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EFFECTS OF FEEDING BOVINE RUMEN CONTENT-BLOOD MEAL (50:50) MIXTURES ON PERFORMANCE AND SLAUGHTER CHARACTERISTICS OF GROWING RABBITS

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ABSTRACT

The synergistic effects of combining bovine rumen content-blood meal (50:50) (BRC-BM) mixtures on the performance characteristics and nutrient digestibility of growing rabbits was investigated in a 12 week feeding experiment. The mixture replaced palm kernel cake and groundnut cake of the control at 10 and 20% levels. Thirty (30) cross-bred growing rabbits with average initial weights of 521.3-524.5 ±85.10 g were divided into three treatment groups of ten (10) rabbits each. Each rabbit served as a replicate in a complete randomized design experiment. The three groups were assigned to the three dietary treatments as T1 (control) - 0% Rumen content/ blood meal mixture (50:50), T2 (RB 10)- 10 % Rumen content/ blood meal mixture (50:50) and T3 (RB 20) -20 % Rumen content/ blood meal mixture (50:50)**.** The final weight of rabbits on RB10 (1916g) was higher (P<0.05) compared with the control (1715g) and RB20 (1700.g) treatments. Similarly the average daily weight gain of rabbits on RB10 (16.2) was higher (P<0.05) compared with the control (11.8g) and RB20 (12.4g). The average daily feed intake of rabbits in RB10 and RB 20 (87.29g) and (85.50g) respectively was higher (P<0.05) compared to the control (82.84g). The cost per kg gain was lower (P<0.05) in the RB10 compared with control and RB20 treatments. The digestibility of nutrients was not affected (P>0.05) by the dietary treatment. The dressing percentage, relative heart and spleen weights were not affected (P>0.05) by the dietary treatments; however, liver, lungs and kidney were affected (P<0.05). The relative kidney weights of rabbits on control diet 0.43 was lower (p<0.05) than 0.49 and 0.62 for RB10 and RB20 respectively. In a similar pattern the liver weights increased (p<0.05) as the level of inclusion increases. The relative lung weights of rabbits in RB10 (0.59) and RB20 (0.60) are similar (P>0.05) but higher (p<0.05) than 0.45 of the control. Experiment concluded that bovine rumen content-blood meal mixtures (BRC-BM) can replace 10% of palm kernel cake and groundnut cake in growing rabbit diets without adverse effect on growth performance, reduce the production cost and environmental pollution and the attendant impact on climate.

Key words: growing rabbits, bovine rumen-blood content, organ weights, final weights, digestibility.

INTRODUCTION

In developing countries, annual per capital consumption of meat doubled from 14kg to 28kg since 1980 to 2002; whereas, total meat production tripled from 47 million tonnes to 137 million tonnes (FAO 2006). Furthermore, livestock products accounts for over 40% of the value of world agricultural output, and they provide one-third of humanity's protein intake. The demand for livestock products is expanding due to growing populations and incomes along with changing preferences (FAO 2009). Rabbit production is esteemed as a veritable means of meeting the animal protein need of the population due to its obvious advantage over other non ruminants. Some of these good attributes had earlier been enumerated by Ojebiyi *et al.* (2006, 2010b).

Feeds, accounting for about 70% of the total production cost in livestock are a major threat to the expansion of the sector in Nigeria. This is because both cereals and legumes grains that serves as main source of energy and protein respectively in livestock diets are inadequate due to the stiff competition for their usage by man and industry. Sourcing for alternative to these inadequate and expensive energy and protein sources is therefore imperative.

As humans develop more sophisticated food chains, agro-industries are growing and so is the availability of associated by-products as sources of animal feed. An increasing share of human food is being processed and the number of stages of processing is growing. These factors among others will raise the quantity of available by-products of reliable quality, that could be gathered and processed as feed economically and profitably (FAO, 2006). However, to be qualified as a useful alternative (non-conventional) feed ingredient it must not be a staple food item. In addition, an alternative feed resource must have a comparative cost advantage over the conventional feed stuffs and must not contain anti-nutritional factors or toxic substances (Ojebiyi *et al*. 2010a).

Rumen Content as well as well as bovine blood are abattoir by-products which if not properly handled, can cause nuisance in the environment. With the present

advocacy to reduce green house gases which has been impacting on the environment negatively, any efforts made at reducing them in the environment will reduce the effect on climate change. According to Adeniji and Balogun 2001, 2002; Mann 1984 and Dairo 2005;the composition and potentials of rumen content and blood-rumen content mixture qualifies them as good sources of protein for monogastric animals. Their availability all year round is confirmed by the report of Adeniji (1996) that rumen content of bovine origin is about 9634 metric tons per annum in Nigeria. Study on the use of bovine rumen-blood meal on rabbit has been done by Togun *et al.,* (2009) and Dairo *et al.,* (2005) using the mash feed. In the study with mash feed, it was reported that inclusion of BRC-BM resulted in significant drop in feed intake and consequently weight gain was adversely affected. This was probably due to unattractive odour of the RC-BM diets. Pelletizing the feed may results in better performance, this formed the basis of this experiment.

The present study was aimed at evaluating the effect of feeding pelleted diets containing bovine rumen contents-blood meal (BRC-BM) mixtures on the growth, nutrient digestibility and carcass characteristics of growing rabbits.

MATERIALS AND METHODS

The experiment was carried out at the Rabbitry of Ladoke Akintola University of Technology Teaching and Researh Farm in Ogbomoso. The agro-ecological description of the study area had earlier been done by Oguntoyinbo (1976).

Procurement and Processing Of Test Ingredients: Fresh bovine rumen contents were collected from the central abattoir, spread out on flat surface for sun drying to 10% moisture contents. Rumen was processed according to method described by Ojebiyi *et al* (2010).

Experimental diets: The sundried rumen content and blood were ground to 2 mm size using a hammer mill and mixed to 50:50 ratio. Mixture of BRC-BM was mixed to formulate experimental diets. Diet 1 (control) without BRC-BM mixtures, diets 2 (RB10) containing 10% BRC-BM mixture, and Diet 3 (RB20) containing 20% BRC-BM. The experimental diets were fed in pelleted form (Table 1).

Experimental Animals and Management: Thirty (30) crossbred male rabbits, weaned at 5weeks of age, were randomly divided into three treatment groups with n=10 rabbits in each treatment. Each rabbit served as a replicate in a completely randomized design experiment. The rabbit were intensively managed and housed individually in cages measuring 42.5 × 30 × 31 cm. Each cage was provided with drinking and feeding facilities made of earthen ware re-enforced with cement to prevent tipping over. The rabbit were given known quantity of feeds at 8.00h and 16.00h daily and orts were collected on daily basis. The rabbits were weighed initially and later on a weekly basis. Data collected on feed intake and body weight gain were used to calculate the feed to gain ratio.

Nutrient utilization by rabbits was evaluated through digestibility study which lasted for 5 days. Records of feed intake, orts as well as the wet and dry weight of the feces voided were kept and composited for proximate analysis. The experiment lasted for 12 weeks

Representative samples of the test ingredient, experimental diets, and fecal samples were analyzed for dry matter, crude protein, crude fiber, ether extract, and ash using the methods describe in AOAC (2000). Gross energy was determined using Ballistic Bomb Calorimeter manufactured by Gallenkamp, United Kingdom.

All data collected were subjected to analysis of variance using the general linear model according of SAS (2000) and means were compared using Duncan Multiple Range Test of the same package.

RESULTS AND DISCUSSION

The crude protein value of the Rumen Content (RC) used in this study (Table 2) was higher than values documented by Dairo *et al* (2005) and Togun *et al* (2009). The factor responsible for the differences in value could be that the water (filtrate) containing dissolved nutrients in the RC were squeezed in those studies before being sundried. According to Dairo *et al* (2005), variation could also be due to the chemical composition of the type of pasture consumed by the slaughtered animal and species differences. The crude protein of RC-BM mixtures used in this study is also higher than their values. The composition of the experimental diets as presented in Table 3 falls within the nutritional recommendations of NRC (1977) and Lebas *et al* (1997) for growing rabbits.

Rabbits on RB10 feed gained more weight ($P<0.05$) compared with the control and RB20 (Table 4). Similarly the average daily weight gain of rabbits on RB10 (16.2) was higher ($P<0.05$) compared with the control (11.8g) and RB20 (12.4g). The values obtained in this experiment were higher than the values reported by Taiwo *et al.,* (2005) Ojebiyi *et al* (2006), these may be related to the quality of the tested ingredients (BRC-BM). It was also comparatively higher than that of Togun *et al.,* (2009) who used BRC-BM mixtures containing diets but in mashed form. The results on final weight in this experiment confirmed the findings of Ojebiyi *et al (*2008) that rabbits fed on pelleted diets performed better than those fed with mash. Pelleting usually minimizes feed wastage, prevents selection of ingredients as each pellet is a balanced ration, improves palatability, increase density among other advantages (Jensen 1957) and for

rabbits pelleting will produce homogeneous feed, reduce dustiness losses (Ascott 1967). The comparatively lower weights of rabbits fed RB20 with the control may be due to the high level inclusion level of RC/BM mixtures, although they have similar weight with the control.

The economic analysis of the diets showed that cost per kg of feed decreased with increasing levels of BRC-BM mixtures. The highest (₦51.50) and the lowest (₦49.30) cost were obtained in control and RB20 diets respectively thus implying some cost savings. As expected due to design used herein, the inclusion of contents reduced the cost per kg for feed. Although rabbits on RB10 and RB20 had similar (P>0.05) feed intake that is numerically lower than the rabbits on the control, the feed: gain ratio of rabbits on RB10 is lower than the control and RB20. This is an indication of better feed utilization thus resulting in lowest cost per kg weight gain.

Table 1. Gross Composition of the Experimental Diet (%)

Ingredients	control	RB 20%	RB 20%
Maize	25.00	25.00	25.00
Corn bran	15.00	15.00	15.00
Palm kernel cake	10.00	9.00	8.00
Brewers dried grain	20.00	20.00	20.00
Groundnut cake	15.00	13.50	12.00
Rice bran	10.00	10.00	10.00
Fishmeal	1.25	1.25	1.25
Bone meal	3.00	3.00	3.00
Premix*	0.25	0.25	0.25
Salt	0.50	0.50	0.50
RC/BM (50:50) mixtures	----	2.50	5.00
TOTAL	100.00	100.00	100.00

*Premix Composition/kg of diet: Vitamin A:3200000IU, Vitamin D3:1200IU, Vitamin E:3200IU, Vitamin B_2:1000mg, Vitamin B_{12}:2000mg, Niecin:4000mg, Selenite (Se):40mg, Magnesium(Mn):3200mg, Pantothenic Acid:2000mg, Folic Acid:200mg, Choline-Chloride:60000mg, Iron(Fe):8000mg, Cupper(Cu):3200mg, Zinc:20000mg

Control =0% BRC-BM mixtures

RB10= 10% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures

RB20= 20% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures

The digestibility coefficients are presented in Table 5. The digestibility of nutrients was not different (P>0.05) among the dietary treatments. The dressing percentage and organ characteristics are presented in Table 6. The dressing percentage was not affected (P<0.05) by the dietary treatments. However, the dressing percentage values obtained in this study are higher than the values reported by Olorunsanya *et al.*, (2007), lower than values reported by Togun *et al.,(* 2009) but similar to the average of 56.50% ready to cook carcass of different European breeds reported by Lebas *et al.*, (1997). Both the heart and spleen size were not affected (P>0.05) by the dietary treatments. The relative kidney values 0.43, 0.49 and 0.62 for the control, RB10 and RB20 respectively is higher (P<0.05) than the values reported by Togun *et al*., (2009) and Olorunsanya *et al.*, (2007), this could probably be related to a kidney overload resulting from the excess effluent or the presence of anti-nutritional factor. In addition, kidneys in conjunction with the liver are directly involved in the metabolism of carbohydrate and protein in the diet (Bawa *et al.*, 2005).The relative liver weights of rabbit fed control diet (2.26) was significantly (P<0.05) lower than rabbit fed RB10 (2.50) and RB20 (2.90) diets. Rabbit fed RB10 (2.50) had lower liver value than (P<0.05) rabbit fed RB20 (2.90). The relative lungs value for rabbit fed control diet (0.45) is significantly (P<0.05) lower than the values for rabbits fed RB10 (0.59) and RB20 (0.60) which were similar.

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

Parameter	RC	BM	RC:BM (50:50)
Dry matter (%)	89.1	90.4	90.0
Crude protein (%)	42.3	79.3	51.0
Crude fibre (%)	26.2	0.5	2.26
Ether extract (%)	2.0	0.43	2.26
Ash (%)	9.67	2.83	11.78
NFE (%)	8.93	7.34	22.7
Gross energy (Kcal/g)	1.30	2.91	1.30

Rumen content (RC), BM: Blood meal, RC/BM: Rumen content/ blood meal mixture (50:50).

NFE: Nitrogen free extract =100- %(crude protein-crude fibre-Ether extract-ash-moisture)

Table 3. Proximate composition of experimental diets

Parameters (%)	control	RB 10%	RB 20%
Dry matter (DM)	91.11	90.91	91.15
Crude protein (CP)	17.34	17.43	17.52
Crude fibre (CF)	11.73	11.57	11.40
Ether extract (EE)	3.74	3.68	3.06
Ash	7.04	6.09	7.10
NFE	51.26	52.14	52.07
Gross energy (kcal/g)	3.92	3.90	3.91

Control =0% BRC-BM mixtures

RB10= 10% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures

RB20= 20% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures

NFE: Nitrogen free extract =100- %(crude protein-crude fibre-Ether extract-ash-moisture)

The liver weight recorded in this study is higher than the value reported by Amaefule *et al.,* (2004). The lung weights recorded in this study are higher than value reported Amaefule *et al., (*2004) but lower than the values reported by Togun *et al.,* (2009). In feeding trials internal organs weights like liver and kidney are used as indicator or otherwise of toxicity, the higher weights of the liver and kidneys of rabbits in RB10 and RB20 could be as a result of increased metabolic rate of the organs in an attempt to reduce the toxic metabolites or the anti-nutritional factors to none toxic metabolites (Bone 1979). Since organs like the lungs, kidney and liver were significantly (P<0.05) affected, caution must be exercised in the use of rumen content/ blood meal in the rabbit's diets as an alternative protein source.

Table 4. Performance characteristics of rabbit fed varying inclusion levels of rumencontent/blood meal (50:50) mixture.

Parameters	control	RB10	RB20	SEM	P value
Initial weight (g)	521.30	523.92	524.55	±85.10	P>0.05
Final weight (g)	1715.20^{b}	1916.68^{a}	1700.00^{b}	±26.59	P<0.05
Daily weight gain (g)	11.82^{b}	16.15^{a}	12.41^{b}	±0.36	P<0.05
Daily feed intake (g)	82.84^{b}	87.29^{a}	85.50^{a}	±0.57	P<0.05
Cost/kg feed	51.50^{a}	50.40^{b}	49.30^{c}	±0.26	P<0.05
Feed: gain	5.84^{b}	4.65^{c}	6.03^{a}	±0.18	P<0.05
Cost/kg weight gain (₦)	300.76^{a}	232.85^{b}	297.28^{a}	±5.0	P<0.05

^{abc} Means long the same row with similar superscript are not significantly (P>0.05) different.

- Control =0% BRC-BM mixtures
- RB10= 10% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures
- RB20= 20% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures
- SEM- Standard error of the mean

One Hundred and sixty naira (₦) = One dollar

Table 5. Nutrient digestibility of rabbit fed varying levels of rumen content/ blood meal (50:50) mixture

Parameters (%)	control	RB10	RB20	SEM
Dry matter	87.20	86.46	86.41	±0.57
Crude protein	84.63	83.92	83.71	±0.54
Crude fibre	23.17	20.63	20.69	±0.74
Ether extract	92.26	94.51	93.85	±0.57
Ash	87.53	83.85	86.19	±0.63
NFE	91.75	93.84	93.95	±0.39

- Control =0% BRC-BM mixtures
- RB10= 10% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures
- RB20= 20% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures
- SEM- Standard error of the mean
- NFE- Nitrogen free extract

Table 6: Dressing percentage and organ characteristics of rabbit fed varying inclusion of rumen content/ blood meal (50:50) mixture

Parameters (% of body weight)	control	RB10	RB20	SEM	P value
Dressing percentage (g)	55.99	56.74	56.32	±0.24	P>0.05
Organ characteristics					
Heart	0.17	0.16	0.16	±0.01	P>0.05
Kidney	0.43^{b}	0.49^{c}	0.62^{a}	±0.21	P<0.05
Liver	2.26^{c}	2.50^{b}	2.90^{a}	±0.07	P<0.05
Spleen	0.03	0.03	0.03	±0.03	P>0.05
Lungs	0.45^{b}	0.59^{a}	0.60^{a}	±0.13	P<0.05

^{abc} Means along the same row with similar superscript are not significantly (P>0.05) difference.

- Control =0% BRC-BM mixtures
- RB10= 10% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures
- RB20= 20% replacement palm kernel cake and groundnut cake of the control by BRC-BM mixtures
- SEM- Standard error of the mean.

Conclusion: Rumen content/ Blood meal (50:50) mixture can be included in the diet of growing rabbits to replace 10 % groundnut cake and palm kernel cake without compromising growth performance. The use of the nonconventional feed ingredients will reduce the cost of feeding and by implication the overall cost of production and encourage more rabbit production.

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