



EFFECT OF REPLACING MAIZE WITH A MIXTURE OF RUMEN CONTENT AND BLOOD MEAL ON THE GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS

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ABSTRACT

The study investigated the effect of replacing maize with varying levels of mixture of rumen content and blood meal (8:2) on the growth performance and carcass characteristics of weaner rabbits. 30 weaner rabbits were randomly allocated to five dietary treatments. The experimental diets incorporated rumen content and blood meal as substitutes for maize at inclusion levels of 0%, 25%, 50%, 75%, and 100%. Data were collected on growth performance, hematological parameters, nutrient digestibility, and carcass characteristics. The findings revealed that diets T3 and T4 (50% and 75% replacement levels) resulted in the highest growth performance, with mean daily weight gains of 20.15 g/day and 21.54 g/day, respectively. Average daily feed intake for diets T2–T4 ranged from 46.41 g to 46.74 g, which was significantly ($P < 0.05$) higher than T1 (38.53 g). Rabbits fed T5 had the lowest (₦3,537.60) feed cost per kilogram of weight gain whereas T4 exhibited the most efficient feed conversion ratio (2.11). Carcass analysis revealed that T4 had the highest pre-slaughter weight (1398.00 g) and carcass weight (989.63 g), alongside a dressing percentage of 66.70%. In conclusion, incorporating rumen content and blood meal into weaner rabbit diets significantly improved growth performance and carcass quality, with optimal results achieved at 50–75% replacement levels. The findings suggest that rumen content and blood meal are cost-effective and sustainable alternatives to maize in rabbit diets. It is recommended that farmers include up to 75% replacement levels for enhanced growth and economic benefits.

Keywords: Rumen, Blood, Meal, Performance, Weaner, Rabbits

INTRODUCTION

Rabbits are fast-growing herbivores widely reared for meat in many developing countries due to their high reproductive rates, efficient feed conversion, and ability to thrive on a wide range of feedstuffs. However, one of the major constraints to commercial rabbit production is the high cost of conventional feed ingredients, especially cereals like maize, which are in direct competition with human food (Okorie *et al.*, 2019). Maize is commonly used as a primary energy source in livestock diets, but its increasing price and fluctuating availability have prompted the need for alternative feed resources that are affordable and nutritionally adequate. One promising approach is the use of agro-industrial by-products and slaughterhouse waste, which are often underutilized or improperly disposed of, causing environmental pollution. Rumen content and blood meal are two such by-products that have shown potential as feed ingredients. Rumen content, a fibrous material obtained from the stomach of ruminant animals, is rich in microbial protein and partially digested plant matter, while blood meal is a protein-rich material derived from abattoirs, known for its high digestibility and amino acid profile (Olorunsanya *et al.*, 2018).

Several studies have explored the nutritional potential of blood meal and rumen digesta when used individually or in combination with other feed ingredients. For instance, Ojebiyi *et al.* (2020) reported that blood meal can significantly improve protein intake and growth performance in monogastric animals when included at appropriate levels. Similarly, rumen content has been evaluated as a roughage or filler that can aid in gut health and nutrient absorption, especially in non-ruminants such as rabbits when processed properly (Aro *et al.*, 2017). The combination of these two by-products could provide a cost-effective and balanced alternative to maize when adequately formulated. In rabbit nutrition, protein and energy are critical components influencing growth, feed intake, and overall health. Young rabbits (weaners) are particularly sensitive to dietary imbalances,



making the careful formulation of alternative diets essential. A mixture of rumen content and blood meal may not only help reduce feed cost but also contribute essential nutrients that support growth and development. However, due to the high fiber content of rumen content and the risk of anti-nutritional factors or imbalanced amino acids in blood meal, it is necessary to evaluate the performance of animals fed such combinations carefully (Akinfala & Tewe, 2019). The incorporation of alternative ingredients like rumen content and blood meal into livestock diets is also aligned with sustainable agricultural practices. It supports waste recycling, reduces environmental pollution, and minimizes the pressure on conventional feed resources (Adesehinwa, 2021). In resource-limited regions, such sustainable feeding strategies are vital to improving food security and profitability among smallholder rabbit farmers. Therefore, this study seeks to investigate the effect of replacing maize with a graded mixture of rumen content and blood meal on the growth performance and carcass characteristic of weaner rabbits.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Teaching and Research farm of the Department of Animal Production, Abubakar Tafawa Balewa University, Bauchi, Nigeria. The state is located between latitudes 10°17' North and longitudes 9° 49' East at an altitude of 690.2m above the sea level (Abubakar and Burriah, 2013).

Experimental Rabbits and their Management

The feeding trial was conducted using thirty (30) weaner rabbits obtained from different rabbit farmers and open markets. The rabbits were randomly allotted to five different experimental diets (0, 25, 50, 75 and 100%). The weaner rabbits were managed intensively. Water and feeds were given *ad libitum*. The experiment lasted for a period of eight weeks.

Experimental Diets

The ingredients for diet formulation were maize, wheat offal, soyabean meal, rumen content, blood meal, groundnut haulms, bone meal, premix, lysine, methionine and salt. The rumen content and blood meal were mixed with other ingredients to compound a balanced diet for the weaner rabbits. Experimental diets were formulated to meet protein and energy requirements of weaner rabbits. Five diets were formulated with rumen content and blood meal mixture added to replace maize at varying levels; 0, 25, 50, 75 and 100% and the diets were labelled T1-T5 respectively.

Experimental Design

There were five treatments and each treatment was replicated three times with two rabbits per replicate in a Completely Randomized Design (CRD).



Table 1: Percentage Composition of Experimental Diets

Ingredients	Levels of Replacement of SBRC and blood meal (%)				
	T1	T2	T3	T4	T5
Maize	37.30	27.97	18.65	9.33	0.00
SBM	20.00	20.00	20.00	20.00	20.00
RC/BM (80:20)	0.00	9.33	18.65	27.97	37.30
Rice Offal	25.00	25.00	25.00	25.00	25.00
GNH	15.00	15.00	15.00	15.00	15.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Bone meal	2.00	2.00	2.00	2.00	2.00
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
Crude protein	15.81	15.89	15.97	16.18	16.20
Me/kcal/kg energy	2620.44	2610.22	2600.77	2599.89	2598.78
Crude fibre	9.40	9.93	10.45	10.98	11.50
Calcium	1.12	1.12	1.11	1.11	1.10
Phosphorus	0.93	0.88	0.86	0.82	0.78
Lysine	0.93	0.89	0.84	0.77	0.69
Methionine	0.32	0.29	0.29	0.28	0.24

RC/BM- Mixture of rumen content with blood meal; GNH- Groundnut haulms; SBRC-Sundried Bovine Rumen Content

Data Collection

Weekly measurements of body weight and feed intake, and feed conversion ratio (FCR) were taken to assess growth performance. At the end of the trial, two rabbits from each treatment were slaughtered for carcass analysis, which included measurements of dressed weight, dressing percentage, and organ weights.

Statistical Analysis

Data were analyzed using one-way ANOVA with the SPSS software package, and means were separated using Duncan's Multiple Range Test at a significance level of 5%.

RESULTS AND DISCUSSION

Growth Performance

The results in Table 2 revealed that there were no significant differences ($P > 0.05$) in the average initial weights of the weaner rabbits across the treatment groups, indicating uniformity at the beginning of the experiment. Significant differences ($P < 0.05$) were observed in final live weight, with rabbits on T2 (25%), T3 (50%), and T4 (75%) recording significantly higher weights compared to the control (T1) and T5 (100%). This trend indicates that the partial replacement of maize with the mixture of rumen content and blood meal up to 75% positively influenced weight gain. The highest weight gain was observed in T4 (75%), suggesting that this level of substitution provided a balanced nutrient composition that supported optimal growth. The slight reduction in T5 (100%) may be due to the excessive inclusion of the alternative mixture possibly affecting palatability or nutrient digestibility (Aro *et al.*, 2017).

Table 2: Performance of Weaner Rabbits Fed Mixture of Rumen Content and Blood Meal

Parameters	Treatments					SEM
	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	
Average initial weight (g)	277.89	278.67	278.83	278.83	277.89	14.99 ^{NS}
Average final live weight (g)	1249.17 ^b	1390.00 ^a	1395.00 ^a	1398.00 ^a	1326.00 ^{ab}	22.27*
Average daily feed intake (g)	38.53 ^b	46.41 ^a	46.68 ^a	46.74 ^a	46.47 ^a	0.82*
Average daily weight gain (g)	17.41 ^b	20.11 ^a	20.15 ^a	21.54 ^a	19.28 ^{ab}	0.32*
Feed conversion ratio	2.84 ^a	2.79 ^a	2.50 ^{ab}	2.11 ^c	2.41 ^c	0.06*
Feed cost/kg of feed (₦)	350.88	348.22	330.17	320.32	301.11	-
Feed cost/kg gain (₦)	996.49	971.53	825.43	675.88	725.68	-

abc: Means within the same row bearing different superscripts are significantly different ($P < 0.05$)

NS: No significant difference

Average daily feed intake followed a similar trend, with significant increases observed in all treatment groups compared to the control. This increased feed intake could be attributed to the palatability and high protein content of blood meal, as previously reported by Olorunsanya *et al.* (2018). However, the marginal decline in intake at 100% replacement (T5) could be due to potential limitations in digestibility or acceptability at high levels of rumen content inclusion. Average daily weight gain was significantly higher in T2, T3, and T4 compared to T1 and T5, corroborating the earlier observation on final live weight. The result agrees with the findings of Ojebiyi *et al.* (2020), who observed improved weight gains in rabbits fed blood meal-supplemented diets. The enhanced growth performance at 75% replacement suggests that the mixture was efficient in supplying both energy and high-quality protein, which are essential during the weaner stage. The feed conversion ratio (FCR), which indicates feed efficiency, was best (lowest) in T4 (2.11), followed by T5 (2.41) and T3 (2.50). The poorest FCR was recorded in the control group (T1) with a value of 2.84. These results imply that diets with 50–75% replacement of maize led to better feed utilization, which aligns with Akinfala and Tewe (2019), who noted improved feed conversion in rabbits when unconventional protein sources were strategically incorporated in the diet.

The economic analysis of the feed indicates a progressive reduction in feed cost per kilogram as the level of replacement increased, from ₦350.88 in T1 to ₦301.11 in T5. This reflects the economic advantage of using cheap and available by-products like rumen content and blood meal. Furthermore, the cost per kilogram of weight gain was lowest in T4 (₦675.88), confirming the efficiency and profitability of this treatment level. This result supports the findings of Adesehinwa (2021), who emphasized that partial substitution of conventional feeds with agro-industrial by-products could reduce production costs and improve profit margins.

Carcass Characteristics

Table 3 revealed that, the pre-slaughter weight, carcass weight, and dressing percentage showed significant differences ($P < 0.05$) among treatments. Rabbits fed diets with 25% to 75% replacement (T2–T4) had significantly higher pre-slaughter and carcass weights than the control (T1), with T4 showing the highest values. This confirms the growth performance trend observed earlier and highlights improved nutrient utilization due to the dietary mixture. The improved dressing percentage, particularly in T4 (66.70%), suggests better muscle deposition, likely due to the high protein quality of blood meal (Akinfala & Tewe, 2019). The weights of internal organs such as the heart and kidney did not differ significantly, indicating that the dietary treatment did not adversely affect the health of vital organs, which supports the safety of the dietary replacement. However, the lung and liver weights were significantly higher in T4, which could be attributed to increased metabolic activity or enhanced detoxification demands associated with processing animal by-product-based feeds (Ojebiyi *et al.*, 2020). Nonetheless, the values remained within normal physiological ranges for rabbits (Aro *et al.*, 2017).

Table 3: Carcass Traits of Weaner Rabbits Fed Mixture of Rumen Content and Blood Meal

Parameters	Treatments					SEM
	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	
Pre-slaughter weight	1249.17 ^b	1390.00 ^a	1395.00 ^a	1398.00 ^a	1326.00 ^{ab}	22.27*
Carcass weight	775.98 ^c	959.10 ^a	963.07 ^a	989.63 ^a	899.54 ^b	10.15*
Dressing percentage	57.68 ^b	65.85 ^a	65.95 ^a	66.70 ^a	64.77 ^a	0.43*
Heart	0.28	0.27	0.27	0.31	0.29	0.01 ^{NS}
Lung	0.66 ^b	0.77 ^{ab}	0.82 ^{ab}	0.89 ^a	0.67 ^b	0.02*
Liver	3.26 ^c	3.81 ^{ab}	3.22 ^c	4.37 ^a	3.62 ^b	0.07*
Kidney	0.96	1.02	1.14	1.18	1.17	0.03 ^{NS}
Stomach	1.99 ^a	1.72 ^a	1.40 ^b	1.78 ^a	1.22 ^b	0.03*
Intestine	15.29 ^c	19.56 ^b	20.00 ^{ab}	21.90 ^a	19.50 ^b	0.40*
Head	12.13	11.77	11.08	12.33	11.56	0.25 ^{NS}
Skin	10.96 ^{ab}	12.59 ^a	10.73 ^{ab}	12.74 ^a	11.55 ^{ab}	0.25*
Feet	2.62	2.65	2.62	3.13	2.59	0.10 ^{NS}
Tail	1.16	1.26	1.08	1.06	1.25	0.03 ^{NS}
Shoulder	25.66	23.90	26.99	27.42	25.66	0.31 ^{NS}
Loin	21.45 ^a	17.37 ^b	20.41 ^{ab}	27.78 ^a	19.86 ^{ab}	0.34*
Thigh	26.02	24.91	23.44	29.65	26.01	0.64 ^{NS}

^{abc}: means within the same row bearing different superscripts are significantly different ($P < 0.05$)

NS: No significant difference ($P > 0.05$)

A notable decrease in stomach weight in T3 and T5 may suggest better digestibility and less undigested residue, possibly due to improved protein digestibility from blood meal. Intestine weight increased significantly with the level of replacement, peaking at T4, suggesting enhanced nutrient absorption capacity or adaptation to fiber content from rumen content (Olorunsanya *et al.*, 2018). For non-carcass components like head, feet, tail and shoulder, no significant differences were observed, indicating consistency in skeletal development across treatments. However, skin weight was significantly higher in T2 and T4, which may be linked to better fat deposition or hydration status. Loin weight, an indicator of meat yield, was highest in T4, supporting the superior performance and carcass value of rabbits fed 75% replacement.

CONCLUSION AND RECOMMENDATION

Inclusion of rumen content and blood meal mixture in the diets of weaner rabbits significantly improved their growth performance. The use of rumen content and blood meal in rabbit diets resulted in lower feed costs compared to the control diet. The dietary inclusion of rumen content and blood meal positively influenced carcass traits, with significant improvements observed in carcass weight, dressing percentage and weights of key organs. It can therefore be recommended that, rabbit farmers should include up to 75% replacement levels of rumen content and blood meal in weaner rabbit diets to achieve the best growth performance, carcass quality and reduced environmental pollution from abattoir wastes. Additional research should be conducted to explore the long-term effects of feeding rumen content and blood meal to rabbits, including their impact on reproductive performance, longevity and overall health

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