

EFFECT OF REPLACING MAIZE WITH A MIXTURE OF RUMEN CONTENT AND BLOOD MEAL ON THE PERFORMANCES OF GROWING RABBITS: INITIAL STUDY WITH MASH FEED

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ABSTRACT: A total of 24 cross-bred male weaner rabbits, between 6-8 weeks of age, were fed diets which included a mixture (50:50) of rumen content (RC) and blood meal (BM), containing a crude protein content of 37.6% and crude fibre content of 9.0%, at 0 (control), 10 and 20% levels. The mixture replaced maize and maize bran in the control diet. The 3 experimental diets were restricted to 100 g daily in mash form for a period of 8 weeks to the individually housed rabbits. The inclusion of RC+BM mixture in diet 1 at 10% (RB10) significantly ($P<0.05$) worsened final live weight, daily feed intake, daily weight gain and feed: gain ratio, while its inclusion at 20% (RB20) only reduced daily feed intake. Weight gain in controls, RB 10 and RB 20 was 483, 273 and 422 g, respectively. Kidney, spleen and lungs, but not the liver, were observed to be significantly ($P<0.05$) affected by the dietary treatment. Carcass yield followed a similar response pattern as final live weight, since it was a product of the final live weight. However, left thigh muscle components were not affected by the dietary treatments. This preliminary study indicated that more research is necessary to reduce the negative effect on feed intake when RC-BM mixture (50:50 ratio) is included in growing rabbit diets, which was probably due to the presentation form applied.

Key Words: rumen content, blood meal, performance, growing rabbits.

INTRODUCTION

Many laudable programs and policies in most developing countries in general and in Nigeria in particular have aimed at alleviating the problem of insufficiency in animal production with the ultimate aim of increasing animal protein supply. However, the various programs such as ensuring availability of replacement stock, subsidizing prices of drugs and other regulatory policies have been frustrated by inadequate supply of basic feed ingredients, particularly protein and energy sources, due to stiff competition between man and livestock on one hand and the prohibitive prices of these conventional feed ingredients on the other. This has led to high costs of feeds, especially for monogastrics (poultry, pigs and rabbits) with the consequent high price of animal products. Rabbits (*Oryctolagus cuniculus*) are considered a fast growing and highly prolific species with a short generation interval (Cheeke, 1986), and represent a high potential for improving animal protein intake in the developing countries generally and Nigeria in particular.

Diversification into large scale production of rabbits for supply of animal protein and at the same time utilizing unconventional feed resources can therefore result in the provision of good quality meat with a high percentage of protein content at more affordable prices.

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Animal nutritionists and other specialists have mainly been interested in finding cheap alternative ingredients that can replace the usually expensive and scarce cereal and legume grains consumed directly by humans. Such non-conventional ingredients, should be readily available and inexpensive to procure and process (Okonkwo *et al.*, 1995; Pascual *et al.*, 2007; Lakabi-Ioualitene *et al.*, 2008). Rumen content and blood meal are examples of unconventional feed ingredients that have potential for inclusion in rabbit diet after appropriate processing in order to reduce production costs and keep environmental pollution to the minimum.

Rumen content is one of the abattoir by-products that are known to be environmentally unfriendly if not properly handled (Dairo *et al.*, 2005). In Nigeria, it has been estimated by Adeniji (1996) that rumen content of bovine origin is about 9 634 metric tonnes per annum. Mann (1984) and Dairo and Aina (2000) have reported on the composition and potential of rumen content and blood-rumen content mixtures as a good source of protein in diets of monogastric animals. To author's knowledge, only Whyte and Wadak (2002) included rumen content in growing rabbit diet and reported that there was no adverse effect on performance.

The objective of this study was to evaluate the effect of a mixture of cattle rumen content and blood (mixture 50:50) on the growth performance and carcass characteristics of growing rabbits.

MATERIALS AND METHODS

Site

The experiment was conducted at the Rabbitry Unit of the Teaching and Research Farm, Ladoko Akintola University of Technology, Ogbomoso, located within the derived Savannah zone of Nigeria. The study area has a mean annual temperature of 26.2°C and relative humidity of between 75 and 95%.

Preparation of test ingredients

Fresh cattle rumen content (RC) collected from the central abattoirs located in the Ogbomoso North Local Government area was thinly spread on a flat surface and air-dried to preserve the nutrient as much as possible. After drying to about 10% moisture content, it was packed and stored in air-tight containers until needed.

The blood meal (BM) and other ingredients used in formulating the diets were bought from a feed mill located within Ogbomoso.

Formulation of experimental diets

Three experimental diets were formulated as shown in Table 1. Diet 1 was the control without rumen content/blood meal mixture. Diets 2 (RB 10) had 10% rumen content/blood meal mixture (50:50) while diet 3 (RB 20) had 20% rumen content/blood meal (50:50) mixture. The experimental diets were fed in mash form. The test ingredients replaced the maize and maize bran in the control diet.

Experimental animals and management

Twenty-four (24) cross-bred male rabbits weaned at 5 weeks of age, with an initial weight range of between 784 and 803 g, were randomly divided into three treatment groups of 8 rabbits each in a completely randomized-design study. The rabbits were intensively managed and housed individually in metabolic cages measuring 42.5×30×31cm and provided with drinking and feeding facilities made of earthenware pots re-enforced with cement to prevent tipping over. A total of 100 g of feed was supplied to each rabbit per day at the rate of 50 g in the morning and 50 g in the evening to reduce wastage. Orts were collected and weighed the following morning in order to determine feed intake. Water was provided *ad libitum*.

Table 1: Percentage composition of experimental diets.

Ingredients	Control	RB 10	RB20
Maize	10.00	5.00	2.50
Maize bran	35.00	30.00	18.50
Groundnut cake	18.00	18.00	18.00
Palm Kernel cake	23.00	23.00	23.00
Fish meal	1.50	1.50	1.50
RC/BM ¹ (50:50)	-	10.00	20.00
Bone meal	3.00	3.00	3.00
Premix ²	2.00	2.00	2.00
Sunflower oil	4.00	4.00	4.00
Salt	0.50	0.50	0.50
Molasses	3.00	3.00	3.00

¹RC: Rumen content, BM: Blood meal

²Premix composition/Kg: vit. A: 4 000,000 IU, vit. D3: 800,000 IU, vit. E: 8,000 mg, vit. B1: 1,200 mg, vit B2 : 2,000 mg, niacin: 18.00 mg, calcium pantothenate: 4,000 mg, vit. B6:1600 mg, folic acid: 400 mg, biotin: 20 mg, choline chloride: 120,000 mg, manganese: 48,000 mg, iron: 40,000 mg, zinc: 32,000 mg, copper: 3,400 mg, iodine: 600 mg, cobalt: 120 mg, selenium: 48 mg, antioxidant: 48 mg.

The animals were weighed at the start of the study and thereafter were weighed weekly to determine weight gain. Records of actual feed intake and weight changes were kept for further analyses. The experiment lasted for 8 weeks.

Carcass evaluation

At the end of the experiment, rabbits were weighed, tagged, starved overnight and taken to the laboratory where they were stunned, bled by cutting the jugular vein and eviscerated. The spleen, kidneys, lungs, heart and liver were carefully removed, freed of all adhering membranes and weighed. The left thigh was cut out, weighed and processed for proximate analysis of the tissue.

$$\text{The dressing percentage} = \frac{\text{carcass weight (g)}}{\text{final live weight (g)}} \times 100$$

Proximate analysis

Representative samples of RC, BM, mixture of RC/BM and of the three experimental diets were analyzed for their chemical constituents using the method of the Association of Official Analytical Chemists (AOAC, 1990).

Statistical Analysis

All data collected were subjected to one-way analysis of variance according to Gomez and Gomez (1983) and means were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of the test ingredients and experimental diets are presented in Table 2. The proximate composition of RC shows that the values of CP and CF were lower than those reported by Dairo *et al.* (2005), while the values for EE, Ash and NFE were higher. Variation in the proximate composition

Table 2: Proximate composition of rumen content, blood meal, rumen content/blood meal mixture (50:50) and the experimental diets.

Composition	RC ¹	BM ¹	RC/BM (50:50) ¹	Control	RB10	RB20
Dry matter	91.8	89.9	94.8	59.58	89.49	89.45
Crude protein (%)	11.38	71.75	37.63	19.17	20.92	20.5
Ether extract (%)	6.1	4.00	5.80	5.61	5.89	6.26
Crude fibre (%)	24.00	2.00	9.00	7.92	8.79	9.37
Ash (%)	8.11	5.8	7.50	4.78	4.78	5.23
NFE ² (%)	42.21	6.35	22.17	52.1	49.11	48.09

¹RC: Rumen content, BM: Blood meal, RC/BM: Rumen content-blood meal mixture.

²NFE: Nitrogen free extract.

values may be due to the differences in chemical composition of the types of pastures consumed and species differences.

The crude protein content of the blood meal (71.8%) is less than the values reported by and Aduku (1993) but higher than the 56% reported by Patigiri *et al.* (1978). This difference could be due to different processing methods and the shelf life and/or the preservation method before analysis. The proximate composition values of the diets are higher than values used by Balogun *et al.* (2003) but similar to those of Bawa *et al.* (2005). However, the protein content of the three experimental diets was higher than the values recommended by NRC (1984) and Lebas *et al.* (1986).

The performance of rabbits fed the RC/RM-based diets is presented in Table 3. The diets had significant ($P<0.05$) influence on the final live weight, daily feed intake, daily weight gain and feed:gain ratio. Rabbits on control diet consumed a significantly ($P<0.05$) higher quantity of feed than those on RB10 and RB20 diets. The difference in feed consumption between the control and the experimental diet RB20 may be due to the odour of the rumen content, as well as the bitter taste resulting from the inclusion of blood meal. The feed intake values obtained in this study are higher than the values reported by Onyimonyi and Ene (2003).

Rabbits on the control and RB20 diets had similar final live weight. This is an indication that both the control and RB20 diets provided good growth in these rabbits. The decreased final live weight of the rabbits on diet RB10 is mainly the result of the decreased feed intake with this experimental diet. Although the analyzed nutrient compositions were similar, the availability of the nutrients may be a secondary factor in the decreased weight gain.

However, the final live weights obtained in this study are higher than the values reported by Taiwo *et al.* (2005) but lower than values reported by Dairo *et al.* (2005) and Bawa *et al.* (2005).

Table 3: Performance of rabbits (mean±standard deviation) fed diets containing rumen/blood meal mixture (n=8 per diet).

Diet	Initial Live Weight (g)	Final Live Weight (g)	Daily Feed Intake (g)	Daily Weight Gain (g)	Feed: Gain (g/g)
Control	784±241	1167±117 ^a	68.0±4.0 ^a	9.0±4.0 ^a	7.00±0.2 ^b
RB10	803±260	1076±160 ^b	53.0±6.0 ^b	7.0±5.0 ^b	8.00±0.9 ^a
RB20	797±242	1219±182 ^a	57.0±7.0 ^b	9.0±5.0 ^a	6.01±0.3 ^c

^{a,b}Means with different superscript in the same column are significantly different at $P<0.05$.

Table 4: Effect of a rumen content/blood meal mixture-based diet (mean±standard deviation) on organ weight (expressed as a percentage of body weight) of rabbits (n=8 per diet).

Diet	Liver	Heart	Kidney	Spleen	Lungs
Control	3.02±0.31	0.27±0.03	0.46±0.05 ^b	0.07±0.03 ^a	0.65±0.09 ^a
RB10	2.85±0.61	0.26±0.02	0.61±0.01 ^a	0.04±0.01 ^b	0.49±0.09 ^b
RB 20	2.73±0.49	0.21±0.06	0.57±0.09 ^a	0.05±0.01 ^b	0.62±0.01 ^b

^{a,b}Means with different superscript in the same column are significantly different at $P<0.05$.

The daily weight gain value obtained shows that significant ($P<0.05$) differences existed between the treatments. Rabbits on the control diet had a daily weight gain similar to rabbits on diet RB20, which were significantly ($P<0.05$) higher to those observed for rabbits on diet RB10.

The feed: gain ratio obtained in this study reflects a significant ($P<0.05$) difference between the control diet and diets RB10 and RB20. However rabbits on diet RB20 appeared to have utilized the feed better than those on diets control and RB10, in spite of the lower feed intake. There was no mortality in any of the treatments, hence it cannot be concluded that the poor performance on diet RB10 was health related.

The value of organ weights expressed as a percentage of the live weight is presented in Table 4. Neither liver nor heart weights across the treatment groups were affected by the dietary treatments. This indicates that the test ingredients had no negative effect on the normal functioning of the liver. However, kidney, spleen and lung weights were significantly ($P<0.05$) affected.

The kidney weight for rabbits on the control diet was significantly ($P<0.05$) lower than the values for rabbits on diets RB10 and RB20, which are similar. The kidney was obviously enlarged, and this could probably be related to a kidney overload resulting from the excess of effluents or the possibility of the presence of an anti-nutrient. In addition, kidneys, in conjunction with the liver, are actively involved in the metabolism of carbohydrates and protein in the diets (Bawa *et al.*, 2005). The spleen value, on the other hand, was significantly ($P<0.05$) higher for rabbits on the control diet than diets RB10 and RB20. The higher weight of the spleen in the control diet, though unexpected is thought to be a response to an anti-nutritional factor that may have been present in the feed, since part of the function of the spleen is the formation of anti-bodies and antitoxins (Wilson, 1981) and the sequestration of erythrocytes in the splenic pulp (Thompson, 1974). According to Adewumi *et al.* (2004) this may not be an indication of splenomegaly, since the experimental rabbits were not-pre-disposed to any disease condition.

The lung weights of the rabbits on the control diet was significantly ($P<0.05$) higher than the value recorded for rabbits on diet RB10. Similarly, the lung weights of rabbits on diet RB10 differ significantly ($P<0.05$) from those on diet RB20. This is indicative of a retardation of the development of the lung and suggests the possibility of compensated haemopoiesis. For kidney, spleen and lungs, histological studies

Table 5: Carcass yield, tissue components (mean±standard deviation) of the left thigh of rabbits fed diets containing rumen content/blood meal mixture (n=8 per diet).

Diet	Final Live Weight (g)	Carcass Weight (g)	Dressing Percentage (%)	Left Thigh (%)	Left thigh muscle analysis		
					Muscle (%)	Bone (%)	Muscle: Bone ratio
Control	1167±117 ^a	727±73	62.3±4.6	6.7±0.9	78.3±3.2	16.5±2.7	4.7±0.5
RB10	1076±160 ^b	698±71	64.9±5.5	6.4±1.8	80.5±4.6	16.9±3.0	5.1±0.6
RB20	1219±182 ^a	814±80	66.8±5.9	7.1±1.2	81.4±6.3	15.2±2.4	5.4±1.1

^{a,b}Means with different superscript in the same column are significantly different at $P<0.05$.

are required to determine the incriminating factor responsible for these differences. However, this will be dealt with in further studies.

The carcass yield of the rabbits is presented in Table 5. Despite the differences in the terminal and carcass weights of the rabbits on different diets, there were no significant differences in dressing percentages and left thigh components. However, the dressing percentages obtained in this study were higher than the average of 56.50% for ready-to-cook carcass of different European breeds reported by Lebas *et al.* (1986).

CONCLUSION

With the inclusion of RC+BM, feed intake significantly drops and as a consequence weight gain also suffers. Nevertheless, the rabbits showed good weight gain and there was no mortality. The use of this mixture (RC+BM) can therefore be said to be promising, but of course more trials are necessary. Further research, including pelleting of the diets, is required to overcome the negative effect found on feed intake, which was probably due to the unattractive odour of the RC+BM diets.

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