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THE COMPARATIVE EFFECT OF FISH AND BLOOD MEAL BASED DIETS ON THE GROWTH AND SURVIVAL OF JUVENILE TILAPIA (*Oreochromis niloticus*) IN CONCRETE TANK

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ABSTRACT

*An experiment was carried out to find out the comparative effect of imported fish meal, blood meal and local fish waste based diets on the growth and survival of juvenile tilapia. (*O. niloticus*) in concrete tank. Four diets consisting of N.I.O.M.R. pelleted feed containing 40% CP, with imported fish meal, as the control and three others formulated with fresh, boiled cattle blood and local fish waste meal at 30% CP, were fed to juvenile tilapia with average initial weight of 55.24g in four treatments and four replicates in a completely randomized design. Result indicated final body weights of 100.83, 96.54, 98.4 and 86.82g and average body length of 18.47, 18.16, 18.4 and 18.14cm, for treatments 1 (control), 2 (fresh blood based diet), 3 (boiled blood based diet) and 4 (local fish waste meal based diet) respectively, with no significant difference between the treatments ($P>0.05$). The same was also true for average daily weight gain of 0.41, 0.36, 0.31 and 0.28g. However, treatment 1 and 2 had better relative weight gain 93.69 and 80.21%, than 3 and 4 at 62.37 and 64.85% respectively, ($P<0.05$). The survival was 100% in all treatments. Treatment 2 was*

more cost effective at ₦539.06/Kg fish, followed by 1 with ₦667.52. Treatments 3 and 4 had the highest at ₦698.20 and ₦718.60 per kg fish. The trial showed that tilapia feed processed with fresh cattle blood performed as well as imported fish meal, boiled blood and local fish waste and in addition was more cost effective.

INTRODUCTION

Protein provides the major basis for growth, development and reproduction etc, in fish (Stiffens 1989, Kaushik 1995). The protein source is the major indicator of the quality of protein with fish meal excelling all other alternatives in fish feeding (Desilva, and Anderson, 1995). The nutritional practice is to combine animal and plant protein concentrates. The available nutrient in one complementing the deficient in the other (Jackson and Capper, 1982, Tacon and Jackson 1985). The availability of fish meal for large scale production of fish feed is highly suspect (Rosamond *et al.*, 2000). It's use in Nigeria, is dependent on importation with resultant high cost and waste of foreign exchange. Cattle blood available in most abattoirs in Nigeria is currently not efficiently used. Harris (1980) asserted that the combined deficiency of cystine and methionine in blood meal could be remedied by fortifying with pure synthetic methionine which is available as a feed supplement. Ogunji and Wirth (2001) in their study on alternative protein sources as substitute for fish meal in the diet of young tilapia (*O. niloticus*) observed that a proper combination of Soya beans, blood meal (not more than 6% level), groundnut cake and wheat bran could provide the 42-45% protein needed by the fish. Such

combination could provide the low cost feed required for low cost of production (Webster *et al*, 1992, Tacon and Jackson, 1985) which is needed for tilapia production. This work was thus effected to find out the comparative effect of cattle blood made into feed in the fresh liquid state, boiled state, imported fish meal and local fish waste meal based diets on the growth and survival of tilapia and the resultant cost benefit effect on stagnant concrete tank, the system mostly used by farmers in Nigeria.

MATERIALS AND METHODS

Feed for the trial- Pelleted commercial feed (6 mm size) obtained from NIOMR Lagos, containing 40% cp and made up of imported fish meal, defatted soya bean

meal, and groundnut cake as crude protein sources and corn and wheat bran as carbohydrate sources, served as the control. Three other diets were formulated at 30% Cp with 8.5% CP contributed by fresh, boiled blood and local fish meal respectively as animal protein sources with soyabean cake as plant protein source and wheat bran and garri as carbohydrate sources. The formulae are as shown in Table 1. The materials were scaled out according to the formulae, ground, mixed and pelleted with a 6mm die. The nutrient composition in all the diets were calculated as shown in Table 1.

Feeding Trial: The four diets were allotted to 1m³ concrete tanks in the family testing unit at the African Regional Aquaculture Centre.

Table 1: Ingredient and calculated proximate composition of experimental diets

Ingredients	Diet 1 (Control diet)	Diet 2 (Fresh blood)	Diet 3 (Boiled blood)	Diet 4 (Local fish meal)
Wheat bran	10.80	46.40	46.40	41.92
Corn	10.80	-	-	-
Soya bean	32.40	33.01	33.01	34.75
Fish meal	18.40	-	-	13.33
Blood meal	-	10.00	10.00	-
Groundnut Cake	34.60	-	-	-
Garri	-	5.00	5.00	5.00
Vegetable oil	0.70	5.00	5.00	5.00
Vitamin/trace mineral premix	0.25	0.25	0.25	0.25
Methionine	-	0.35	0.35	-
Vitamin C	0.10	0.10	0.10	0.10
Total	100%	100%	100%	100%
Proximate composition:				
Crude protein	44.38	30.44	30.44	30.50
Ether extract	5.23	8.14	8.14	8.60
Crude fiber	5.60	5.46	5.46	5.25
Ash	4.33	4.54	4.54	6.87
Moisture	11.60	12.54	11.54	12.12
NFE	28.86	38.88	39.88	36.16

(ARAC), Aluu, Port Harcourt, as four treatments each with 4 replicates in a completely randomized design. Eleven juvenile tilapia were stocked per tank at an average initial weight of 55.24g. Borehole water was supplied from a concrete reservoir. Water quality parameters such as PH, temperature and DO were measured using the pencil type PH meter with temperature display and La Motte fresh

water aquaculture test kit (Model AQ-2, code 3633-03) for DO every week.

At the beginning of the third month, electricity failure and damage to the borehole pump led to acute water shortage with resultant effect on water quality. Remediation measures included the agitation of the water in all the tanks to raise the DO level.

Sampling was done every month and new weights and lengths determined. The new feeding rate was worked out based on the new biomass. At the end of the trial in 4 months, final weights and length were determined and the means of growth performance parameters were subjected to analysis of variance (ANOVA).

RESULT AND DISCUSSION

Physico-Chemical parameters

The result of water quality as shown on Table 2 indicated fair pH value of 7.07 for borehole water and 6.87, 6.75, 6.86 and 6.87 for months 1,2,3 and 4 averages for tank water, and temperature values of 28.9, 28.1, 30, 28.4 and 28.6°C respectively. Dissolved oxygen values were low at 2.35, 1.53 and 1.85 mg/l. For borehole water and months 1 and 2 tank water, and depressingly low at 0.85mg/lit; in month 3 due to acute water shortage.

The values rose again to 2.89 following remediation action. All the diets had similar effect on the quality of tank water.

Growth performance: There was gradual increase in body weight within the first two months of the trial in all treatments (table 3), followed by a drop in the third month due to very low DO. This agrees with the finding of Okaeme (1990) that low DO retards the growth of juvenile fish. A rise occurred again with remediation action in the 4th month. Condition factors (Table 4) improved in all the treatments for the first two months, dropping in the third till the end. Average final body weight of 100.83, 96.4 and 86.82g and average body length of 18.47, 18.16, 18.45 and 18.14 cm for treatments 1 (control), 2 (fresh blood), 3 (boiled blood) and 4 (local fish waste meal based diet) respectively.

Table 2: Physico-Chemical Parameters of borehole and tank water

Parameters	Borehole	Experimental tank water			
		Month 1	Month 2	Month 3	Month 4
PH	7.07	6.87	6.75	6.86	6.87
T°C	28.90	28.10	30.00	28.40	28.60
DO ₂ mg/lit.	2.35	1.53	1.85	0.85	2.89

Table 3: Average monthly body weight of juvenile tilapia in grams

Treatments	Initial	Month 1	Month 2	Month 3	Month 4
1.	52.50	81	110.83	91.98	100.83
2.	53.85	79.58	105.12	89.26	96.54
3.	61.45	83.46	103.19	92.61	98.4
4.	53.17	71.40	95.91	78.75	86.82

Table 4: Average monthly condition factor

Treatments	Initial	Month 1	Month 2	Month 3	Month 4
1.	1.36	1.99	2.28	1.68	1.60
2.	1.36	1.72	2.14	1.65	1.61
3.	1.51	1.73	2.04	1.60	1.57
4.	1.38	1.80	2.06	1.61	1.45

Table 5: Growth performance, nutrient utilization and survival of juvenile tilapia fed the experimental diet.

Parameters	Diet 1 (control)	Diet 2 (fresh blood)	Diet 3 (Boiled blood)	Diet 4 (Local fishmeal)
Growth performance				
Av. Initial body weight (g)	52.50	53.85	61.45	53.17
Av. Initial length (cm)	15.67	15.82	15.98	15.66
Av. Final body weight (g)	100.83	96.54	98.40	86.82
Av. Final length (cm)	18.47	18.16	18.45	18.14
Av. Weight gain (g)	48.34	42.68	36.95	33.65
Av. Daily weight gain (g)	0.41	0.36	0.31	0.28
Av. Relative weight gain %	93.69	80.21	62.37	64.85

showed no significant difference ($P > 0.05$), Table 6. Average weight gain of 48.34, 42.68, 36.95 and 33.65g for treatments 1-4 respectively, also showed no significant difference ($P > 0.05$). The same was true for average daily weight gain of 0.41, 0.36, 0.31 and 0.28g. However relative weight gain was higher in treatments 1 and 2 at 93.69 and 80.21 than in treatments 3 and 4 at 62.37 and 64.85% respectively ($P < 0.05$). This result contradicts the findings of Ogunji and Wirth (2001) who observed that blood meal inclusion rate not exceeding 6% may be recommended for *O. niloticus* and that beyond this level poor performance of fish was noticed and increased mortality. The level used was 10% and compared effectively with the fish meal based diet. The fresh blood type more so. The reason for this may not be unconnected with the fact that absorbing fresh blood in wheat bran and other materials and pelleting before sun drying ensures that nutrients which could be destroyed by heat in the conventional method of processing blood meal are saved as observed by Sonaiya (1988). The combination also improves the ratio of leucine: Isolencine and removes

the antagonism between the two observed by Taylor *et al* (1977), and fortification with methionine takes care of the deficiency in blood meal and soyabean meal as stated by Haris (1980). The relatively poor growth rate in all the treatments was due to the low DO level particularly after the second month.

Survival: Survival was 100%, showing that tilapia could survive even beyond 6% level of blood inclusion, contrary to the observation of Ogunji and Wirth (2001).

Cost Effectiveness: Diet 2 (fresh blood diet) produced 1kg of tilapia at the lowest cost of ₦539.06 (Table 7), followed by diet 1 (control) with ₦667.52. Diets 3 and 4, the boiled blood and local fish meal based diets had the highest cost at ₦698.20 and ₦718.06 respectively for every 1kg of the fish produced. The high cost was due to the poor growth in all the treatments.

CONCLUSION

The study showed that blood meal compares favourably with fish meal particularly when used fresh in processing the feed for juvenile tilapia. It is also more cost effective.

Table 6: Estimation of cost effectiveness.

Ingredients	Diet 1			Diet 2		Diet 3		Diet 4	
	Cost/kg Ingred. (₦)	Kg ing. /100kg diet	Cost/ 100kg diet (₦)	Kg ing. /100kg Diet	Cost/ 100kg diet (₦)	Kg ing. /100kg diet	Cost/ 100kg diet (₦)	Kg ing. /100kg diet	Cost/ 100kg diet (₦)
Wheat bran	36	10.80	388.80	46.40	1670.40	46.40	1670.40	41.92	1509.12
Corn	60	10.80	648	-	-	-	-	-	-
Soya bean	140	32.40	4536	33.01	4621.40	33.01	4621.40	34.75	4865
Imported fishmeal	350	18.40	6449	-	-	-	-	-	-
Blood meal	120	-	-	10	1200	10	1200	-	-
Garri	145	-	-	5	725	5	725	5	725
Local fishmeal	250	-	-	-	-	-	-	13.33	3332.5
Vegetable oil	350	0.70	245	5	1750	5	1750	5	1750
Premix	1000	0.25	250	0.25	250	0.25	250	0.25	250
Methionine	1400	-		0.35	490	0.35	490	-	-
Vitamin C	5000	0.10	500	0.10	500	0.10	500	0.10	500
GNC	110	34.60	3806	-	-	-	-	-	-
Total		100kg	16,813.8	100kg	11,206.8	100kg	11,206.8	100kg	12,937.62
Cost effectiveness:									
1. Cost/kg diet (₦)			168.14		112.07		112.07		129.38
2. Amount of feed required to produce 1kg fish (FCR)		3.97		4.81		6.23		5.55	
3. Cost effectiveness (1) X (2)			667.52		539.06		698.20		718.06

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