

COST ANALYSIS OF PRODUCING *Oreochromis niloticus* WITH DIETS CONTAINING *Moringa Oleifera* LEAF MEAL AS SOYBEAN REPLACER

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ABSTRACT

Economic performance of *Moringa Oleifera* leaf meal as a dietary protein source in the diet of *Oreochromis niloticus* was evaluated in 56 days feeding trial. Seventy-five tilapia fingerlings of 1.0 ± 0.01 g average weight were acclimatized for a week, weighed and allotted into five dietary treatments; containing 0, 25, 50, 75 and 100% *Moringa Oleifera* leaf meal replacement levels with soybean meal. Fish were fed 5% body weight per day. Economic analysis was carried out using the incidence of cost. Profit index and gross profit as economic indices. The results of the study indicated the profitability of using *Moringa Oleifera* leaf meal with positive profit index and gross profit. The profit index of fish fed diet D5 was the highest, while the fish fed diets D1 had the lowest profit index. There existed significant variation ($P < 0.05$) in the profit index of fish fed various dietary treatments. However, there was no significant difference ($P > 0.05$) in the profit index of fish fed D2, D3, D4 and D5. Similar trends of results were also observed for the incidence of cost and gross profit. It can be concluded from this study that it is economically viable to produce Nile Tilapia with diets containing *Moringa Oleifera* leaf meal.

Keywords: Variable cost, sustainability, profitability, isonitrogenous, conventional feedstuff

INTRODUCTION

The sustainability of aquaculture is dependent on the quality of feed. Feed contributes between 60 and 70% to the variable cost of fish production (Gabriel *et al.*, 2007). It is one of the factors that determine the profitability and viability of aquaculture production. It is recognized as the main cost expended during the production cycle (Akinrotimi *et al.*, 2007). This situation has contributed in no small measure to the drastic decline in fish production due to the high cost of feeding, with a resultant shortfall in protein intake of the people in many developing countries (Adejinmi, 2000).

Soybean meal protein is the most commonly utilised oilseed protein within feeds for omnivorous fish species used in Africa aquaculture because of its high protein content and the best protein quality among plant protein feedstuffs used in fish feeds (Davies *et al.*, 1989). Wide utilization of soybean is limited by increasing demand for human consumption and for animal feed (Siddhuraju and Becker 2001). Hence, the need to look for a cheaper alternative protein source for the development of low –cost feed that can replace this conventional feedstuff, without reducing the nutritional quality of the diets, which would be beneficial in reducing costs (Barros *et al.*, 2002).

Oreochromis niloticus is chosen for this study because it is an established aquaculture species in Africa and one of the most common cultured fish in

Nigeria. Tilapias are important freshwater fish species for aquaculture. Tilapia is currently known as “aquatic chicken” due to their fast growth, adaptability to a wide range of environmental conditions, disease resistance, high flesh quality, ability to grow and reproduce in captivity and feed on low trophic levels. Thus, they have become excellent candidates for aquaculture, especially in tropical and subtropical regions.

Moringa (Moringa oleifera Lam) belongs to the Moringaceae family. The leaves are rich in protein, carotene, iron and ascorbic acid and the pod is rich in the amino acid lysine (CSIR, 1962). Kristin (2000) reported that there are thirteen species of moringa trees in the family Moringaceae and that *Moringa oleifera* is the most widely cultivated species. It was further stated that they are native to India, the Red Sea area and/or parts of Africa including Madagascar. *Moringa oleifera* is indigenous to Northern India and Pakistan (Bosch, 2004) and was introduced throughout the tropics and sub-tropics becoming naturalized in many African countries. This rapidly-growing tree also known as horseradish tree or drumstick tree was utilized by the ancient Romans, Greeks and Egyptians. However, there is a paucity of information on the use of *Moringa Oleifera* leaf meal as a dietary protein source of fish feed especially the effect it has on the variable cost of fish production. This work, therefore, seeks to evaluate the incidence of the cost of producing

Oreochromis niloticus using diets containing *Moringa oleifera* leaf meal

Seed Collection and Processing

Moringa oleifera leaf was plucked from Moringa trees from Omio-adio in Ido Local Government Oyo State. The leaves were air-dried at room temperature and blended with electric blending machine. The leaf, therefore, were analysed for their proximate composition (AOAC 1990). Fishmeal, soybean meal and other feedstuffs obtained from commercial feed mill in Nigeria were separately milled, screened to fine particles size and triplicate samples were analyzed for their proximate composition (AOAC, 1990)

Experimental Diets

Based on the nutrient composition of the protein feedstuff (Table 1) , a control diet and four test diets (35% crude protein) were formulated (Table 2) containing soybean meal which was replaced by *Moringa oleifera* leaf meal at the rate of 0%, 25%, 50%, 75% and 100% inclusion levels coded as D1, D2, D3, D4 and D5 respectively. The control diets contained soybean meal providing 50% of the total protein which was replaced by *Moringa oleifera* leaf meal. The diets were isonitrogenous containing 35% crude protein and with fish meal (72%), soya bean meal (45%), fish oil, vitamin premix and starch serving as ingredients. The feedstuffs were ground and water was added to aid binding. It was thereafter introduced into a pelleting and mixing machine and then passed through a mincer to produce 2mm size pellet which was immediately sundried at 30 - 32°C. After drying for three days, the diets were stored in a cool place.

Experimental Fish and System

The experiment was conducted at the hatchery unit of the Federal College of Animal Health and Production Technology, Moor Plantation Ibadan, Oyo state. The *Oreochromis niloticus* fingerlings were obtained from a reputable fish farm, Ibadan, Oyo State and transported live to the project site in an aerated bag. The initial average weight of the fish was 1.0±0.01g and a total of 75 *Oreochromis niloticus* fingerlings were acclimated for 7 days prior to the feeding trial while being fed on a commercial pelleted diet. Five (5) fingerlings were allotted into each tank with 3 replicates per treatment. Experimental diet was assigned randomly to the tanks and each was fed 5% body weight per day in two equal proportions between 9.00 –10.00am and 5.00 – 6.00 pm for 56days.

Cost Analysis

The cost-effectiveness of diets used in the feed trial was calculated using prevailing market prices, taking into consideration the cost of feed and the transport fare with the assumption that all other operating costs remained constant (e.g. cost of rearing tanks, cost of fingerlings and labour). Indices computed for were an incidence of cost (IC), profit index (PI) and gross profit (Faturoti, 1989).

$$\text{Incidence of Cost} = \frac{\text{Cost of Feed}}{\text{Weight of Fish}}$$

$$\text{Profit index} = \frac{\text{Value of Fish}}{\text{Cost of feed}}$$

Gross profit

$$= \text{Value of 1kg fish} - \text{Incidence of cost}$$

Statistical Analysis

Data obtained from the experiment subjected to one-way Analysis of Variance (ANOVA). Where the ANOVA reveals a significant difference ($P < 0.05$) Duncan multiple range test was used to compare differences among individual treatment means with the aid of SPSS 16.0 version.

RESULTS

Cost of production of 1kg diet

Table 3: Shows the cost (Naira) of producing 1kg of each diet fed to *Oreochromis niloticus* with diets containing *Moringa oleifera* leaf meal under various replacement levels with Soybean meal. There was a reduction trend in the cost of producing the diet with increasing inclusion of *Moringa oleifera* leaf meal.

The incidence of Cost analysis of producing 1kg of *Oreochromis niloticus* fingerlings

Table 4 shows the incidence of cost analysis of producing 1kg of *Oreochromis niloticus* with diets containing *Moringa oleifera* leaf meal under various replacement levels with soybean meal. The profit index of fish fed diet D5 was the highest while the fish fed diet D1 had the lowest profit index. There existed significant variation ($P < 0.05$) in the profit index of fish fed various dietary treatments. However, there was no significant difference ($P > 0.05$) in the profit index of fish fed D2, D3 ,D4 and D5. Similar trends of results as obtained for profit index was also observed for incidence of cost and gross profit.

Table 1: Proximate composition of the protein feed ingredients

Parameters	Fishmeal	Soybean meal	MOLM
Moisture	9.75	10.70	11.00
Crude protein	72.4	45.74	34.17
Crude lipid	10.45	9.68	4.88
Crude fiber	-	5.10	5.02
Ash	8.32	4.48	8.90
*NFE	-	30.00	36.03
Total	100	100	100

MOLM: *Moringa Oleifera* Leaf Meal, *NFE: Nitrogen Free Extracts**Table 2: Gross composition (g/100g) of experimental diets containing *Moringa oleifera* leaf meal fed to *O. niloticus***

Feed ingredients	Moringa levels meal replacing fish meal (%)				
	0	25	50	75	100
Fishmeal@72	19.44	19.44	19.44	19.44	19.44
Soybean meal	35.71	26.79	17.86	8.93	-
*Molm@ 34	-	11.03	22.06	33.09	44.12
Corn meal	10.00	10.00	10.00	10.00	10.00
**Fishpremix	2.5	2.5	2.5	2.5	2.5
Fish oil	1.5	1.5	1.5	1.5	1.5
Starch	30.85	28.74	26.64	24.54	22.44
Total	100	100	100	100	100

**Moringa oleifera* leaf meal, **Vitamin/ mineral premix supplied kg-diet

Vit A:20,000u; Vit D₃:4,000iu, Vit E:200,000iu; Vit K:1,200 mg Vit B:10,000mg; Vit B₂:30,000mg; Vit B_{H6}:19,000mg; vit B₁₂:1,000 mg nNiacin;200,000mg; Folic Acid:5,000mg, panthothenic Acid;50,000 Biotin;400mg;Antioxidant 125g; vit C;150g;choline chloride 40g manganese; 30g; zinc; 40g; iron; 40g; copper; 4g; iodine 5g selenium: 0.2mg.

Table 3: Cost (Naira) of producing 1kg of each diet fed to *Oreochromis niloticus* with diets containing *Moringa oleifera* leaf meal replacing fish meal

Ingredients	Price/kg	Moringa levels replacing fishmeal				
		D1	D2	D3	D4	D5
Fishmeal@72cp	1000	194.4	194.4	194.4	194.4	194.4
Soybean meal	138	49.28	36.97	24.65	12.32	-
Molm@34	50	-	5.50	11.0	16.60	22.10
Corn meal	135	13.50	13.50	13.50	13.50	13.50
Fish premix	850	21.25	21.50	21.50	21.50	21.50
Fish oil	750	11.25	11.25	11.25	11.25	11.25
Starch	400	123.00	114.00	106.00	98.00	89.00
Cost ₦ /kg	-	412.68	388.67	382.30	367.57	351.75

Table 4: Incidence of cost analysis of producing 1kg of each diet fed to *Oreochromis niloticus* with diets containing *Moringa oleifera* leaf meal replacing fish meal

Parameters	Moringa levels replacing fishmeal				
	D1	D2	D3	D4	D5
Weight in kg(x 10 ⁻⁴)	10.00±0.0008 ^a	4±0.0001 ^a	6±0.0001 ^a	4±0.0002 ^a	7±0.0006 ^a
Cost of 1kg feed	412.68±0.00 ^a	388.67±0.00 ^a	382.30±0.00 ^a	367.57±0.00 ^a	351.75±0.00 ^a
Cost of food fed	0.46±0.38 ^a	0.18±0.04 ^a	0.29±0.007 ^a	0.19±0.07 ^a	0.30±0.25 ^a
Value of fish	0.68±0.55 ^a	0.29±0.00 ^a	0.29±0.00 ^a	0.30±0.11 ^a	0.49±0.39 ^a
Incidence of cost	475.96±10.50 ^a	447.37±7.71 ^b	452.45±16.02 ^b	441.70±15.63 ^b	428.84±10.00 ^b
Profit index	1.47±0.03 ^b	1.57±0.03 ^a	1.55±0.05 ^{ab}	1.59±0.55 ^a	1.63±0.04 ^a
Gross profit	224.04±10.39 ^b	252.62±7.71 ^a	247.55±16.02 ^a	258.30±15.63 ^a	271.16±10.00 ^a

Row means with different superscripts are significantly different ($P < 0.05$) from each other
Market Price of 1kg fish = N700S

DISCUSSION

The economic viability of replacement of soybean meal with the *Moringa oleifera* leaf meal indicated that the cost/kg of the diets reduce as the quantity of soybean meal was being replaced with *Moringa oleifera* leaf meals. This supports the reports of Chalorwang *et al.* (2001), who observed same in channel catfish fed varying levels of cassava root meal in replacement of maize. Soybean meal (SBM) is the most commonly utilized conventional plant protein source used in fish feeds, the need to replace soybean meal is highly imperative.

On the average, the gross profit was high in all the diets replacing a *Moringa oleifera* leaf meal at various levels than one with only soybean meal. According to Olagunju *et al.* (2007), gross profit is a good measure of profitability, therefore replacement of soybean meal with the *Moringa oleifera* leaf meal in the diet of *Oreochromis niloticus* is highly profitable. Diet D5 has the highest gross profit of ₦271.16k. This implies that it had minimum variable cost of production coupled with low fixed cost, hence the highest return it recorded. This is in line with the findings of Fagbenro *et al.* (2001), who reported similar results in the diet of Nile tilapia (*Oreochromis niloticus*).

As a rule of thumb, project with profit index greater than one, equal to one or less than one indicates profit break- even or loss, respectively (Olagunju *et al.*, 2007) since the profit index in the diets is above one. It shows that replacing soybean meal with the *Moringa oleifera* leaf meal in the diet of *Oreochromis niloticus* is highly profitable. Also, Profit index was significantly ($P < 0.05$) higher for D2, D3, D4 and D5 this proved to be profitable and economical, compared to D1 (control) administered because it had the highest profit index value. This also confirms (Abarike *et al.*, 2012, Amisah *et al.* 2009, Abu *et al.* 2012) where they reported that, the lower the incidence of cost values in the use of a diet, the higher the profit index (PI) and the higher the returns.

The calculated incidence of cost in this study showed that the diet D1 without a *Moringa oleifera* leaf meal had the highest incidence of cost when compare with other diets having *Moringa oleifera* leaf meal inclusion. Similar results were obtained when Abarike *et al.* (2014), fed *Oreochromis niloticus* fingerlings with mango leaves as a replacer for farm feed. Jimoh *et al.* (2015) also obtained similar result when *Oreochromis niloticus* fingerlings was fed with watermelon seed meal.

CONCLUSION

The outcome of this study revealed the fact that *Moringa oleifera* leaf meal is a profitable alternative protein source for partial replacement of soybean meal in feeding *Oreochromis niloticus*.

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