Okpuno in Awka South LGA of Anambra state of Nigeria. The forty (40) fishes were stocked at 10 fishes per

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tank (4 tanks in all and two tanks per group). Each treatment has two replicates. One group was used for the actual treatments, while the other group was used for control treatments. The fishes in the actual treatments were fed with the low-cost formulated diet while the fishes in the control treatments were fed with the commercial fish feed (Multifeed). A 5000g capacity, 40g graduation weighing balance (kitchen scale) was used to measure the weight of the fishes per group, the value gotten was divided by the number of fishes in that group to get the average weight per fish. A 30cm transparent metre rule was used to measure the length of the fishes. The fishes were stocked in four plastic cylindrical containers with clean water. The fishes were fed three times a day using a handful of the commercial and formulated feed. The commercial fish feed floated, while the low-cost formulated diet gradually sank in the water. The water was changed thrice per week.

In the first week, the average weight and length of the fishes were determined and recorded. At the beginning of the second week, the fishes were weighed and measured again to determine the increment in weight and length and to determine the effect of the commercial feed and the formulated feed on the fishes. All measurements were done at the same time for both treatments. Care was taken to avoid mortality of the fishes and/or error/loss of data during the experiment. Microsoft Excel 2007 was employed to plot graphs based on average values of weight and length obtained from the experiment.

B. Results

The results of the experiment are tabulated in Tables 2 and 3 from the first to the eighth week of the experiment. Tables 2 and 3 show the average values of weight and length of the fishes for control and actual treatments respectively. As shown in Table 2, average values of weight of fishes for the control treatment ranged from 7.14-55.1g for 3% body weight and 11.43-56.6g for 5% body weight, while that of actual treatment ranged from 6.57-32.3g and 7.14-34.5g for 3% body weight and 5% body weight respectively. Table 3 indicates that the average value of length of fishes ranged from 10.08-19.71cm and 10.93-20.20cm for 3% and 5% body weight for the control treatments, and then 9.54-17.00cm and 9.20-17.80cm for 3% and 5% body weight for the actual treatments respectively. Fig. 1 depicts the effect of control treatments (3% b.w and 5% b.w on weight of fishes, while fig. 2 shows the effect of actual treatments (3% b.w and 5% b.w) on the weight of the fishes. Fig. 3 shows the effect of control treatments (3% b.w and 5% b.w) on the length of fishes. Fig. 4 represents the effect of actual treatments (3% b.w and 5% b.w) on the length of fishes, while figure 10 is a combined graph showing the effects of control treatments (3% b.w and 5% b.w) and actual treatments (3% b.w and 5% b.w) on the length of fishes. Linear regression equations are shown in each graph. The established regression equations had very high coefficients of determination ($R^2 > 0.9$) which indicate that they described the relationships reasonably.

Table 2: Average values of weight of fishes for control and actual treatments.

Week No.	**CONTROL TREATMENTS**		**ACTUAL TREATMENTS**	
	Average weight of fishes, W_1 (g)		**Average weight of fishes, W_2 (g)**	
	A_1 (3% b.w)	**A_2 (5% b.w)**	**B_1 (3% b.w)**	**B_2 (5% b.w)**
1	7.14	11.43	6.57	7.14
2	12.0	13.2	9.0	12.0
3	15.2	17.8	11.8	13.6
4	19.4	21.4	13.2	15.5
5	28.4	33.4	19.6	21.4
6	36.6	39.4	24.0	24.5
7	41.1	42.4	30.2	31.8
8	55.1	56.6	32.3	34.5
Total	**214.94**	**253.63**	**146.67**	**160.44**
Average	**26.87**	**31.70**	**18.33**	**20.06**

ISSN 2349-7823

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Table 3: Average values of length of fishes for control and actual treatments.

Week No.	CONTROL TREATMENTS		ACTUAL TEATMENTS	
	Average length of fishes, L_1(cm)		Average length of fishes, L_2 (cm)	
	A_1 (3% b.w)	A_2 (5%b.w)	B_1 (3% b.w)	B_2 (5% b.w)
1	10.08	10.93	9.54	9.50
2	11.02	11.55	10.25	10.73
3	12.10	12.83	10.85	11.51
4	13.62	14.32	12.21	12.94
5	15.74	16.75	13.97	14.42
6	17.04	17.43	15.19	15.21
7	18.15	18.53	16.32	16.72
8	19.71	20.20	17.00	17.80
Total	**117.46**	**122.54**	**105.33**	**108.83**
Average	**14.68**	**15.32**	**13.17**	**13.60**

L_1, L_2 = Length of fishes for groups 1, 2.

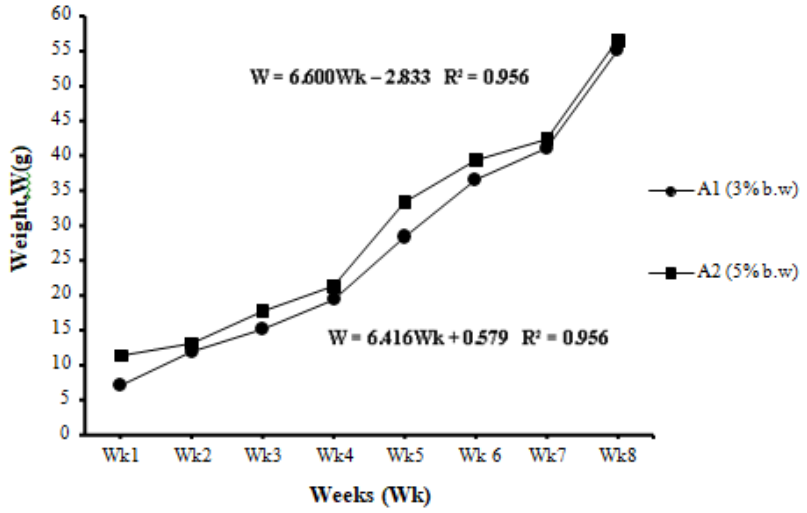

Fig. 1: Effect of control treatments (3%b.w and 5%b.w) on weight of fishes.

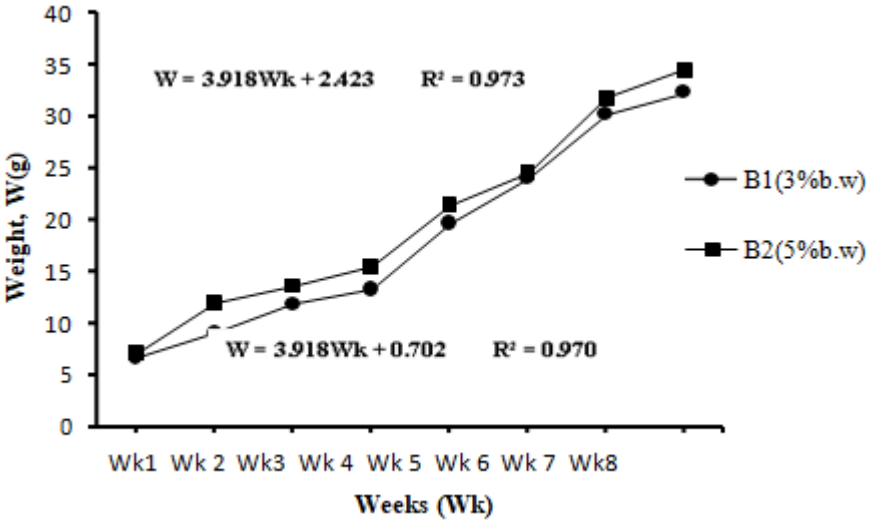

Fig. 2: Effect of actual treatments (3%b.w and 5%b.w) on weight of fishes.

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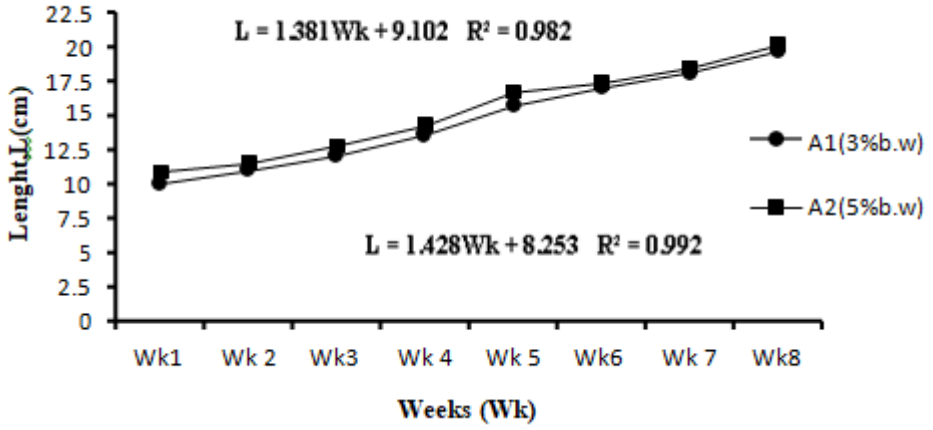

Fig. 3: Effect of control treatments (3%b.w and 5%b.w) on the length of fishes.

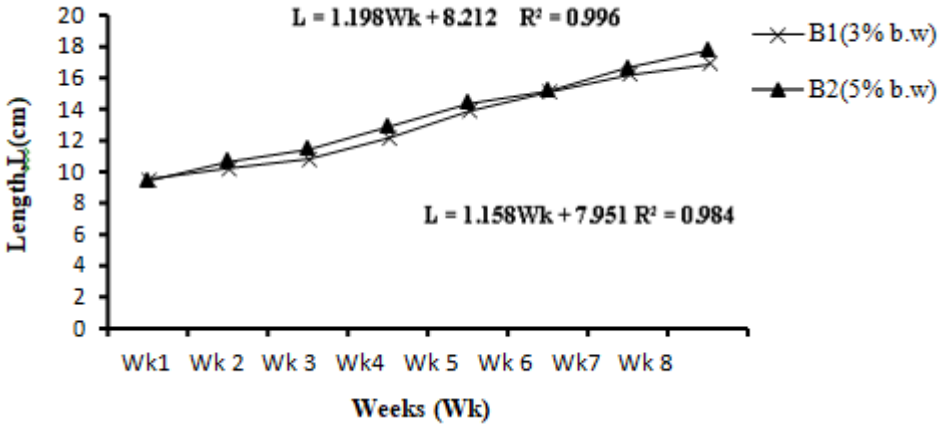

Fig. 4: Effect of actual treatments (3%b.w and 5%b.w) on the length of fishes.

III. CONCLUSION

This research focused on utilizing less expensive and easily available resources to replace commercial fish feed, without reducing the nutritional quality of fish feed. Replacement of fish meal with cheaper ingredients of plant origin in fish feed is essential because of rising cost and uncertain availability of fish meal. Inclusion of feedstuffs with relatively high amounts of carbohydrate in formulated fish feed is preferred because of its protein-sparing action that will make the diet much less expensive. Increased use of plant proteins supplements in fish feed can reduce the price of fish meal. The apparent digestibility involving protein, energy and individual proteins are of prime consideration for low-cost fish feed formulation with different raw materials such as plant by-products, and other agricultural biomaterials commonly employed in the feed manufacturing industry, because fish meal has become the most expensive protein ingredient in aquaculture feeds. Although there was no major difference in the effects of commercial fish feed and locally-produced fish feed on the growth (length and weight) of the fishes, and even though that commercial fish feed produced better results than the locally-produced fish feed, the locally–produced fish feed still competed with the commercial fish feed to a large extent. The local materials and methods used to produce the local fish feed could be responsible for this, as some vital nutrients might have been lost in the course of production. Although a commercial fish farmer might prefer the commercial fish feed to the locally-produced fish feed, the subsistence fish farmer is advised to consider the locally-produced fish feed due to the cost of commercial fish feeds. Although the commercial fish feed showed greater growth potential in the catfish samples, locally-formulated fish feed however remains an alternative and serves as an impetus for encouraging people to go into fish farming where they cannot readily afford commercial fish feeds.

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