Histopathological Studies on the Effects of the Bovine Blood-Rumen Content Mixture on Selected Organs of Growing Rabbits

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ABSTRACT
A ten-week study was carried out with forty-five (45) rabbits (Dutch x New Zealand white) to investigate the effect of bovine-blood rumen content mixture (BBRCM) on selected organs of growing rabbits. The five diets contained 0, 10, 20, 30 and 40% BBRCM respectively. Three rabbits were slaughtered for histopathology from each group at the end of the study. The liver, kidneys and small intestine were used for the histopathological examination. The liver, kidneys and small intestine of rabbits receiving 0 and 10 % levels of BBRCM were normal; the small intestine of rabbits fed with 20% BBRCM was also normal. The liver and kidneys of rabbits receiving 20 to 40% BBRCM and the small intestine at 30 to 40% BBRCM showed necrosis and degenerative changes. However, the effects were more severe at 40% BBRCM compared to other levels. Therefore, histopathological findings showed that BBRCM up to 20% level can be included into the diets of growing rabbits without detrimental effect to their health.
Keywords: Bovine blood-rumen content, Rabbits, Histopathology, Selected organs

INTRODUCTION
The need for an increase in the level of animal protein production in Nigeria cannot be over emphasised. The animal protein consumed by an average Nigeria decreases on daily basis, due to the high cost of meat, milk and egg in the market. The reason for this high cost is associated with the high cost of feed ingredient, poor management, poor feeding strategies and high cost of drugs (1). Hence efforts are being made to source alternative feed ingredients that can lead to a reduction in the cost of feed and hence total cost of production. Rumen content and blood have such potential as reported by other workers (2, 3). Rumen content, a by-product of abattoir and slaughter houses, is readily available in Nigeria; it is usually considered as a waste and nuisance in many of these slaughter houses. Its use is limited in some cases by the presence of extraneous factors. For instance, presence of toxic substances, feed additives, medicines and trace minerals which may be deleterious to the health of animals have been reported in goat rumen content (4). The objective of this study is to evaluate the histopathological changes that occurred in organs of growing rabbits fed up to 40% bovine blood-rumen content mixture.

MATERIALS AND METHODS
Location of the study: The study was conducted at the Livestock Teaching and Research Farm, Department of Animal Science, University of Maiduguri, Maiduguri, Borno State, Nigeria. Maiduguri is located on latitude 11° 15' North and longitude 30° 05'East and on an altitude of 345 m above sea level. The relative humidity ranges from 30 to 50% (Encarta, 2007). The rainfall is between 500 to 600 mm. It has a short period of rainfall (3 to 4 months) usually from June to September followed by long period of dry season (8 to 9 months) (5).

Experimental animals and management: A total of forty-five (45) rabbits (Dutch x New Zealand white), aged between five and seven weeks were used for the feeding trial which lasted for 10 weeks. Before commencement of the experiment, a one-week adjustment period was observed. During this period, the rabbits were treated against internal and external parasites by subcutaneous injection of Ivomec (0.2 ml/rabbit). The rabbits were individually weighed and divided into five groups. Each group was replicated thrice with three rabbits per replicate in such a way to ensure uniformity of average weight and sex of each group (six males and three females per treatment). The groups were randomly assigned to five dietary treatments. Each rabbit was individually housed in a wire cage measuring 38 x 33 x 45 cm. The cages, in rows, were raised 45 cm above the ground to facilitate cleaning. Each cage cell was equipped with plastic drinkers and metal feeding troughs. The experimental diets (in mash form) and clean drinking water were provided *ad libitum* throughout the experimental period. A total of 100g feed was supplied to each rabbit per day at a rate of 50g in the morning (8.00 am) and 50 g in the evening (3.30 pm)

Source of bovine blood-rumen content mixture: The bovine rumen content was collected in Maiduguri abattoir. Blood was collected from bovine in a clean container during slaughter and the blood and bovine rumen content weighed in a ratio of 1:3 (i.e. 1 kg of blood and 3 kg of rumen content) into a drum. The blood and the rumen content were mixed in the drum and boiled for 30 minutes with constant stirring to ensure a uniform mixture. The boiled bovine blood–rumen content mixture was sun-dried for 5 days on a clean dry slab. The dried sample was ground with a hammer mill before inclusion into diets.

Experimental diets: The ingredient composition of the experimental diets is shown in Table 1. The bovine blood–rumen content mixture was incorporated at levels of 0, 10, 20, 30 and 40% in diets 1 (control), 2, 3, 4 and 5 respectively. The diets were formulated to supply 19% crude protein (CP) and 2800-3000 KCal of ME on dry matter basis.

Histopathological examination: Three rabbits from each group were slaughtered for histopathological examination. This was carried out at the Department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri. Specimen of the small intestine, liver and kidneys were collected from each rabbit after slaughter and thereafter, preserved in 10% formalin for histopathological examination. These organs were preferred because they are known as target organs of detoxification (4,6,7,8). The specimens were later prepared for histological presentation using routine histological method and haematoxylin–eosin (H and E) staining technique as described by (9).

RESULTS AND DISCUSSION

Histopathological findings: The results of the histopathological examination of the liver, kidneys and small intestine are summarized in Table 2. The kidneys of rabbits receiving 0 and 10% levels of BBRCM were normal (Plate 1). However, renal tubular epithelial degeneration, necrosis, protein cast and congestion were noticed in the kidneys of rabbits fed diets containing 20, 30 and 40% BBRCM (Plates 2 to 4). Similarly, the livers of rabbits receiving 0 and 10 % levels of BBRCM were normal (Plate 5). The liver of rabbits fed diets containing 20%BBRCM showed fatty changes, while hydrophic change were observed in rabbits fed 30% BBRCM and vascular degeneration with hepatic cellular necrosis in rabbits fed 40% BBRCM diet (Plates 6 to 8). The small intestine of rabbits receiving 0, 10 and 20% levels of BBRCM were normal (Plate 9) while the small intestine of rabbits fed 30% and 40% BBRCM showed goblet cell infiltration with mononuclear cell infiltration (Plates 10 and 11). The degree of degenerative changes increased with increasing levels of BBRCM in rabbits diets. Similar effects were reported by (4) in rabbits fed diets containing up to 40% caprine rumen-content. The lesions on the liver might have occurred due to metabolism of toxic constituents, since it is the primary organ of biotransformation in rabbits. Goblet cell hyperplasia, mononuclear cell infiltration and necrosis of villus epithelium of the small intestine are signs of irritation and alteration of the gut wall morphology by the toxic substance in the feed which is capable of producing such changes as reported by (8). They further observed that such changes are capable of reducing the absorptive capacity of the small intestine. Despite these observations, it will appear that at higher levels of BBRCM, some of the toxic substances were absorbed in the small intestine and distributed to organs such as the liver and kidneys. This is confirmed by the renal tubular epithelial degeneration and necrosis of the kidneys of rabbits receiving 20, 30 and 40% BBRCM in their diets. This view was corroborated by (4) who observed similar effects in rabbits fed goat rumen-content.

Conclusion

The above histopathological findings showed that bovine blood-rumen content mixture can be included up to 20% level in rabbits diets without detrimental effect to their health. Finally, there is need to explore other processing methods or the use of exogenous enzymes that will enhance better utilization of bovine blood-rumen content mixture in the diet of growing rabbits.

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Table 1: Composition of the experimental diets

Ingredients (%)	Levels of BBRCM in the diets (%)				
	0	10	20	30	40
Maize	40.98	39.12	37.41	35.24	24.35
Wheat offal	17.00	17.00	17.00	17.00	17.00
BBRCM	0.00	10.00	20.00	30.00	40.00
Groundnut cake	23.37	15.23	6.94	0.00	0.00
Fish meal	3.00	3.00	3.00	2.11	3.00
Groundnut haulms	13.00	13.00	13.00	13.00	13.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Common Salt (NaCl)	0.50	0.50	0.50	0.50	0.50
*Premix	0.15	0.15	0.15	0.15	0.15
Total	100.0	100.0	100.0	100.0	100.0

* Premix (grow fast) manufactured by Animal Care Service Consult (Nig) Ltd. Lagos, Supplied the following per kg of premix: Vitamin A, 5000,00 IU; Vitamin D_3 800,000IU; Vitamin E, 12,000mg; Vitamin K, 1,5000mg; Vitamin B_1, 1,000mg; Vitamin B_2, 2,000mg, Vitamin B_6, 1,500mg; niacin, 12,000mg; pantothenic acid, 20.00mg; biotin,10.00mg; Vitamin B_{12}, 300.00mg; folic acid, 150,000mg; choline, 60,000mg; manganese, 10,000mg; iron;15,000 mg, zinc 800.00mg; copper 400.00mg; iodine 80.00mg; cobalt 40mg; selenium 8,00mg.

BBRCM= Bovine blood-rumen content mixture.

Table 2: Histopathological examination of some selected organs of rabbits fed different levels of bovine blood-rumen content mixture(BBRCM)

Diets	Organs	Observation	Remark
0% .BBRCM	Kidney Liver Small intestine	Normal	No effect
10% BBRCM	Kidney Liver Small intestine	Normal	No effect
20% BBRCM	Kidney	Renal tubular epithelial degeneration and necrosis	Moderate
	Liver	Fatty changes	Moderate
	Small intestine	Normal	No effect
30% BBRCM	Kidney	Renal tubular epithelial, necrosis and protein cast	Moderate
	Liver	Hydrophic change	Marked
	Small intestine	Goblet cell hyperplasia with ballooning degeneration and necrosis of villus.	Moderate
40% BBRCM	Kidney	Renal tubular epithelial necrosis and congestion.	Marked

Liver	Vascular degeneration and moderate hepatic necrosis.	Marked
Small intestine	Goblet cell hyperplasia, sub-epithelial mononuclear cell infiltration, necrosis of villus epithelium.	Marked

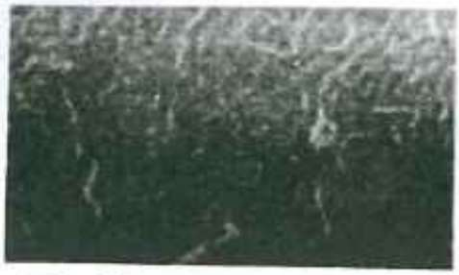

Plate 1: Normal kidney of rabbits fed 0 and 10% BBCM (H & E X 1200)

Plate 2 : Kidney showing moderate renal tubular epithelial degeneration (thin arrow) and necrosis (thick arrows) in rabbit fed 20% BBRM (H & E X 1200)

Plate 3: Kidney showing marked renal tubular epithelial necrosis (arrows) and protein casts (P) in rabbit fed 30% BBRM (H & E X 1200)

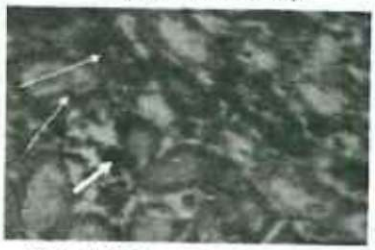

Plate 4: Kidney showing moderate renal tubular epithelial necrosis (thin arrows) and congestion (thick arrow) in rabbit fed 40% BBRM (H & E X 1200)

Plate 5: Normal liver of rabbits fed 0 & 10% BBRCM (H & E X 1200)

Plate 6: The liver showing moderate fatty change (arrows) in rabbits fed 0% BBRCM (H & E X 1200)

Plate 7: The liver showing marked hydrophic change (thick arrows in rabbits fed 30% BBRCM (H & E X 1200)

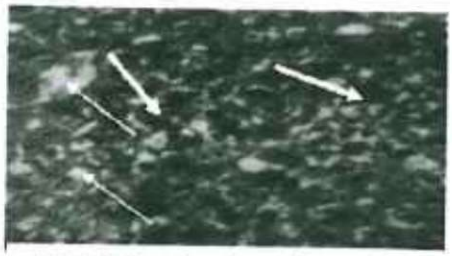

Plate 8: The liver showing marked degeneration (thin arrows) and moderate hepatic cellular necrosis (thick arrows) in rabbits fed 40% BBRCM (H & E X 1200)

Plate 9: Normal small intestine of rabbits fed 0 & 10% BBRCM (H & E X 1200)

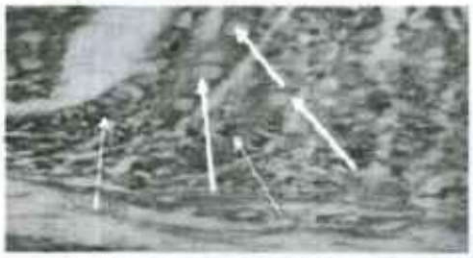

Plate 10: The intestine showing moderate goblet cell hyperplasia (thick arrows) with ballooning degeneration and necrosis of villus epithelium (thin arrow) in a rabbit fed 30% BBRCM (H & E X 1200)

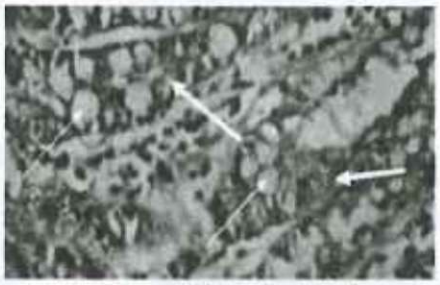

Plate 11: The small intestine showing marked goblet cell hyperplasia (thin arrows) with sub-epithelial mononuclear cells infiltration and necrosis of villus epithelium (thick arrow) in a rabbit fed 40% BBRCM (H & E X 1200)