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Performance Characteristics of Grower Rabbits Fed Enzyme Supplemented Dried Bovine Rumen Digesta as Replacement for Maize

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Abstract

The aim of the experiment was to evaluate the effect of feeding Dried Bovine Rumen Digesta (DBRD) as replacement for maize on the general performance of grower rabbits. Thirty six (36) grower rabbits between 10-12 weeks old were randomly assigned on weight equalization to the treatments during 8-weeks trial. Six (6) diets were formulated using Dried Bovine Rumen Digesta to partially replace maize at 0, 12.5 and 25% with and without enzyme supplementation respectively. There were significant ($p < 0.05$) dietary effect on average daily weight gain which ranges between 6.0g, 4.1g and 3.6g, daily feed intake (52.4g, 52.13g and 50.91g), feed conversion ratio and the feed cost. It can be concluded that Dried Bovine Rumen Digesta at 12.5% inclusion as partial replacement for maize supported comparable performance and reduce feed cost.

1. Introduction

The global food crisis situation is no more news. The shortage in food production with increase in population growth brings about the current food crisis. In animal agriculture, feed accounts for a major proportion of the entire cost of production. Livestock Production is the most significant among all classes of agricultural production that serves as means of livelihood for human production that serves as means of protein provision [1]. In Nigeria, feed and feeding continues to hinder livestock production development thereby leading to high cost of producing the much needed animal protein.

Animal protein, as important as it is to human feed is however not produced sufficiently to meet the dietary requirements of the teeming population of Nigeria. Solutions to this problem depend on the production of fast maturing animals with the use of cheap and locally available feedstuffs [2]. One of such animals is the rabbits. Nutritionally, rabbit meat has a higher protein (20-21%), low calories (1749kcal/kg) and low fat content (10-11%) when compared with meat from most livestock species. Rabbits meat has a low cholesterol value of 169mg/100g (dry matter basis) when compared with beef (200mg), chicken (220mg) and pork (223mg) and low sodium content [3]. In spite of these attributes, rabbit meat production still remain at a low level due to high cost of conventional feed and competition between man and livestock for the available feed ingredients.

Efforts to reduce the high cost of feeds and therefore the cost of poultry and other

monogastric products have concentrated on the use of cheaper and locally available alternative agro-by products especially those that have no nutritional value to mankind [4, 5, 6, 7]. Furthermore, the need to maximize the economic and environmental benefits in disposal of slaughterhouse by-products [8, 9] also stimulated a renewed interest in the investigation of slaughterhouse by-products for possible use as feedstuffs in livestock feeds. Incorporation of such products in poultry feed would help in alleviating the problem of the scarcity of feed supply that is having a negative effect on livestock industry most especially monogastric animal production. Its usage will also reduce pollution problems.

Dried Bovine Rumen Digesta (DBRD) is an abattoir by product that offers a tremendous potential as a cheap and locally available alternative feedstuffs for livestock. Rumen content is a waste with disposal problems only that it is high in crude fibre, hence the need for enzyme supplementation for degradation of the high fibre level of rumen content. It has been used in Nigeria to feed poultry [10, 11, 12, 13], rabbits [14, 15] and ruminants [16] as a cheap unconventional feedstuff to reduce feeding costs and alleviate pollution problems without any reported deleterious clinical effect on animal health and performance.

Rabbit feeding in Nigeria remains traditional and rudimentary. Diets of rabbits in Nigeria are primarily forages, grasses and legumes supplemented with kitchen waste and agricultural byproducts. Forages such as *Panicum maximum* (guinea grass), *Pennisetumpurpureum* (Elephant grass), *Tridaxprocumbens* [17]. Despite the many advantages of keeping rabbits for meat supply, rabbit keeping remains unattractive to the people and rabbit meat consumption remains very low.

The high cost of conventional feed ingredients has created more challenges in livestock management especially feed and feeding, hence the need to source for alternative (unconventional) feedstuff such as DBRD. Rumen content (RC) is obtained from the abattoir after slaughtering of animal. They are discarded as waste and cannot be consumed by human. DBRD is the product obtained after processing the wet rumen content. It is cheap and readily available and could serve as partial replacement for maize in the diet of grower rabbits.

2. Materials and Methods

2.1. Experimental Site

The study was carried out at the University of Abuja Teaching and Research Farm, Animal Science section, along airport road, Federal Capital Territory Abuja, Nigeria. The project site lies between latitude 8°55'N and 9°N and longitude 7°00'E and 7°50'E. Annual rainfall ranges from 1,145-1,631mm. The temperature in the dry season is between 30.4-35.1°C and 25.8°-30.2°C during the dry

season.

2.2. Source and Processing of Test Ingredient (DBRD)

Fresh Bovine Rumen Content was collected from abattoir within Gwagwalada area council. The fresh Bovine Rumen content was boiled for about 10-12 hours, sun dried for about 48 hours (i.e. 2 days) to reduce microbial population as well as reduce the moisture content until a certain percentage of moisture level is attained. It was then milled to obtain a product known as Dried Bovine Rumen Digesta that was included in the diet at specified percentages (%).

2.3. Experimental Animals and Their Management

Thirty six (36) grower rabbits (New Zealand white and Chinchilla) breeds of both sexes purchase from National Animal Production Research Institution (NAPRI) Zaria, Kaduna state were used for the study that lasted for 8 weeks. The rabbits on arrival were given anti-stress for the period of 4-5 days. They were housed in disinfected metal cages with wire mesh at the base for easy collection of faeces and urine. The composition of the experimental diets is presented in Table 1. The rabbits were randomly allocated to six (6) dietary treatments and each treatment replicated three (3) times with two (2) rabbits per replicate. The cages were cleaned on daily basis throughout the period of the experiment. Feeders and drinkers were made available as they were housed and fed differently. The feeders and drinkers were also washed daily before new feed and fresh water were served.

2.4. Parameter Measured

Growth performance

Data were collected on the initial and final weight of the rabbits, quantity of feed given and refusal after 24hours, during the experiment.

The values obtained were used to calculate;

Weight gain/rabbit/day (g)=(Final live weight – initial weight)/Number of rabbits X no of days

Feed intake per rabbit/day (g)=(Quantity of feed given – left over)/Number of rabbits X no of days

Feed conversion ratio=Quantity of feed consumed/Weight gain

2.5. Cost Benefit

The market cost of feedstuff during the study was used to calculate the total cost of feed, cost of feed per kg (₦), cost of per kg live weight (₦), and the economy of feed conversion (₦).

2.6. Statistical Analysis

The data obtained were subjected to analysis of variance

using Completely Randomized Design (CRD). The significant difference between the dietary treatments were determined at 5% confidence level while Duncan's Multiple Range Test [18] were used to separate significant differences among the means

2.7. Chemical Analysis

The milled sample of Dried Bovine Rumen Digesta and experimental diets were analyzed for proximate constituents while the energy values of the feed, faeces, urine and DBRD were determine using bomb calorimeter [19].

Table 1. Composition of experimental diets (%).

Dried bovine rumen digesta inclusion levels						
	D	I	E	T	S	
	0%		12.5%		25.0%	
Ingredients	1	2	3	4	5	6
Maize	48	48	42	42	36	36
DBRD	0	0	6	6	12	12
Enzyme	-	+	-	+	-	+
Wheat offal	25	25	25	25	25	25
GNC	21	21	21	21	21	21
Limestone	2	2	2	2	2	2
Bone meal	2.8	2.8	2.8	2.8	2.8	2.8
Vit. Premix (Grower)	0.35	0.35	0.35	0.35	0.35	0.35
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.3	0.3	0.3	0.3	0.3	0.3
Methionine	0.3	0.3	0.3	0.3	0.3	0.3
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated						
Crude protein (%)	18.10	18.10	18.70	18.70	18.70	18.70
Crude fibre (%)	5.07	5.07	5.59	5.59	6.12	6.12
M. energy (MJ/kg)	2676	2676	2614	2614	2551	2551
E.E. (%)	3.76	3.76	4.00	4.00	4.24	4.24
Ca (%)	1.53	1.53	1.55	1.55	1.56	1.56
P (%)	0.54	0.54	0.55	0.55	0.55	0.55

Experimental diets

T1 control (0% DBRD without enzyme)

T2 control (0% DBRD with enzyme)

T3 - 12.5% DBRD without enzyme

T4 - 12.5% DBRD with enzyme

T5 - 25% DBRD without enzyme

T6 - 25% DBRD with enzyme

3. Results and Discussion

3.1. Growth Performance

Table 2 showed the growth performance characteristics of rabbit fed varying levels of Dried Bovine Rumen Digesta and enzyme supplementation in replacing maize. The initial weight of rabbits were significantly different ($p < 0.05$) from one another across the experimental diets. Their weight ranges from 800 to 860. The experimental ingredient replaces maize at 0, 12.5 and 25% respectively. There was significant difference ($p < 0.05$) in daily weight gain of the animals on 12.5 and 25 replacement levels which had lower weight than those on the control diet. They are 6.0g, 4.1g, 3.6g at 0, 12.5, and 25% inclusion level of DBRD respectively. This indicates that daily weight gain decrease as ($p < 0.05$) as the level of Dried Bovine Rumen Digesta increased from 0 to 25%.

The addition of enzyme to test ingredient showed significant differences ($p < 0.05$) in daily weight of the animals. Rabbits fed enzyme supplemented ration had higher

daily weight gain (5.96g) than rabbits fed ration without enzyme supplementation (4.83g). In the same vein, there were significant differences ($p < 0.05$) in the total weight gain obtained. The values recorded were 380,230 and 200g at 0, 12.5 and 25% inclusion of Dried Bovine Rumen Digesta respectively. The interaction between dietary treatment containing enzyme and without enzyme showed significance differences ($p < 0.05$) in total weight gain of the animals with rabbits fed diets containing enzyme having higher weight gain (330g) than rabbits fed no enzyme ration (270g).

The inclusion of the experimental ingredients had significant effects ($p < 0.05$) on daily feed intake of the rabbits. The values recorded were 52.40, 52.13 and 50.91 at 0, 12.5 and 25% inclusion of Dried Bovine Rumen Digesta respectively. The rabbits fed enzyme supplemented ration consume less (51g) of the feed compared to rabbits fed no supplement (51.82g). The interaction between the levels of Dried Bovine Rumen Digesta and supplementation had significant effects ($p < 0.05$) on the feed values of feed intake obtained.

Table 2. Performance characteristics of Rabbit fed Dried Bovine Rumen Digesta base diets with or without enzyme supplementation to replace maize.

Level of RD	Initial Weight (g)	Final weight (g)	Daily feedintake (g)	Total weight gain (g)	Daily weight gain (g)	Feed Gain Ratio
0%	860 ^a	1240 ^a	52.40 ^a	380 ^a	6.0 ^a	7.73 ^c
12.5%	800 ^b	1030 ^b	52.13 ^b	230 ^b	4.1 ^b	12.71 ^b
25%	800 ^b	1000 ^c	50.91 ^c	200 ^c	3.6 ^c	14.3 ^a
SEM	10	37.7	0.23	27.84	0.37	1.05
Significance	*	*	*	*	*	*
Supplement						
NSA	820 ^b	1090 ^b	51.82 ^a	270 ^b	4.83 ^b	11.61 ^a
Enzyme						
(Maxigrain)	840 ^a	1173 ^a	51.0 ^b	330 ^a	5.96 ^a	8.71 ^b
SEM	4.47	18.56	0.18	14.09	0.25	0.65
Significance	*	*	*	*	*	*
DBRD&Enzyme interaction	*	*	*	*	*	*

Means with different superscripts along the same column are significantly different $P < 0.05$

NS - not significantly different ($P > 0.05$)

*- significant

SEM - standard Error of mean

The varying level of Dried Bovine Rumen Digesta had significant effects ($p < 0.05$) on the efficiency of feed utilization. Values recorded were 7.73, 12.71 and 14.3 at 0, 12.5 and 25% inclusion level of Dried Bovine Rumen Digesta respectively. This indicates that feed to gain ratio increase ($p < 0.05$) as level of Dried Bovine Rumen Digesta increased from 0 to 25%. The rabbit fed ration containing enzyme supplement had better feed to gain ratio (8.71g) compared to rabbit fed no enzyme supplement (11.61g). The efficiency of the feed utilization was significantly affected ($p < 0.05$) by the interaction between the levels of Dried Bovine Rumen Digesta and enzyme supplementation.

The decrease in feed intake observed in this study could be attributed to the differences in aroma and palatability of the digesta included in the diet. Some researchers had reported a similar observation on the unpleasant smell of cattle rumen digesta [20] and [12]. The higher weight gain and better feed conversion ratio observed in animals that were fed control diets without Dried Bovine Rumen Digesta could be due to non addition of Dried Bovine Rumen Digesta. This results disagrees with those of [21] and [22] that rabbit fed rumen

digesta had higher weight gain and feed conversion ratio because rumen digesta from sheep and goat have high nutritive value than those obtained from cattle.

3.2. Financial Implication

Table 3 showed the result of the financial implication of rabbits fed Dried Bovine Rumen Digesta and enzyme supplementation to replace maize. The cost of producing 1kg of feed significantly decreased ($p < 0.05$) with increased level of Dried Bovine Rumen Digesta from 0 to 25%. Values recorded were ₦100.52, ₦98.72 and 96.92 at 0, 12.5 and 25% inclusion of Dried Bovine Rumen Digesta respectively. In terms of supplement, there was significant difference ($p < 0.05$) in the cost of feed per kg, values recorded were ₦98.72 and ₦99.12 for rabbit fed no supplement diet and rabbits fed enzyme diet respectively.

The cost of feeding decreased ($p < 0.05$) with increased level of Dried Bovine Rumen Digesta from 0 to 25% the values recorded were ₦422.18, ₦414.62 and ₦ 407.06 at 0, 12.5 and 25% Dried Bovine Rumen Digesta inclusion respectively.

Table 3. Financial Implication of Rabbit Fed Dried Bovine Rumen Digesta Base Diet With or Without Enzyme Supplementation as Replacement for Maize.

Level of DBRD (%)	Total Cost of feed Produced (₦)	Cost per kg of feed (₦)	Total cost of Rearing (₦)	Feeding cost (₦)	Selling Price ₦	Profit (₦)	Cost / weight gain ₦
0	2533.10 ^a	100.52 ^a	997.18 ^a	422.18 ^a	1240 ^a	242.82 ^c	0.80 ^c
12.5	2487.74 ^b	98.72 ^b	989.62 ^b	414.62 ^b	1030 ^a	40.38 ^b	0.96 ^b
25	2442.38 ^c	96.92 ^c	982.06 ^c	407.06 ^c	1000 ^a	17.94 ^a	0.98 ^a
SEM	13.09	0.52	2.18	2.18	37.75	35.76	0.03
Significance	*	*	*	*	*	*	*
Supplement							
NSA	2487.74 ^b	98.92 ^a	989.62 ^b	414.62 ^b	1090 ^b	100.38 ^b	0.91 ^a
Enzyme							
(Maxigrain)	2497.74 ^a	99.12 ^b	991.29 ^a	416.29 ^a	1173 ^a	181.71 ^a	0.86 ^b
SEM	2.24	0.89	0.37	0.37	18.56	18.19	0.12
Significance	*	*	*	*	*	*	*
DBRD & Enzyme interaction	*	*	*	*	*	*	*

Means with different superscripts along the same column are significantly different ($p < 0.05$)

NS - not significantly different ($p > 0.05$)

*- significant

SEM - standard error of mean

Price: 1000/kg

The cost per weight gain increased ($p < 0.05$) with increased level of Dried Bovine Rumen Digesta from 0 to 25% inclusion. Values recorded were ₦0.80, ₦0.96 and ₦0.98 at 0, 12.5 and 25% inclusion level of Dried Bovine Rumen Digesta respectively. There were significant effects ($p < 0.05$) of supplementation on the cost per weight gain. The best cost per weight gain was recorded at rabbits fed enzyme supplement (₦0.86) compared with rabbit fed with no supplement (₦0.91).

The selling price was ₦1000 per kg of weight. Hence, there was significant difference ($p < 0.05$) in the selling price across all experimental diets. There was significant effect ($p < 0.05$) of treatments on the profit made in this experiment. The profit decreased as the Dried Bovine Rumen Digesta level increased from 0 to 25%. Values recorded were ₦242.82, ₦40.38 and ₦17.94 at 0, 12.5 and 25% inclusion of Dried Bovine Rumen Digesta respectively.

4. Conclusion

The result obtained in this study, on the performance of Grower rabbits fed Dried Bovine Rumen Digesta as the test ingredient, it can be concluded that, Dried Bovine Rumen Digesta was better utilized with the addition of enzyme because rabbits fed with diets containing DBRD with enzyme performed better in all the parameters monitored. On the other hand, 12.5% inclusion of the test ingredient as partial replacement for maize supported comparable performance and reduce feed cost, while the use of DBRD up to 25% had adverse effect on the weight gain of rabbits as values obtained from analysis decrease at this level of inclusion.

Recommendations

The following recommendations are made for further study to enhance the utilization of Dried Bovine Rumen Digesta in rabbit's diets. The inclusion level of DBRD at 12.5 decrease cost of production and increase in profit but at 25% of DBRD inclusion, the cost of production decreases with little profit margin therefore inclusion of DBRD at 12% level is recommended to the livestock producers for use, because farmers are interested in profit margin. Further research is required to examine the level at which the use of Dried Bovine Rumen Digesta will give high weight comparable or even higher than weight gain recorded for control diets.

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