GROWTH RESPONSE OF *Clarias gariepinus* POST-FINGERLINGS TO BLOOD AND DRY POULTRY LITTER MEALS IN UN-EXTRUDED FLOATING FISH FEED

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ABSTRACT
Twelve (12) weeks feeding experiment was conducted at the National Institute for Freshwater Fisheries Research (NIFFR), New Bussa, Niger State, Nigeria. Graded levels (0, 5, 10, 15, 20, 25 or 30) % of dry poultry litter meal (DPLM) and 10% blood meal were fed to post fingerlings of Clarias gariepinus in a completely randomized design with triplicate groups of 27 fish in a (2 m x 2 m x 1 m) concrete tank. Clarias gariepinus responses to the diets showed that there were significant difference in weight gain (WG), feed conversion ratio (FCR), specific growth rate (SGR), survival and nutrient retention (P < 0.05). There was no significant difference between the positive and negative controls with respect to these parameters (P > 0.05). Also, no significant differences were observed between the groups that fed on 5%, 10% and 15% (DPLM) combined with 10% blood meal to replace 15% clupeid fish meal, 5% and 10% wheat offal in the control diet (P > 0.05). The haematological parameters showed slight significant differences (P < 0.05) with generally high levels of lymphocytes in the leukocyte differential analysis (P>0.05). There was also no any pathological defect observed in the fish and no significant difference in palatability of the processed products at the end of the experiment (P > 0.05). The feed cost reduced as DPLM increased and cost ₦/Kg were ₦330, 265, 261, 258, 255, 252, 249 and 246 for diet 1, 2, 3, 4, 5, 6, 7 and 8 respectively. It was recommended that 10 - 15% of dry poultry litter from a battery cage system and 10% blood meal can be included into an un-extruded floating fish feed for cost reduction. There is need to carry out such investigation in other freshwater fish species.
Keywords: growth studies, fish diets, floating fish pellets

INTRODUCTION
Fish is an important source of protein to larger percentage of the human race. This is one of the reasons for the national and world interest in the development of aquaculture as a way to make fish protein available to the common man. This is because the catch from the artisanal fishing continues to decline and aquaculture is the major solution to make fish available to all and sundry as well as replenishing the inland water bodies through re-stocking. Feed and its cost had been identified as major problems of aquaculture (Fasakin, 2001). The relative high cost of fish meal has limited its use in aquaculture over the years (Rodriguez-Sema *et al*., 1996). The search for the use of alternative feed ingredients for fish feeding has therefore gained importance throughout the world (AOAC, 2000). Some animal by-product meals, such as feather meal, blood meal, meat and bone meal have been tried as substitutes to fish meal and have shown relative economic and nutritional importance in fish diets (Steffens, 1994; Al-Asgah and Ali, 1999). Waste fed aquaculture is likely to alleviate pollution from livestock production (Little, 1995). The proper use of these alternatives in the diets of cultured fish is essential for the development of aquaculture industry. Animal manure, which is used as fertilizer to increase the natural food production, might also be used directly in feeding fish (Kausat and Ali, 1988; Al-Asgah and Ali, 1999). Dried poultry waste has long been identified as excellent source of protein and minerals for pigs and ruminants (Zinn *et al*., 1996). Fish farmers in the integrated farming have been advised to recycle waste particularly poultry waste (Oladosu *et al.*, 1990). However very little information is available on its use as ingredient in fish feed. This study was conducted to evaluate the growth response of *Clarias gariepinus* post fingerlings on partial replacement of clupeids fish meal in an un-extruded floating fish feed with safe level of blood meal and graded levels of dry poultry litter meal.

MATERIALS AND METHODS
Six hundred and sixty (660) post fingerlings of *Clarias gariepinus* with mean weight and length of 19 ± 1.7 and 23 ± 2.6 cm respectively were obtained and acclimated for two weeks during which they were fed the control diet. The basal diet composed of clupeids fish meal, soybean meal, groundnut cake, starch etc. (Ibiyo *et al*., 2011). They were randomly distributed in a group of 27 into a 2 m x 2 m x 1 m concrete tanks in out-door experimental system of hatchery Complex in National Institute for Freshwater fisheries Research, New Bussa. The remaining ones were stored for the determination of their initial body proximate composition. Blood meal and graded levels (5, 10, 15, 20, 25 or 30) % of dry poultry

litter meal (DPLM) from battery cage system was included into clupeids meal based un-extruded floating feed. The diets were fed to post fingerlings of *Clarias gariepinus* for 12 weeks in a completely randomized design with triplicate groups. The clupeids fishmeal based diet served as the positive control while 10% level (the safe inclusion level) of blood meal combined with the clupeids fish meal served as the negative control. This was termed negative because it led to 10% reduction in the fish meal.

The fish were fed their respective diets at 5% body weight in the first 8 weeks and 3% in the last 4 weeks given in two instalments daily (morning; 8-9.00 am and evening; 6-700 pm). Sampling was carried out fortnightly during which health condition of the fish was also ascertained with subsequent adjustment of feed supply per day. The water quality parameters such as dissolved oxygen, pH, conductivity, nitrite concentration and temperature were monitored with the assistance of the limnology unit using the methods described by APHA (1995). The pH was measured with a pH meter (JENWAY) model 4076. Nutrient retention trial was carried out 6 weeks into the experiment. A group of four fish per treatment were taken into a separate container. Faecal samples were collected for three days from the fish through hand press after weighed quantities of feed were fed and allowed to digest. The diets, initial fish and faecal samples were subjected to proximate composition analysis in accordance with AOAC (2000). At the end of 12 weeks final sampling were carried out, 5 fish were randomly selected from each replicate for blood samples using heparinized syringe into an EDTA bottles, whole fish for histological study, proximate composition and another 5 were taken for processing and used for palatability test. Haematological values were measured following standard methods (Joshi *et al*., 2002b and 2002c) Packed cell volume (haematocrit method) and haemoglobin (Hb) concentration (cyanmethaemoglobin method) were analysed within two hours after collection. Data obtained were subjected to analysis of variance using SPSS version 15 with the principle of Steel and Torrie (1980) and where ANOVA identified significant difference, means were separated with New Duncan Multiple Range Test by setting type -1 error at 5% level of significance (Duncan 1955).

Table 1: Composition of experimental diets

	Diets							
Ingredients /Diets	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Dry Poultry Litter Meal	0	0	5	10	15	20	25	30
Blood meal	0	10	10	10	10	10	10	10
Basal	100	90	85	80	75	70	65	60

RESULTS

Table 2 showed growth performance of the fish after 12 weeks. There were significant differences in weight gain (WG), feed conversion ratio (FCR), specific growth rate (SGR), survival and nutrient retention ($P < 0.05$). The haematological parameters showed slight significant difference ($P < 0.05$). However, there were generally high levels of lymphocytes in the leukocytes differential. There was no any pathological defect observed in the fish. There was a feed cost reduction and there was no significant difference in the palatability test of the processed products at the end of the experiment ($P > 0.05$). There was a significant decrease in the survival of the fish ($P < 0.05$). The mortality significantly increased linearly with increased level of DPLM ($P < 0.05$). However the mortality that was recorded occurred within the first three weeks of the trial period. There was no significant difference in nutrient retention ($P > 0.05$), however the control groups and 5% DPLM had the highest retention values. High turbidity of water was frequently observed in the tanks and high algae bloom in the 25% and 30% DPLM level of inclusion. The feed cost reduced as DPLM increased and cost (₦/Kg) were ₦330, 265, 261, 258, 255, 252, 249 and 246 for diet 1, 2, 3, 4, 5, 6, 7 and 8 respectively. The results showed that it becomes significantly more expensive to raise a kg fish as the feed becomes excessively cheaper with increased feed to gain ratio (Table 3) ($P < 0.05$).

Table 2: Proximate composition of experimental diets and dry poultry litter meal (DPLM)

Parameters (%)	Diets with DPLM inclusion Levels								DPLM
	0	0	5	10	15	20	25	30	
Crude Protein	39.3	40.20	38.08	37.80	37.40	38.58	38.68	38.50	22.90
Crude Fat	12.50	13.30	12.80	12.60	11.35	10.10	10.01	10.89	2.50
Crude Fibre	4.30	4.30	4.50	4.57	5.10	5.35	5.54	5.60	12.70
Ash	9.80	10.30	11.2	12.00	12.34	12.60	12.73	13.20	16.90
Nitrogen free extract	27.1o	31.90	33.42	33.02	33.81	33.37	33.17	31.81	39.90
Dry matter (DM)	94.70	94.50	94.80	95.20	94.70	95.80	94.80	95.10	94.00

Table 3: Growth response of post fingerlings of *Clarias gariepinus* fed a basal diet with graded levels of dry poultry litter meal (0 - 12 weeks)

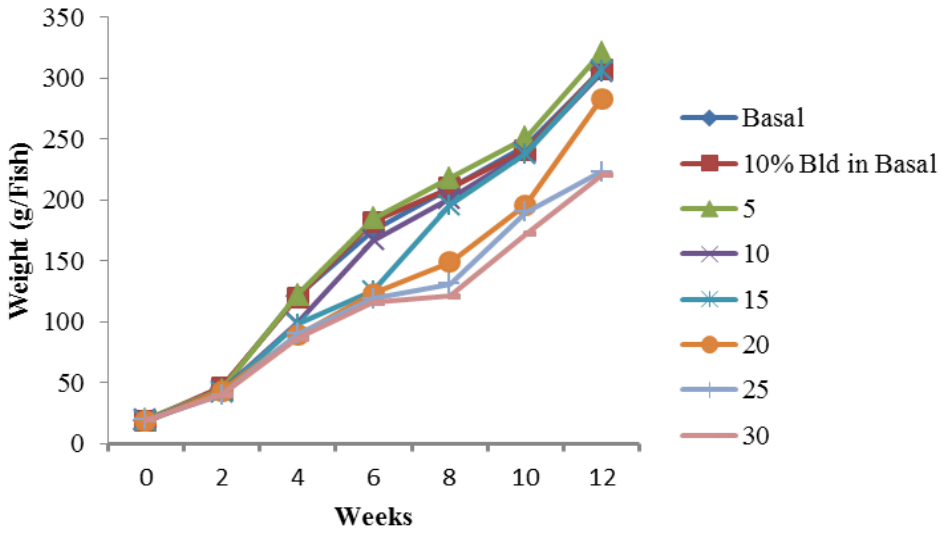
Treatment Basal+ DPLM	Weight gain (g)	Feed consumed (g/fish)	FCR	SGR (%)	Survival (%)	Cost Kg^{-1} Fish ₦
0 %	288.33^{ba}	288.03^{ab}	1.00^{a}	3.18^{ab}	88.90^{a}	330.30^{a}
10 % Blood meal	288.66^{ba}	294.87^{ab}	1.02^{a}	3.46^{ab}	86.40^{a}	270.30^{a}
5%	301.00^{a}	345.34^{ab}	1.14^{a}	3.43^{ab}	79.00^{a}	299.23^{a}
10%	285.16^{a}	331.36^{ab}	1.13^{a}	3.23^{ab}	78.96^{a}	299.28^{a}
15%	288.00^{ab}	331.23ab	1.16^{a}	3.30^{ab}	85.16^{a}	288.15^{a}
20%	265.00^{cb}	312.98^{ab}	1.18^{a}	2.83^{b}	80.26^{a}	300.60^{a}
25%	204.00^{c}	430.26^{cb}	2.11^{b}	3.03^{ab}	62.91^{b}	456.50^{b}
30%	201.00^{c}	521.06^{c}	2.59^{c}	2.8b	61.68^{b}	508.40^{b}
SEM	14.8	50.77	.09	0.15	4.98	22.28

a-c Means with different superscript(s) within column significantly different.
DPLM = Dry Poultry Litter Meal

Table 4: Haematological response of post fingerlings of *Clarias gariepinus* fed a basal diet with graded levels of dry poultry litter meal (0-12 weeks).

Treatment Basal+ DPLM	HGB (g/dl)	PCV (%)	RBC (million/L)	LYMPH (10^3/L)
0 %	9.10^{a}	31.15^{a}	2.36^{a}	220.00^{a}
10 % Blood meal	9.01^{a}	31.03^{a}	2.26^{a}	220.00^{a}
5%	9.12^{a}	31.03^{a}	2.34^{ab}	219.10^{a}
10%	9.02^{a}	29.10^{b}	2.24^{ab}	220.33^{a}
15%	8.92^{a}	28.90^{b}	2.09^{cb}	219.01^{a}
20%	8.46^{b}	29.34^{b}	2.17^{b}	220.33^{a}
25%	8.17^{b}	29.15^{b}	2.36^{ab}	220.00^{a}
30%	7.89^{c}	29.70^{b}	1.95^{d}	220.80^{a}
SEM	0.01	0.08	0.04	0.73

a-d Means with different superscript(s) within column significantly different.
DPLM = Dry Poultry Litter Meal



Bld = Blood meal

Fig. 1: Growth performance of *Clarias gariepinus* post-fingerlings fed dry poultry litter meal included into an un-extruded floating Feed (0 – 12 weeks)

DISCUSSION

The significant difference observed in parameters such as WG, FCR and SGR were indications of variability in feed utilization. Similar results were observed in *Clarias* by Obasa *et al.*, (2009) and in Tilapia by Al-Asgah and Ali (1999). Although, Obasa *et al.*, (2009) observed a better response with higher level of dry poultry manure inclusion. It might be due to the ingredient replaced in their study which was soybean while in this present study fish meal was the target. The high proliferation of the lymphocytes revealed by the leukocyte differential counts (Table 4) might be a defence mechanism of the fish in the culture medium which was likely to be high in microbial load as the health status of the fish was not affected. The significant difference in survival which resulted from the mortality that was recorded in the first three weeks of the trial period could be due to fish's adjustment to the treatments. However, no mortality was observed by Al-Asgah and Ali (1999) with tilapia, which might be due to tilapia's better ability to handle poultry manure as tilapia is capable of taking poultry droppings directly (Kausat and Ali, 1988; Al-Asgah and Ali, 1999) and even under poultry-cum fish integration system. The high turbidity of water observed in the tanks and high algae bloom prominent in the 25% and 30% DPLM treatments might be due to high level of fertilization resulting from the left over feeds. Frequent reduction of the water from the tanks and topping it with freshwater might have assisted in ameliorating its effect on the fish.

The search for non-conventional feedstuffs to reduce cost of fish feed is a continual process to achieve an economic diet for a more profitable fish production to increase fish farmers' income. The use of livestock waste has become a norm in fish production (Shevgoor *et al*., 1994). The results of this trial demonstrated that up to 15% level of the fish meal in the un-extruded floating fish feed can be replaced by dry poultry litter meal from a battery cage system in combination with the 10% safe inclusion level of blood meal. It was noted that 5% DPLM inclusion level had the highest weight gain with high feed intake and second best SGR, though it was not significantly different from the positive and negative control groups (Table 2; figure 1). The better performance obtained in the 5% inclusion level must have been enhanced by the quality of the animal proteins which were fish meal and blood meal interacting with a lower quantity of DPLM.

The reduction in feed cost per Kg was encouraging however it becomes more expensive to raise a kg fish as the feed becomes too cheap. This was because the fish need to eat more and gained less weight indicating significantly poor utilization at 25% and 30% DPLM level (Table 3). The cost to benefit ratio indicated that the negative control is most profitable to use. This was due to the relatively low cost of blood meal which is also very high in crude protein with a low FCR.

CONCLUSION

It can be concluded from the observations and analytical results of this investigation that incorporation of 5-15 % DPLM in combination with blood meal into un-extruded floating fish feed does not have any deleterious effect on the fish as

no adverse effect on health status of the fish. Little (1995) noted that control use of poultry waste is likely to reduce pollution and poisoning of the fish. It was recommended that 10 - 15% of dry poultry litter from a battery cage system and 10% blood meal can be included into un-extruded floating feed for cost reduction.

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