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Utilization of rumen filtrate fermented corn-cobs by weaner rabbits

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Abstract

A feeding trial was conducted to evaluate the feeding value of rumen-filtrate fermented corn cob (RFFCC) for weaner rabbits. Twenty-five rabbits were divided groups. Each group was further divided into five replicates, housed in individual rabbit hutches. RFFCC was incorporated in the diets at 0, 25, 50, 75 and 100% replacement for yellow maize. Feed intake increase progressively (P<0.05) with increased dietary level of EFFCC. Feed intake and average daily weight gain exhibited an inverse relationship. Feed: Gain ratio value increased with increasing dietary level of RFFCC, an indication of progressive decline in the efficiency of feed utilization. Feed: Gain ratio was however not affected up till 25% RFFCC inclusion level (i.e 50% replacement of dietary maize). The result of the experiment showed that RFFCC posses some potential as a feed resource for the rabbit. It was concluded that RFFCC should not constitute more than 25% of total diet as this will result in impairment of performance.

Keywords: Utilization, Corn-cob, Rumen filtrate, fermentation, performance, weaner rabbits

Introduction

The solution to the current animal protein shortage in the developing economic of the world lies with adequate utilization of short gestation livestock, especially monogastrics (Adeyemi, 2005). Rabbits is one of such animals that has elicited much interest by virtue of occupying a unique niche in that it is easy to manage, highly prolific and has a short gestation interval. Taiwo and Oyedele (2002) observed that amongst domesticated animals, rabbits are the most efficient converters of feed to flesh.

The cost of feeding rabbits is however very high, a condition that also prevailed for other Nigerian livestock species. Agunbiade *et al.* (2001) explained that the most important and expensive feed items are the energy concentrates usually grains. Ikurior and Akem (1998) observed that in many of the less developed tropical regions shortages in cereal grain supplies have persisted into the terminal years of the 20th century. The resulting unprecedented increase in the cost of grains necessitated intensive investigations into the use of agricultural and agro-based industrial by- products. One of such by-product is corn-cob.

Post-harvest processing of corn (maize) result in the generation of its cob, which accounts for about 30-40% of the weight of the dehusked maize. Alokan (1998) reported that corn-cob is perhaps the most prominent cereal crop by-product in Nigeria. Several million tons of corn-cobs that had no immediate use to humans accumulate on farm processing units

contributing to land and air pollution as sizeable percentage are burnt to provide space for other useful purposes and ashes used as fertilizer in crop farming (Oladeinde, 2002). Although corn-cob has been employed in ruminant feeding as feed fillers (Umunna *et al.*, 1980; Alokan, 1998), its usefulness as component of commercial monogastic animal feed is not popular because of its high fibre, lignin and lignocellullose which will impair digestion and utilization.

Diar (1992) showed that fermentation technique is one important way of using feed that is under normal circumstances denigrated. Adeyemi and Familade (2003) reported that fermentation of corn-cob for 20 days using rumen filtrate resulted in an improvement in the crude protein and reduction in the crude fibre fraction. Feeding for fermented corn-cob products to laying hen however resulted in reduced performance compared to the maize based control diet. It was concluded that the result obtained may be related to the relatively high level crude fibre in the corn-cob based diet or that there may be need for amino supplementation. This poses the question of what will be the result if the material were fed to animal that can handle relatively higher fibre that poultry.

The objective of this study was therefore to investigate the effect of feeding rumen filtrate fermented corn-cob at different levels on the performance of weaner rabbits.

Materials and Methods

Test ingredient preparation

The procedure for collection and fermentation of corn-cob has been previously described (Adeyemi and Familade, 2003). Briefly, Aliquots of rumen content of freshly slaughtered and eviscerated cattle were collected from the Lafenwa Central abattor, Abeokuta Ogun State. The mass of rumen content squeezed and the liquid portion filtered through milled a sieve. The rumen filtrate was fine sprayed on to dried corn-cob that has been previously milled to pass through a 3.5mm mesh. The mixture was stirred and packed in double layered polythene bags. The bags were made airtight and allowed to stand for a 20-day fermentation period. The fermented material was sundried for 4 days on concrete platform. The dried product was re-milled to break lumps before use.

Experimental animals, diets and management

Twenty-five, six week old weaner rabbits of mixed breeds and sexes with initial weights of 520-545g were divided into five groups of five rabbits each after balancing for weights and sexes. Each of the rabbits in each group was individual caged in compartments measuring 55x25x45cm.

Five experimental diets (Table 1) were formulated in which rumen-filtrate fermented corn-cob replaced maize on a quantitative basis at 0,25,50,75 and 100%. The rabbits were randomly allocated to the five experimental diets such that there were five rabbits on each diet. Diets were provided in a moistened form in earthenware pots and offered twice a day at a level that ensured *ad libitum* feed intake without wastage. Water was also provided free choice. The feeding trial lasted for 56 days during which record of daily feed intake and weight gain were kept.

Chemical and statistical analyses

Proximate analysis of test ingredient and experimental diets were carried out using the method of A.O.A.C. (1995). Gross energy was detemined by use of a Gallenhkamp® bomb calorimeter. The fibre fractions (acid detergent fibre (ADF), neutral detergent fibre (NDF) and acid detergent lignin (ADL) were detergent using Goering and van Soest (1990) method. All data were subjected to analysis of variance employing a completely randomized design as described by

Table 1: Composition of rabbit diets containing rumen filtrate fermented corn cobs

	Replacement of maize with corn-cob (%)				
Ingredient	0.00	25.00	50.00	75.00	100.00
Maize	50.00	37.50	25.00	12.50	0.00
R-F Fermented corn-cob	0.00	12.50	25.00	37.50	50.00
Wheat offal	23.70	23.70	23.70	23.70	23.70
Soybean meal	18.00	18.00	18.00	18.00	18.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Palm oil	1.50	1.50	1.50	1.50	1.50
Oyster shell	2.00	2.00	2.00	2.00	2.00
Bone meal	1.00	1.00	1.00	1.00	1.00
DL-Methionine	0.30	0.30	0.30	0.30	0.30
Vit/mineral 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
Determined Analysis					
Dry matter	92.13	90.15	90.13	92.80	90.20
Crude protein	18.06	18.10	18.20	18.32	18.43
Crude fibre	10.25	13.35	16.53	19.44	22.48
Ether extract	5.56	5.28	5.22	5.16	5.02
Ash	5.00	5.20	5.38	5.56	5.75

Steel and Torrie (1980) using Minitab Analytical computer package (Minitab Inc. 1999). Significant means were separated using Duncan's multiple range test (Duncan 1995).

Results and Discussion

Table 2 shows that proximate constituents, detergent fibre components and gross energy of the test ingredient.

The proximate composition obtained for maize grains are in the close agreement with reported values (NRC, 1994, Aduku, 1995). Corn-cob with a crude a fibre content of 41.50%, crude protein value of 31.15% and ether extract value of 1.32% was certainly nutritionally inferior to maize grain. Fermentation of the corn-cob with rumen filtrate for 20 days resulted in a 36.02% decrease in crude fibre, 11.99% decrease in gross energy and a 219.37% increase in crude protein. With regard to these values, it can be argued that the fermented product has a better potential as a feed ingredient compared to the unfermented material. If corn-cob and RFFCC were to be used as separate ingredients in direct replacement of maize in an iso-nitrogenous diet, it will be more economical to use RFFCC than corn cob because of the wide protein margin of maize (9.42%) and corn-cob (3.15%). The wide differential will increase the use of substantial amount of a protein concentrate, which will invariably result in a higher feed cost.

Dietary treatment significantly ($P<0.05$) affected performance indices (Table 3). Feed intake was significantly increased as the inclusion of RFFCC increase above 50% replacement of maize with corn-cob. This increase was expected because of the drop in dietary energy concentration and increment in crude fibre content of the diet at higher inclusion rate of RFFCC. Livestock are known to eat to satisfy their energy requirement (McDonald *et al.*, 1998). Esonu (1997) reported a similar finding when a mixture of rice milling by products was substituted for maize in the diet of weaner rabbits. This finding is also in agreement with the finding of Doma *et al.*, (1999) who reported an increase in dry matter intake (DMI) with increasing dietary fibre level. Corn-cob being a fibrous feedstuff could account for the increase rate of passage of digestion and could in turn result in increased feed intake.

The final body weights recorded were significantly influenced by dietary treatments. The final body weight gains of rabbits on 12.5 and 25.0% RFFCC were not significantly different from the final body weight gain of rabbits on the control diet. Final weights were significantly depressed ($P<0.05$) to the magnitude of 18.64 and 26.13% respectively for diets containing 75 and 100% replacement of RFFCC for maize when the 100% maize based diet was taken as the base line. This corresponded to body weight gains of 766.48,757.44, 730.60, 524.80 and 427.76g respectively for diets. 1,2,3,4 and 5 over a 56 day period. The trend showed a linear decline with increasing dietary inclusion of RFFCC. The daily weight gains followed the same trend as the final live weight and were inversely related to the feed intake. The average daily weight gains of 13.69, 13.53, 13.04, 9.37 and 7.64 gm for diets 1,2,3,4, and 5 respectively were lower than the range of 15 – 20g reported for growing rabbits in the tropics by Aduku and Olukosi (1990).

Increasing the level of inclusion of RFFCC significantly ($P<0.05$) increase Feed: Gain ratio of rabbits. Feed: Gain ratio was not affected up till 25% inclusion level of RFFCC (i.e 50.0% replacement of dietary maize). The direct replacement of graded levels of RFFCC for maize on weight for weight basis resulted in a situation in which the crude fibre and ash content of the

Table 2. Proximate and detergent fibre components and gross energy (MJ/Kg. DM) of test ingredients

	Corn-cob	Rumen filtrate fermented corn-cob
Dry matter (%)	90.20	88.10
Crude fibre (%)	41.50	26.55
Crude protein (%)	3.15	10.06
Ether extract (%)	1.32	1.00
Ash (%)	2.54	3.21
Neutral detergent fibre	975.00	922.00
Acid detergent fibre	433.50	310.70
Acid detergent lignin	302.00	122.50
Gross Energy	17.10	15.05

Table 3 Performance characteristics of rabbit fed varying levels of rumen filtrate fermented corn cobs

	Replacement of maize with corn-cob (%)					
Parameters	0.00	25.00	50.00	75.00	100.00	SEM
Initial live weight (g)	530.00	530.00	530.00	530.00	530.00	-
Final live weight (g)	1296.48a	1287.44a	1260.60a	1054.80b	957.76c	23.05c
Daily feed intake (g)	71.50c	72.26c	77.60b	78.20b	84.10a	1.09
Daily weight gain (g)	13.69a	13.53a	13.04a	9.37b	7.64c	0.92
Feed: gain ratio	5.22c	5.34c	5.95c	8.35b	11.00a	0.33
Mortality (%)	0.00	0.00	0.00	0.00	0.00	-

SEM – Standard error of means
Abc Means on the same row having different superscripts are significantly different

diets increased as the amount RFFCC in the diet increased. The high fibre and ash content is perhaps the reason for the poor feed efficiency at higher RFFCC inclusion. Adegbola and Osuji (1985) implicated high crude fibre content as being responsible for poor rabbit performance. According to Cheeke *et al.*, (1986), the coprophagous behaviour of rabbits is particularly relevant for the gigestion of proteins of forages and less important in fibre utilization, as would be expected because of selective retention of non-fibre compounds in the caecum. Although in this trial nutrient retention was not evaluated, Slade and Hinz (1969) pointed out that the limitation of rabbits in digesting dietary fibre affects nutrient availability and subsequent utilization. Onwudike and Omole (1994) also made similar observation.

Conclusion

From this study, it has been shown that corncob fermented with rumen filtrate posses some potential as a feed resource for the rabbit. Rumen filtrate fermented corn-cob can replace 50% of dietary maize and can be included in practical rabbit diets at up to 25%. Results appear to indicate that inclusion of RFFCC above 25% level in the diet will impair performance of rabbits.

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