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FULL PAPER **TAM MAKALE**

GROWTH PERFORMANCE OF *Oreochromis niloticus* FINGERLINGS FED *Moringa oleifera* LEAF AS REPLACEMENT FOR SOYBEAN MEAL

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Abstract:

This study seeks to determine the nutritive potential of *Moringa oleifera* Leaf (MOL) meal as replacement for soybean meal in the diet of *Oreochromis niloticus* fingerlings. Five diets of 25% crude protein were formulated with MOL meal substituting soybeans (14.68 level of inclusion) at 25%, 50%, 75%, 100% and control diet had no inclusion of MOL. Twenty fingerlings were randomly allocated in replicate for each treatment in outdoor hapas and fed 5% body weight for a of 56 days, weighing was done weekly and feed adjusted appropriately. Results obtained revealed that 50% substitution of MOL meal for soybean meal gave the best growth and nutrient utilization, beyond this, growth significantly reduced, hence for better performance of *O. niloticus,* MOL should not be included more than 7.34%.

Keywords: Unconventional feedstuff, Nile Tilapia, Nutrient utilization

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Introduction

The demand for fish is continually increasing holding to the increase in population and the health benefits of eating fish. As a result, the aquaculture industry is becoming the fastest growing food producing sector in the world (FAO 2000; FAO 2006). As fish farming intensifies, so is the fish feed industry challenged with providing feed that are nutritionally balanced for the utmost growth of cultured fish. The major ingredients in fish feeds are protein and energy supplement. Tiamiyu et al., (2015) reported that conventional feed stuffs are dwindling in supply leading to arbitrary hike in prices. More so, conventional ingredients used in fish feed are in high demand for human consumption hence, to reduce this competition between human and animals it is important to get locally available material of lower price and has wide availability to replace costly conventional feed stuffs.

Moringa (*Moringa oleifera*) is a fast-growing plant widely available in tropical and subtropical Africa with several economic-important industrial and medicinal uses. Nutritional advantage includes high essential amino acid (EAA) (Ogunji, *et al*., 2001; WHO, 1985; Guillaume *et al.*, 2001). This study however tend to investigate the suitability of processed Moringa leave meal as substitute for soybean mean in the diet of *O. niloticus.*

Materials and Methods

Moringa oleifera leaves (MOL) were obtained from the Crop production research farm of the University of Agriculture Makurdi, Nigeria, and were dried under shade (to prevent nutrient loss under direct sunlight). After drying, the leaves were steam heated at 60°C for 15 minutes in auto–clave oven according to methods described by Hardy (2000). This is to deactivate anti-nutritive factors such as tannins, phytic acid and saponin that may inhibit digestion of MOL proteins (Hardy, 2000). The leaves were allowed to dry under shade before being milled through a 0.01 mm screen, other feed ingredients used in the feed formulation includes Fish meal, soybean meal, Maize meal, Vitamin and Mineral premixes, these were purchased from the Makurdi Modern market, they were processes and grinded into meal for storage. Five diets of 25% crude protein were formulated with MOL meal replacing soybeans at 25% (DT_2), 50% (DT_3), 75% (DT_4), 100% (DT_5) and control diet 0% (DT_1) had no inclusion of MOL. *O. niloticus* fry were gotten from the Departmental of Fisheries and Aquaculture fish hatchery and were acclimatized for two weeks prior to the start of the study. 20 fingerlings of *O. niloticus*, of initial weight 10.62g were randomly distributed to 10 hapas and growth monitored for 56 days. The Hapas were made from nets measuring 1x1x1 and mounted with a kuralon rope bamboo sticks staked on the pond. Stones were attached to the four bottom corners of the hapas to serve as sinkers. This enables the bottom surface of the hapas to spread uniformly and to extend properly. The extension made easy inflow and outflow of water through each hapa and were immersed in the pond water half way to enable ease of access.

Feeding was done twice daily by hand at 5% of the cumulative body weight of each hapa. Fingerlings were weight weekly so as to adjust the feed by virtue of weight gained. A Tefal electronic digital scale was used to measure weights of fingerlings per week in grams.

Growth performance was estimated as stated below.

(a) Mean Weight Gain (MWG) =

Mean final weight – Mean initial weight

(b) Feed Conversion Ratio (FCR) =

$$\frac{\text{dry feed intake}}{\text{wet weight gain}}$$

(c) Specific Growth Rate (%/day) =

$$\frac{\log_e(wt_2) - \log_e(wt_1)}{t_2 - t_1}$$

Where Wt_1= Initial weight gain

Wt_2= Final weight gain

T_2-T_1= Duration (in days) considered between Wt_2 and Wt_1

(d) Protein Efficiency Ratio =

$$\frac{\text{wet weight gain}}{\text{protein fed}}$$

Where Protein Fed=

$$\frac{\%\text{protein in diet} \times \text{total diet consumed}}{100}$$

(e) % Survival Rate =

$$\frac{\text{total number of fish} - \text{mortality}}{\text{total number of fish}} \times 100$$

Proximate compositions of MOL meal, diets formulated, initial and final carcass of fish were determined according to standard methods by AOAC (2000). The data obtained from the study were analyzed using Gen stat® discovery edition 4 and Minitab® 14, descriptive statistics were done and mean gotten were subjected to analysis of variance, where significant differences were obtained ($P<0.05$), means were separated using Duncan's least significant difference (LSD).

Results and Discussion

Most published research on the use of plant protein as a substitute of SBM in fish feeds has focused on the inclusion of various unconventional feeds stuff such as Palm kernel meal (Ng and Chen, 2002), cotton seed meal (Yue and Zhou, 2008), Faba beans (Azaza et al., 2009) to mention but a few, this has been with the goal to increase their inclusion, however varied results has been reported with different unconventional plant protein used. Results from the present study reveal that feeding Nile tilapia with 7.34gKg^{-1} (50% substitution of MOL meal) was better in terms of growth and nutrient utilization. This is lower than the report of Afuang *et al.,* (2003) of 33 g kg-1 methanol-extracted leaf meal in the diet of Nile tilapia. Richter *et al.,* (2003) had earlier reported that feeding moringa leaf meal diet more than 10% replacement for fishmeal cause adverse effect on growth performance. MOL has been reported to have low level of methionine (Guillaume *et al.*, 2001), furthermore, Gaber, (2006) had revealed that methionine is generally limiting amino acid consequently suppressing growth and feed utilization at low levels. Hence as dietary inclusion increased beyond 7.34gKg-^{1} growth may have consequently been impaired in the experimental fish. Keembiyehetty and Gatlin, (1993) had earlier reported poor growth and increased mortality of juvenile hybrid striped bass fed low dietary levels of methionine, However, due to its richness in cysteine and tryptophan, it is better used as supplementation only as they are less available in soybean meal. Conclusively, the study reviewed that Moringa leaves meal can be substituted for soybeans meal at 50:50 ratios for better growth performance and nutrient utilization.

There was a general decrease in FCR and increase in PER as the growth increased and vice versa. Such observation may be related to the fact that FCR decreases while PER increases with increased feeding rate as reported by Pechsiri and Yakupitiyage, (2005). The implication of this is that it will take 7.37kg of diet 3 to add a kg of flesh, while it will take lot more in the other diet.

The decreased body lipid content of the present study was probably due to poor feed intake in diets with higher levels of MOL meal, which resulted in starvation and in turn led to mobilization of body lipid reserves to meet energy requirements for vital body functions (Madalla et al. 2013). The presence of saponins may also have contributed to inhibited pancreatic lipase activity and hence delayed intestinal absorption of dietary fat (Han et al., 2000).

Table 1. Gross composition of feed ingredients

Feed ingredients	Diet1 (100:0)	Diet2 (75:25)	Diet3 (50:50)	Diet4 (27:75)	Diet5 (0:100)
Yellow maize	60.65	60.65	60.65	60.65	60.65
Soybean	14.68	11.01	7.34	3.67	–
Moringa leaves	–	3.67	7.34	11.01	14.68
Fish meal	14.68	14.68	14.68	14.68	14.68
Salt	5.0	5.0	5.0	5.0	5.0
Vit premix	2.5	2.5	2.5	2.5	2.5
Mineral premix	2.5	2.5	2.5	2.5	2.5

Table 2. Proximate composition of experimental diets

PARAMETER	MOL	DT_1	DT_2	DT_3	DT_4	DT_5
MOISTURE	4.1	9.65 ± 0.00^{b}	8.51 ± 0.00^{e}	9.63 ± 0.0^{c}	8.91 ± 0.01^{d}	9.71 ± 0.01^{a}
PROTEIN	25.12	28.56 ± 0.01^{a}	29.05 ± 0.01^{a}	29.44 ± 0.00^{a}	29.24 ± 0.00^{a}	29.24 ± 0.01^{a}
LIPID	1.45	6.69 ± 0.01^{a}	5.27 ± 0.01^{e}	5.73 ± 0.01^{c}	5.96 ± 0.00^{b}	5.64 ± 0.01^{d}
ASH	10.57	14.26 ± 0.0^{e}	14.42 ± 0.01^{d}	14.82 ± 0.01^{c}	14.87 ± 0.00^{b}	16.66 ± 0.01^{a}
FIBRE	4.7	7.92 ± 0.01^{d}	7.88 ± 0.01^{e}	8.22 ± 0.01^{e}	9.26 ± 0.00^{b}	9.64 ± 0.01^{a}
NFE	51.1	42.56 ± 0.01^{b}	43.38 ± 0.00^{a}	42.00 ± 0.01^{c}	40.47 ± 0.01^{d}	38.82 ± 0.01^{e}

Means in the same column with different superscripts differ significantly ($p<0.05$)

Table 3. Growth and Nutrient utilization of fish fed experimental diet.

PARAMETERS	DT_1	DT_2	DT_3	DT_4	DT_5
MIW (g)	10.62 ± 0.01	10.62 ± 0.01	10.62 ± 0.01	10.62 ± 0.00	10.63 ± 0.01
MFW	14.02 ± 0.01^{bc}	14.71 ± 0.03^{b}	18.95 ± 0.01^{a}	13.96 ± 0.01^{bc}	13.57 ± 0.12^{c}
MWG	2.42 ± 0.01^{bc}	3.09 ± 0.03^{b}	4.33 ± 0.02^{a}	2.34 ± 0.46^{bc}	1.95 ± 0.13^{c}
SGR	0.37 ± 0.01^{bc}	0.46 ± 0.00^{b}	0.62 ± 0.00^{a}	0.34 ± 0.01^{bc}	0.24 ± 0.00^{c}
FCR	12.20 ± 0.04^{ab}	9.90 ± 0.08^{bc}	7.37 ± 0.03^{c}	12.93 ± 2.50^{ab}	14.59 ± 0.89^{a}
PER	0.29 ± 0.00^{bc}	0.35 ± 0.00^{b}	0.46 ± 0.00^{a}	0.27 ± 0.05^{bc}	0.24 ± 0.01^{c}
ANPU	1.78 ± 0.00^{c}	1.74 ± 0.00^{d}	1.90 ± 0.00^{a}	1.80 ± 0.00^{b}	1.75 ± 0.00^{d}
% SURVIVAL	100.0 ± 0.00	100.0 ± 0.00	100.0 ± 0.00	80.0 ± 0.00	80.0 ± 0.00

Means in the same column with different superscripts differ significantly ($p<0.05$)

Table 4. Proximate composition of fish fed experimental

PARAMETER	INITIAL	DT_1	DT_2	DT_3	DT_4	DT_5
MOISTURE	60.62 ± 0.01^{d}	64.51 ± 0.01^{a}	64.22 ± 0.01^{a}	63.11 ± 0.01^{b}	63.19 ± 0.01^{b}	62.49 ± 0.31^{c}
PROTEIN	11.50 ± 0.01^{f}	18.51 ± 0.00^{d}	18.81 ± 0.00^{c}	20.60 ± 0.00^{a}	19.08 ± 0.00^{b}	16.56 ± 0.01^{e}
LIPID	4.76 ± 0.11^{d}	7.02 ± 0.01^{a}	6.65 ± 0.01^{b}	6.37 ± 0.00^{c}	6.51 ± 0.01^{bc}	4.91 ± 0.01^{d}
ASH	3.39 ± 0.01^{e}	3.55 ± 0.01^{d}	3.80 ± 0.00^{b}	3.65 ± 0.01^{c}	4.10 ± 0.01^{a}	4.10 ± 0.01^{a}
FIBRE	2.99 ± 0.01^{c}	2.34 ± 0.01^{e}	2.34 ± 0.01^{e}	2.40 ± 0.01^{d}	3.37 ± 0.01^{a}	3.08 ± 0.01^{b}
NFE	20.95 ± 0.08^{a}	7.39 ± 0.01^{e}	7.99 ± 0.02^{c}	7.49 ± 0.01^{e}	7.70 ± 0.01^{d}	8.56 ± 0.01^{b}

Means in the same column with different superscripts differ significantly ($p<0.05$)

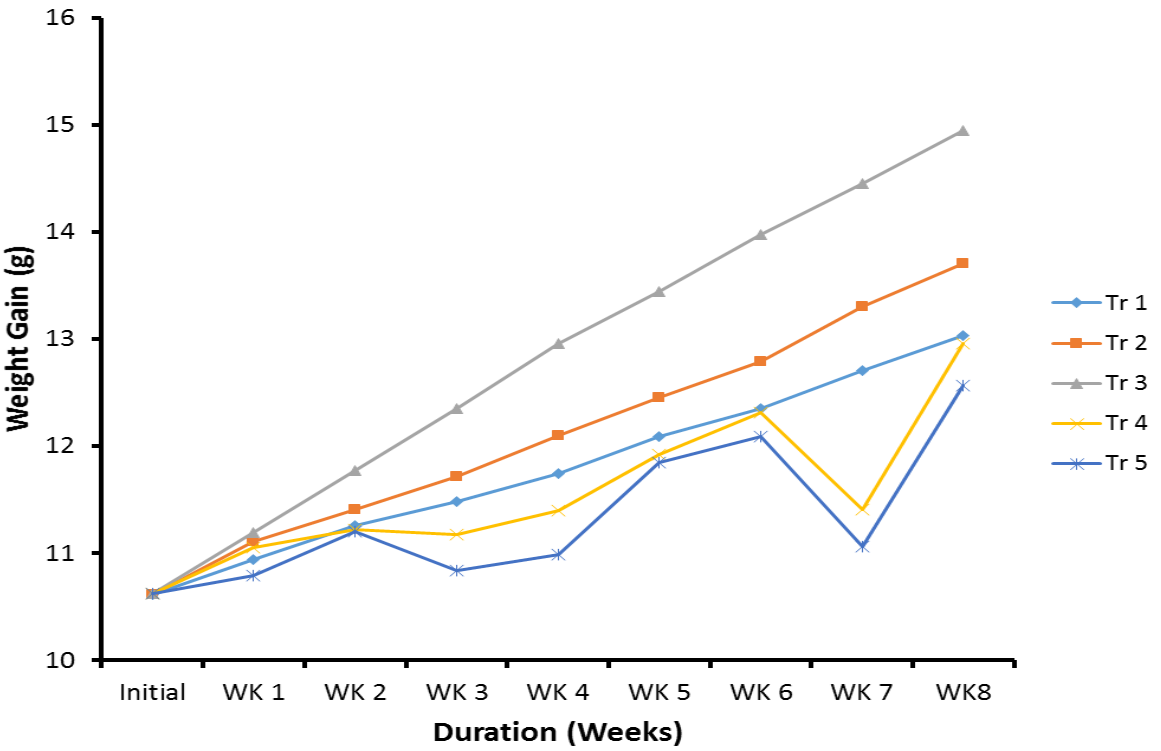

Figure 1. Weekly weight record and growth of experimental fish in various treatments

Conclusion

This study has shown that feeding *Oreochromis niloticus* with 50% substitution of MOL meal for soybean meal gave the best growth and nutrient utilization, beyond this, growth significantly reduced, hence for better performance of *O. niloticus,* MOL should not be included more than 7.34%.

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