PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition 10 (6): 564-567, 2011
ISSN 1680-5194

Growth Response of African Catfish (*Clarias gariepinus*, Burchell 1822) to Dried Rumen Digesta as a Dietary Supplement

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Abstract: The growth response of catfish (*Clarias gariepinus*) juveniles fed Dried Rumen Digesta (DRD) based diets was investigated for 9 weeks in hapa nets. One hundred and eighty (180) fish were randomly assigned to five diets formulated such that DRD replaced groundnut cake at 0, 10, 20, 30 and 40% represented as diets A, B, C, D and E respectively. Thirty six fish were assigned to each of the diets in hapa nets and fed at 5% body weight daily. Results showed that control diet 'A' gave the highest weight gain followed by 'B' and 'C' but poor results were obtained from diets 'D' and 'E'. There were significant differences ($p<0.05$) in fish feed intake of control group and those fed DRD diets, the body weight gain followed similar trend as feed intake. There was no significant difference in feed conversion ratio ($p>0.05$) of fish fed diets 'A' and 'B' but were significantly different ($p<0.05$) from diets 'C', 'D' and 'E'. This experiment revealed that DRD can be tolerated by *Clarias gariepinus* juveniles and support growth when dietary inclusion does not exceed 20%.

Key words: Growth response, *Clarias gariepinus*, rumen digesta

INTRODUCTION

The use of non conventional feedstuff is gaining more recognition in the field of animal nutrition particularly in fish. This is primarily due to the continued increase in cost of conventional feedstuffs that often times serve as staple foods for the ever increasing Nigerian population and Agro-allied companies.

Rumen digesta is fermented and unfermented forage in rumen of ruminant animals and one of the by-products of abattoir. It is usually discarded as waste and allowed to rot hence posing a high environmental pollution and disposal problems. The rumen digesta may be a potential resource for fish nutrition if properly harnessed by a biotechnological process. It has been found that DRD contained 18.52% crude protein, 8.79% fat, 7.60%, 15.30% and 38.39% Ash, crude fiber and carbohydrate (NFE) respectively (Esonu *et al*., 2006). Several trials and handful of successes have been achieved by utilizing DRD in diets of livestock such as rabbits (Dairo *et al*., 2005), broiler chicken (Esonu *et al*., 2006), layers (Odunsi, 2003; Adeniji and Balogun, 2002) and fish (Abdel-Hakim *et al*., 2008). There is however, paucity of information on the potential of dried rumen digesta as feedstuff for catfish. This study therefore aimed at evaluating the potential of dietary inclusion of DRD on the growth performance of *Clarias gariepinus* juveniles and its cost benefit in alleviating feed cost in Nigeria.

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° 35^1 N and 6° 10^1 N and longitudes 6° 40^1 E and 7° 11^1 E at 90 m above sea level. The annual rainfall is between 192-194 cm and annual mean temperature of 32.18°C (Federal Ministry of Aviation, 2001).

The rumen digesta from cattle was collected from abattoir at Obinze, Owerri; sundried for 3-4 days depending on sun intensity and later ground into meal to facilitate pelleting.

Sample of the DRD meal was analyzed for proximate composition (AOAC, 1990).

Experimental fish and design: A total of 180 *Clarias gariepinus* with mean weight of 8.40±0.1 g were purchased from a commercial hatchery at Owerri. The fish were starved for 24 h prior to commencement of the study to allow for digestion of food already eating and prepare the stomach for the experiment diets. The fish were acclimatized and fed control diet for seven days. The fish were divided into five groups of thirty six fish fingerlings each and randomly assigned to the five treatments in a completely randomized design. Each group was replicated 3 times in fifteen hapa nets, each measuring (1.0 x 1.0 x 1.0 m) and suspended by bamboo poles in an outdoor cistern (4 x 5 x 1.2 m).

Table 1: Proximate composition of dried rumen digesta

Moisture	5.47
Crude protein	18.58
Crude fat	3.77
Crude fibre	34.44
Nitrogen free extracts	19.28
Ash	18.48

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Table 2: Ingredients composition of experimental diets fed catfish (*Clarias gariepinus*) juveniles

	Dietary treatments				
Ingredients	A	B	C	D	E
Maize	25.00	25.00	25.00	25.00	25.00
Soyabean meal	15.00	15.00	15.00	15.00	15.00
Groundnut meal	25.00	22.50	20.00	17.50	15.00
Fish meal	20.00	20.00	20.00	20.00	20.00
Blood meal	10.00	10.00	10.00	10.00	10.00
Dried Rumen Digesta (DRD)	-	2.50	5.00	7.50	10.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Vegetable oil	2.00	2.00	2.00	2.00	2.00
Vit/min premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total (kg)	100.00	100.00	100.00	100.00	100.00

Experimental diets: Five (5) diets were formulated such that they contained DRD meal at 0%, 10%, 20%, 30% and 40% replacing groundnut meal in the diets respectively (Table 2).

The compound feeds were pelleted using a pelleting machine with die 2 mm and sundried for 3 days until they were crispy. The diets were fed to the fish at 5% body weight shared into two between 8-900 h and 17-1800 h daily for a period of 63 days.

Data collection: The fish in each hapa were batch weighed weekly using digital weighing balance and returned to respective hapas thereafter. Feed were adjusted weekly according to the new body weight. Stale water was usually drained off pond fortnightly and refilled through the borehole at the fish farm complex. Water quality was monitored for temperature, dissolve Oxygen, pH and transparency according to Boyd (1979) throughout the duration of the experiment.

Statistical analysis: Data collected were subjected to one-way analysis of variance as described by Steel and Torrie (1980) while means were separated using Duncan multiple range test.

RESULTS

Proximate composition of dried rumen digesta and experimental diets: Results of the proximate composition of the DRD show that it contained 18.58% crude protein, 34.44% crude fibre, 18.48% Ash, 19.28% Nitrogen free extracts and 3.77% crude fat (Table 1). However, control diet A had the highest Crude Protein (CP) value of 40.88% followed by 40.31%, 39.04%, 38.45% and 38.36% for diets B, C, D and E respectively (Table 3).

Biological evaluations: Growth performance of the trial fish showed that control diet (A) had the highest weight gain of 32.75 g while the least value of 5.25 g was obtained in E. There was significant difference ($p<0.05$) in weight gain among the treatment and control groups. Feed intake of the experimental fish were 10.30 g, 8.95, 8.89, 4.60 and 4.85 g for A, B, C, D and E respectively. There was a significant difference ($p<0.05$) among the treatment groups in feed intake.

Table 3: Proximate composition of the experimental diets

	Treatment diets				
Ingredients (%)	A	B	C	D	E
Dry matter	91.44	92.73	92.95	95.76	91.96
Ash	7.59	9.89	8.36	13.35	13.35
Crude protein	40.88	40.31	39.04	38.45	38.36
Crude fat	9.38	9.26	8.33	6.27	5.75
Crude fibre	6.08	7.24	7.88	8.30	9.27
Nitrogen free extract	35.07	33.30	36.39	33.63	34.27

Table 4: Performance of *Clarias gariepinus* fed rumen digesta based diets

	Treatment Diets				
Parameters	A	B	C	D	E
Mean initial weight (g)	8.30^{a}	8.30^{a}	8.35^{a}	8.45^{a}	8.50^{a}
Mean final weight (g)	40.80	36.60	33.25	15.80	13.75
Mean weight gain (g)	32.75^{a}	28.30^{b}	24.90^{b}	7.35^{c}	5.25^{c}
Total feed intake (g)	10.30^{a}	8.95^{b}	8.89^{b}	4.60^{c}	4.85^{c}
Daily weight gain (g)	0.51	0.45	0.40	1.12	0.08
FCR	0.32^{a}	0.32^{a}	0.36^{b}	0.62^{c}	0.96^{d}
SGR	1.07	1.02	0.95	0.42	0.03
PER (%)	9.22	7.91	7.03	3.99	2.70
Cost/kg feed (Naira)	158.25	156.88	155.50	154.13	132.80

abcd in the same row with different superscripts are significantly different ($p<0.05$). FCR = Feed Conversion Ratio, SGR = Specific Growth Rate, PER = Protein Efficiency Ratio (%)

Table 5: Water quality parameters measured during the feeding trials

	Parameters			
Weeks	Water temp. (°C)	Hydrogen ion conc. (pH)	Dissolve oxygen (mg/l)	Trans. (cm)
1	29.10	6.8	5.6	50.0
3	28.60	5.2	6.0	36.0
5	32.20	7.4	5.2	43.0
7	27.00	8.4	6.5	28.0
9	29.23	6.9	5.8	39.0
Mean	29.20	6.9	5.8	39.2

Temp. = Temperature, Trans. = Transparency

The Feed Conversion Ratio (FCR) of the groups were 0.32, 0.32, 0.36, 0.62 and 0.96 for A, B, C, D and E respectively. There was significant difference ($p<0.05$) among the treatment groups. The groups on Diets A and B recorded significantly ($p>0.05$) better FCR than the other groups (Table 4).

DISCUSSION

The Crude Protein (CP) content of DRD analyzed for this study (18.58%) is higher than the value of 11.52% recorded by Abara Sunday (2007) but in agreement with the value of 18.52% reported by Esonu *et al.* (2006). This may be due to vegetation diversity and selectivity of pasture by different ruminants in different locations.

The decrease in crude protein content of the diets is attributed to the inferior crude protein content of DRD (18.58%) when compared to groundnut cake (45%) as reported by Aduku (1993).

All the experimental diets were accepted by the test fish hence, inclusion of DRD did not affect palatability. This may be due to the influence of partial fermentation which might have reduced the concentration of anti-nutrients usually associated with leaf meals (Francis *et al*., 2001).

Growth performance of test fish showed weight gains of 32.75 g, 28.30 g, 24.90 g, 7.35 g and 5.25 g for diets A, B, C, D and E respectively. The poor weight gains obtained from diets D and E coupled with low feed intake as DRD level increase in the diets may be due to inadequate protein utilization that is attributed to high concentration of anti-nutrients such as alkaloids, oxalate, phenols, saponins and mimosine typical of leafmeals (Bressani, 1994; Adeniji *et al*., 2007; Francis *et al*., 2001).

Nevertheless, presence of anti-nutritional inhibitors such as lectins, tannins coupled with the high fibre content of DRD could be an impediment to feed intake as dietary inclusion of DRD increased in the diets which consequently resulted in poor body weight gain in diets D and E. Anti-nutrients such as Saponins has also been reported to reduce pancreatic lipase activity, thus, delaying intestinal absorption of dietary fat (Putsztai, 1989; Adewolu and Adamson, 2011).

However, the inability of *Clarias gariepinus* to effectively utilize high dietary level of DRD beyond 20% could perhaps be as a result of low concentration of enzyme cellulase which often is absent in most Piscivores such as *Malapterurus electricus*, *Gymnarchus niloticus, Parachanna obscura* unlike Tilapia species (Fagbenro *et al*., 2005).

The utilization of 20% DRD based diets (B) by *Clarias gariepinus* is in agreement with finding of Aminsah *et al.* (2009); Olukunle and Agboola (2005) but not in agreement with 40% dietary inclusion reported for African catfish fed water hyacinth (Konyene *et al*., 2006).

Conclusion: The utilization of DRD in diets of *Clarias gariepinus* at 20% dietary level will not only reduce cost of production but will also alleviate problem of environmental pollution and disposal.

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