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Nutritive Value of Dried Rumen Digesta as Replacement for Soybean in Diets of Nile Tilapia (*Oreochromis niloticus*) Fingerlings

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Abstract: An eight (8) weeks experiment was carried out to determine the nutritive potential of dried rumen digesta as replacement for soybean meal in diets of Nile Tilapia *Oreochromis niloticus*. One hundred and fifty Nile Tilapia fingerlings were assigned to five different diets such that Dried Rumen Digesta (DRD) replaced soybean meal at 0, 10, 20, 30 and 40% represented by T_1, T_2, T_3, T_4 and T_5 respectively in a completely randomized design. Result showed that all fish fed DRD based diets performed better than the control group. There was significant difference ($p<0.05$) in weight gain among the control groups and those fed DRD based diets. Evaluation on feed intake and feed conversion ratio showed significant difference among the control and DRD groups ($p<0.05$). This study revealed that DRD at 40% dietary inclusion could replace soybean in the diet of *Oreochromis niloticus* fingerlings without compromising growth. The trial lasted for eight (8) weeks.

Key words: Rumen digesta, nutritive value, *Oreochromis niloticus*, performance

INTRODUCTION

Various studies have been reported on the substitution of more expensive protein concentrates particularly fishmeal and plant oil seeds and their products which usually constitute a major source of dietary protein with less expensive and non competitive feedstuffs in livestock/fish production (Akiyama, 1991; Fanimo *et al*., 1988; Agbabiaka, 2010).

Leaf meals made from fodder shrubs, legumes and trees are currently helping small scale farmers in tropical countries such as Nigeria to boost production (Esonu *et al*., 2002; Nwogu and Fapounda, 2002). Leaf meals from legumes and browse plants have been used as sources of nutrient and Xanthophylls in diets of broiler chicken and layer hens (Esonu *et al*., 2002; Madubuike and Ekenyem, 2006). Leaves of *Tridax procumbens* have been incorporated in feeds of *Oreochromis niloticus* at 20% level without compromising growth (Ojobe, 2003) while a combination of 20% groundnut cake and 15% water hyacinth have produced good growth and protein utilization in Nile tilapia (Ofojekwu *et al*., 1994). Recycling slaughter house wastes as feedstuff for some categories of livestock/fish have been a continuous investigation. This is due to global emphasis on the utilization of non conventional feedstuffs in solving inadequate animal protein intake by humans (Swan, 1992), arising from prohibitive cost of feed and consequently high cost of animal products such as meat, eggs, fish, milk etc.

Rumen digesta is one of the by-products of abattoir, it is the partially digested forage mainly found in the rumen of ruminant animals. It is fairly rich in crude protein (18.52%) and other micro-flora such as fungi, protozoa and bacteria (Esonu *et al*., 2006; Dairo *et al*., 2005). Its utilization as animal feed will also alleviate and maximize the economic and environmentally benign disposal of slaughter-house by-products (NAVN, 1994; Esonu *et al*., 2006). This experiment was designed to determine the nutritional value of Dried Rumen Digesta (DRD) in diets of Nile Tilapia (*Oreochromis niloticus*) fingerlings.

MATERIALS AND METHODS

Study area: The research was conducted at the Teaching and Research Farm, Federal Polytechnic, Nekede, Owerri, Nigeria. Owerri lies between latitude 5^o 35^1 N and 6^o 10^1 N and longitudes 6^o 40^1 E and 7^o 11^1 E at 90 m above sea level. The annual rainfall is between 192-194 cm and annual mean temperature of 32.18^{o}C (Fed. Min. Aviation, 2001).

Experimental fish and design: One hundred and fifty (150) *Oreochromis niloticus* fingerlings with average weight 7.6±0.2 g were purchased from African Regional Aquaculture Centre (ARAC), Aluu, Portharcourt, Nigeria. The fish were acclimatized for a week and fed daily with commercial ration at 5% body weight. The fish were divided into five groups of thirty fish each and randomly assigned to five isonitrogenous experimental diets in a

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completely randomized design. The fish were starved for 24 h to allow for digestion of food eaten prior to commencement of the feeding trail. Each treatment was further divided into three replicates of 10 fish per hapa net, measuring (1.0 x 1.0 x 1.2 m) suspended by bamboo poles in an outdoor cistern (4 x 5 x 1.2 m). Main source of water was from the bore-hole at the fish farm complex. Water quality was monitored throughout the duration of the study as described by Boyd (1979). Stale water was drained off pond fortnightly and refilled by fresh water from the bore-hole.

Experimental feedstuff and feeding: The rumen digesta was collected from an abattoir at Obinze, Owerri, Imo State. It was sundried for about 3 days to a desirable moisture content and passed through a mill to facilitate pelleting. The DRD meal produced was mixed with other feeding ingredients to formulate five Isonitrogenous diets such that DRD replaced soybean at different inclusion levels of 0% (control), 10%, 20%, 30% and 40% represented by T_1, T_2, T_3, T_4 and T_5 respectively. The mixed feeds were pelleted using a pelleting machine with die 2 mm and sundried for 3-4 days depending on intensity of the sun. The diets so produced were fed to experimental fish at 5% body weight daily between 8-9 am and 5-6 pm for a period of 8 weeks.

Proximate analysis of test ingredient and feeds: Samples of the dried Rumen Digesta and experimental feeds were taken for proximate analyses using standard methods (AOAC, 1990).

Data collection: The experimental fish were weighed at the beginning of the experiment and batch weighed weekly thereafter using digital weighing scale and returned into their respective hapas thereafter. Feeding was usually adjusted weekly according to the new body weight.

Water quality parameters such as temperature, dissolved oxygen and hydrogen ion concentration were measured biweekly using mercury in glass thermometer, winkler's method and pH meter respectively as outlined by Boyd (1979).

Statistical analysis: Data collected were subjected to one-way Analysis of Variance, means were separated by Duncan multiple range test as described by Obi (1990).

RESULTS AND DISCUSSION

The result of the proximate composition of the test ingredient is shown in Table 1; while Table 3 shows the chemical composition of the experimental diets. Control diet contained highest crude protein value of 35.20% while least value of 34.24% was obtained from diet with 40% inclusion of DRD. The crude fat values of the diets were 6.76%, 6.15%, 5.97%, 4.05% and 3.54% for T_1, T_2, T_3, T_4 and T_5 respectively. The crude fibre content of the

Table 1: Proximate composition of dried rumen digesta (% DM)

Parameters	Percentage
Moisture	5.47
Crude protein	18.58
Crude fat	3.77
Crude fibre	34.44
Nitrogen free extract	24.81
Ash	18.40

Table 2: Composition of experimental diets

	Dietary inclusion of DRD (%)				
Ingredients	T_1	T_2	T_3	T_4	T_5
Maize	30.00	30.00	30.00	30.00	30.00
Soyabean	25.00	22.50	20.00	17.50	15.00
DRD	-	2.50	5.00	7.50	10.00
Blood meal	8.00	8.00	8.00	8.00	8.00
Fish meal	12.00	12.00	12.00	12.00	12.00
Spent grain	20.00	20.00	20.00	20.00	20.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Vegetable oil	2.00	2.00	2.00	2.00	2.00
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00

Table 3: Proximate composition of experimental diets (%DM)

	Treatment diets				
Parameters	T_1	T_2	T_3	T_4	T_5
Crude fat	6.76	6.15	5.97	4.05	3.54
Crude fibre	6.39	8.23	9.50	10.45	11.09
Crude protein	35.20	35.08	34.92	34.36	34.24
Ash	9.13	8.74	7.48	7.48	7.96
NFE	42.52	41.80	42.13	43.66	43.17
Moisture	10.24	10.53	9.35	9.84	6.56

NFE = Nitrogen Free Extract

trial feeds did not show similar trend as the crude protein and crude fat. The highest crude fibre value of 11.09% was recorded in (T_5) 40% dietary inclusion of DRD while least value of 6.39% was obtained from the control diet. This is attributed to the concentration of the DRD which is high in crude fibre (Table 1) compared to soybean meal.

The body weight gain of the experimental fish revealed that the best value of 8.75 g was obtained from T_4 (30%), followed by T_3, T_2, T_5 and T_1 (control diet) with least value of 5.85 g (Table 4). There was a general increment in growth rate as dietary inclusion of DRD increased in the feed up to T_4 with little decline in weight of fish in T_5 but better than control group, this agrees with work of (Esonu *et al*., 2006).

This study also showed that DRD was better utilized by Nile Tilapia compared to duckweed whose optimum dietary inclusion for good growth were reported to be 10% and 15% levels by Fasakin *et al.* (2001) and Ofojekwu *et al.* (2010) respectively. However, there was also an improvement in Nutrient utilization of DRD by test fish when compared to reports of Ofojekwu *et al.* (1994) in the trial with *Tridax procumbens* leaf meal for Nile Tilapia. There was significant difference ($p<0.05$)

Table 4: Nutrient utilization of Nile Tilapia fed DRD based diets

	Treatment diets				
Parameters	T_1	T_2	T_3	T_4	T_5
Mean initial weight of fish (g)	7.75	7.70	7.60	7.65	7.40
Mean final weight of fish (g)	13.60	15.85	17.05	16.40	15.25
Mean weight gain of fish (g)	5.85^c	8.15^b	8.40^a	8.75^a	7.85^b
Total feed intake/fish (g)	7.13^c	7.86^a	8.06^a	8.93^b	8.33^a
Weekly weight gain of fish (g)	0.73^c	1.02^b	1.05^a	1.10^a	0.98^b
Feed Conversion Ratio (FCR)	1.22^b	0.96^a	0.96^a	1.01^a	1.06^a
Mean growth rate	0.10^a	0.15^b	0.15^b	0.16^b	0.14^b
Specific growth rate (%/day)	0.44	0.56	0.63	0.50	0.51
Protein Efficiency Ratio (PER)	2.34^a	2.96^b	3.06^b	2.99^b	2.94^b
Cost of 25 kg bag of feed (Naira)	3344.00	3291.00	3238.00	3185.00	3131.00

abc in the same row with different superscripts are significantly different ($p<0.05$)

between the treatment groups and control (T_1). The utilization of DRD, a relatively high fibre forage might be due to the acidic nature of Tilapia stomach (pH<2) and cellulase in gut that facilitate to rupture the cell wall of vegetative matter (Ugwumba, 1988; Fagbenro *et al.*, 2005) and perhaps the action of unidentified single cell micro-flora such as fungi, bacteria on the rumen digesta that might have partially digested the forage prior to collection at the abattoir.

The increase in feed intake of the trial feeds as DRD increased in the diets may be attributed to the dilution of nutrients by the dietary fibre thereby reducing the nutrient composition and consequently the energy. Animals have been reported to continue eating until their dietary energy requirement is met (Obidinma, 2009; Esonu *et al.*, 2006). The Feed Conversion Ratio (FCR) of the treatments showed significant difference ($p<0.05$) between the control group (T_1) and those fed DRD based diets. The best FCR was obtained from T_2 and T_3 with value of 0.96 while control diet (T_1) gave the least FCR value of 1.22.

Conclusion: The performance of the trial fish revealed that *Oreochromis niloticus* can tolerate 40% inclusion of DRD in the diets without compromising growth; however, it has further proved not only to be of economic advantage in feed cost by reducing Naira 213.00 per 25 kg feed, but also to alleviate the problem of environmental pollution arising from the slaughter house waste which hitherto has been of great concern to environmentalist in Nigeria.

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REFERENCES

Agbabiaka, L.A., 2010. Evaluation of some underutilized protein feedstuffs in diets of (*Clarias gariepinus*) fingerlings. Int. J. Trop. Agric. Food Syst., 4: 10-12.

Akiyama, D.M., 1991. The use of soyabean product and other plant protein supplements in aquaculture feeds. In: Processing of Aquaculture Feed Processing and Nutrition workshop [Akiyama D. M.; R.K.H. Tan (Eds)]. American Soybean Association, Singapore, pp: 199-206.

AOAC, 1990. Association of Official Analytical Chemist. Official Methods of Analysis. 15th Edn., Washington DC., pp: 1298.

Boyd, C.E., 1979. Water Quality in Warm Water Fish ponds. Auburn University, Alabama Agriculture Experimental Station, pp: 359.

Dairo, F.A.S., O.O. Aina and A.R. Asafa, 2005. Performance evaluation of growing rabbits feed varying levels of rumen content and blood rumen content mixture. Nig. J. Anim. Prod., 32: 67-72.

Esonu, B.O., F.C. Iheukwumere, O.O. Emelanom, M.C. Uchegbu and E.B. Etuk, 2002. Performance, nutrient utilization and organ characteristics of finisher broiler fed *Microdesmis puberula* leaf meal. Livestock Res. Rural Dev., 14: 15. http.www.cipar.org.co/lrrd14/6/eson.146.htm.

Esonu, B.O., U.D. Ogbonna, G.A. Anyanwu, O.O. Emelanom, M.C. Uchegbu, E.B. Etuk and A.B.I. Udedibe, 2006. Evaluation of performance, organ characteristics and economic analysis of broiler finisher fed dried rumen digesta. Int. J. Poult. Sci., 5: 1116-1118.

Fagbenro, O., O. Adedire, O. Fateru, I. Owolabi, O. Ogunlana, B. Akanbi, T. Fasanmi and Ayo-Amu Peace, 2005. Digestive enzyme assays in the gut of *O. niloticus*, *Parachanna obscura* and *Gymnarchus niloticus*. Anim. Res. Int., 2: 292-296.

Fanimo, A.O., E. Mudama, T.O. Umukoro and O.O. Oduguwa, 1988. Substitution of shrimp waste meal for fishmeal in broiler chicken rations. Trop. Agric. (Trinidad), 73: 201-205.

Fasakin, E.A., A.M. Balogun and O.A. Fagbenro, 2001. Evaluation of sundried water-fern, *Azolla Africana* and Duckweed, *Spirodela polyrrhiza* in practical diets for Nile Tilapia (*Oreochromis niloticus*) fingerlings. J. Applied Aquac., 11: 83-92.

Federal Ministry of Aviation, 2001. Department of Meteorology Services, Abuja, Nigeria.

Madubuike, F.N. and B.U. Ekenyem, 2006. Haemetology and serum biochemistry characteristics of broiler in chicks fed varying dietary levels of *Ipomea asarifolia* leaf meal. J. Poult. Sci., 5: 9-12.

NAVN, 1994. Nigeria Agro Vet. News. Jan/Feb. 1994; pp: 1: 6.

Nwogu, F.C. and J.B. Fapounda, 2002. Performance of broiler chicks fed Mimosa (*Mimosa invisa*) leaf meal supplements. Proc. 27th Ann. Conf. Nig. Soc. Anim. Production (NSAP), pp: 128-131.

Obi, I.U., 1990. Statistical methods of detecting differences between treatment means. 2nd Edn., Snaap Press Enugu, Nigeria.

Obidinma, V.N., 2009. Brewers' spent grain as energy source in finisher broiler birds and laying hen production. Ph.D Thesis, Imo State University Owerri, Nigeria, pp: 179.

Ofojekwu, P.C., I.R. Keke, G.N. Asala and J.C. Anosike, 1994. Evaluation of water Hyacinth (*Eichhoma crassipes)* and groundnut cake as dietary components in feeds for *Oreochromis niloticus* (L). Acta Hydrobiologia, 36: 227-233.

Ofojekwu, P.C., E.I. Amali, Keke and L.E. Akpa, 2010. Substitution of fishmeal by Duckweed (*Lemna minor*) meal in diets for Nile Tilapia (*O. niloticus*). J. Aquatic Sci., 25: 1-7.

Ojobe, T.O., 2003. Studies on the effects of indigenous plants materials as feed in fish Production. Ph.D Thesis. Department of Zoology. University of Jos, Nigeria, pp: 140.

Swan, J.E., 1992. Animal by-product. In: Hui, Y.H. (Ed); Encyclopedia Food science technology. 4: 42-49.

Ugwumba, A.A., 1988. Food and Feeding habits of Juveniles of some Culturable fish species in Nigeria. NIOMR Tech. Paper 31: pp: 18-22.