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Impact of Feeding Spice-Treated Bovine Blood Rumen Content Mixtures on Productive Performance and Economics of Production of Weaned Rabbits

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Abstract **- This study was conducted to investigate the impact of feeding spice-treated bovine blood rumen content mixtures on growth performance and economics of production of weaned rabbits. Five experimental diets were formulated using bovine blood rumen content mixture (BBRCM) such that diet 1 (T_1) which served as control contained 0% BBRCM while diet 2 (T_2) contained 20% BBRCM without spice supplementation. Diets 3 (T_3), 4 (T_4) and 5 (T_5) contained 20% BBRCM supplemented with ginger, garlic and thyme respectively. A total of 60 weaned rabbits were assigned equally into five treatment groups, with four replicates of 3 rabbits each. Compared to control and the unsupplemented, rabbits fed supplemented BBRCM exhibited significantly ($p < 0.05$) higher body weights, greater weight gain, and higher feed consumption during the experimental period. There was no significant ($P < 0.05$) difference in the weight gain and feed intake of rabbits fed the control and unsupplemented BBRCM diets. The dietary treatments did not have significant impact ($p > 0.05$) on the feed conversion and protein efficiency ratios of the animals. In conclusion, ginger, garlic and thyme could be safely used in weaned rabbits diets to promote growth and to impart healthful constituents to the consumer.**

Keywords **- Bovine Blood Rumen Content, Performance, Spices, Weaned Rabbits.**

I. INTRODUCTION

Efforts to reduce the high cost of feeds and therefore the cost of animal products have concentrated on the use of cheaper and locally available alternative agro-by products especially those that have no nutritional value to mankind [1]-[4]. Furthermore, the need to maximize the economic and environmental benefits in disposal of slaughterhouse by-products [5], [6] also stimulated a renewed interest in the investigation of slaughterhouse by-products for possible use as protein feedstuffs in livestock feeds. Incorporation of such products in rabbit feed would serves the dual purpose of cleaning the environment and help in alleviating the problem of the scarcity of feed supply that is having a negative effect on livestock industry most especially monogastric animal production.

Bovine blood /rumen content mixture (BBRCM) is an abattoir by product that offers a tremendous potential as a cheap and locally available alternative feedstuffs for livestock. The mixture of bovine blood and rumen digesta is rich in nutrients including food particles, micro-organisms and fermentation products [7], [8]. It has been used in Nigeria to feed monogastrics [9]-[16] as a cheap untraditional feedstuff to reduce feeding costs and alleviate pollution problems. Unfortunately, its usage has been encumbered by its obnoxious odour and low palatability. As a consequence, this leads to depressed feed consumption. There is need therefore, to enhance the nutritive value and bio safety of this material by the incorporation of natural feed additives of plant origin like spices which are believed to be safer, healthier and less subject to hazards. The usefulness of these products depends on the specific nutrient requirements of the animals, the nature of the feed materials, management practices, health and physiological status of the animal and the economic returns associated with the use of such additives.

Herbs and spices are commonly used for flavour, colour, aroma and preservation of food or beverages. It has reported that due to their aromatic characteristic essential oils derived from herbs and spices had the ability to increase feed intake and could thus be successfully used as growth promoters [17]. Herbs and spices are incorporated in livestock feeds in order to stimulate or promote the effective use of feed nutrients which result in more rapid gain, higher production and better feed efficiency, improved carcass quality and reduced mortality rates [18], [19]. They have a stimulating effect on the digestive system of animals, through the increasing production of digestive enzyme and by improving the utilization of digestive products through enhanced liver function [18], [20], [21]. In addition, [22] reported that herbs and spices help to increase the resistance of the animals exposed to different stress situations and increase the absorption of essential nutrients, thus improving the growth of the animals.

However, no report to my knowledge is available on the effect of BBRCM diets supplemented with ginger, garlic and thyme on the performance and economics of production of weaned rabbits. Therefore, the objective of this study was to investigate the effects of feeding spice-treated bovine blood rumen content mixtures on growth performance and economics of production of weaned rabbits.

III. MATERIALS AND METHODS

This experiment was carried out at the Teaching and Research Farm (Rabbitry Unit) of the Department of Animal Science, Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki, Nigeria, with the approval of the Animal Ethics Committee of the University.

The bovine rumen content and the blood were collected from the abattoir while slaughtering of the animal was in progress. The fresh blood was collected into a clean container while the rumen content was obtained from freshly eviscerated cattle into a clean bucket. A mixture of 3 parts rumen content and 1 part blood was measured into a drum. The mixture in the drum was placed on fire to boil for 30 minutes with constant stirring. After which the mixture (BBRCM) was sun dried on a concrete floor, milled and stored for mixing with other ingredients.

Sixty (60) weaned rabbits with an initial weight range of between 590.5 and 623.72g, were randomly assigned to five (5) treatments in a completely randomized design. Each treatment was replicated four (4) times giving three (3) animals per replicate. The animals were housed individually in a cage and supplied with the experimental diets in mash form.

Five experimental diets were formulated such that diet 1 (T_1) which served as control contained 0% BBRCM while diet 2 (T_2) contained 20% BBRCM without spice supplementation. Diets 3 (T_3), 4 (T_4) and 5 (T_5) contained 20% BBRCM supplemented with 200mg of ginger, garlic and thyme respectively. Diets and clean drinking water were offered *ad libitum* over the experimental period of 8 weeks. The animals in all treatments were kept under the same management system. Feed intake was recorded daily, while live body weight was recorded weekly. Body weight gain, feed conversion and protein efficiency ratios were calculated. The economic implication of including spice treated BBRCM into the diets of growing rabbits was also assessed. Data obtained from the study were tested for significance by one-way ANOVA using the GLM procedures of [23]. Differences among treatment means were separated by Duncan's New Multiple Range Test as outlined by [24].

III. Result and Discussion

There were significant ($P<0.05$) variation in the weight gain of rabbits among the treatments. Rabbits fed spice treated BBRCM gained significantly ($P<0.05$) higher weight than those fed the unsupplemented BBRCM and the control diets. There was no significant ($P < 0.05$) difference in the weight gain of rabbits fed the control and unsupplemented BBRCM diets.

The higher weight gain of rabbits fed BBRCM diets supplemented with spices over the unsupplemented and the control could be that the spices may have controlled and limited the growth and colonization of numerous pathogenic species of bacteria in the gut leading to improved translation of feed to meat [25].The improvement in body weight of rabbits could also be attributed to their positive effect on nutrient digestibility [19], [20], [26]. According to [27] a more balanced biota population in gut could lead to a greater efficiency in digestibility and utilization of food, resulting in an enhanced growth. The enhanced weight gain of rabbits fed T_3, T_4 and T_5 is in line with the reports of [28]-[30].

The lower weight gain of rabbits fed unsupplemented BBRCM based diets may be due to the lower feed intake of the animals resulting from the high fibre content of the diet. The lower feed consumption may have reduced the intake of major nutrients like protein and energy since fibre depresses utilization of nutrients. This energy deficit would in turn affect other biological parameters as well as nutrient retention and thus weight loss of the animals [31]. The result of this study showed that there were significant ($p<0.05$) differences in daily feed intake of the rabbits. Rabbits fed spice treated BBRCM diets consume significantly more feed than those fed the control and unsupplemented diets. There was no significant ($P < 0.05$) difference in the feed intake of rabbits fed the control and unsupplemented BBRCM diets.

The lower feed intake of rabbits on diet T_1 could be as a result of higher energy content of the diet. This is an agreement with the reports of [32] that monogastric eat primarily to meet their energy requirement. The lower quantity of feed consumed by rabbits placed on BBRCM – based unsupplemented diet (T_2) could be attributed to the odour of the BBRCM, the bitter taste resulting and the low palatability resulting from the inclusion of BBRCM in the feed without spice supplementation. This result is in agreement with the report of [13], [33] who fed similar diet to weaned rabbits and recorded lower feed intake without spice supplementation. [34] observed that when cooked blood was sun dried, it resulted in chocolate brown lumps with an unpleasant smell. Also the inclusion of blood meal or rumen content was reported by [7], [10], [35] to impact obnoxious odour to the final diet and make it less palatable to the animals causing a depression in consumption and subsequently poor performance [8]. In this study, the diets became darker in colour with an unpleasant odour, with the inclusion of BBRCM. These two factors may have negatively influence palatability, resulting in low consumption.

The higher feed intake of the rabbits fed diets with spice (T_3, T_4 and T_5) could be attributed to an improvement in palatability and the quick digestive effect of these spices resulting in quicker empting of the digestive tract and consequently increased feed consumption. This observation further strengthened the report of [34], [36] that spice could make feed more palatable for animal consumption. [9] opined that the flavouring agents (spices) may have stimulated an increase in feed intake among rabbits that were fed spices, whose effects could be due to smell or taste.

There was no significant ($P<0.05$) difference in the feed conversion and protein efficiency ratio of the rabbits. This observation is in agreement with previous observations that herbs, spices and plant extracts did not affect feed efficiency of monogastric animals [37]-[41].

However, the comparable weight gain, feed conversion and protein efficiency ratios of rabbits fed the control and the unsupplemented diet was an indication that the rabbits efficiently utilized the feed they consumed. These results suggest that the BBRCM diets were not inferior to the control diet.

The result of economic analysis favoured the inclusion of BBRCM, ginger, garlic and thyme supplementation in ration of the weaned rabbits in terms of feed cost per kg,

cost of feed consumed, cost of production, and profit or benefit per rabbit.. The supplemented diets had the highest profit compared with the control, which was least ($P < 0.05$).BBRCM is comparatively cheaper than many other feed ingredients. It was observed that additional weight gain caused by spice supplementation, offset the cost of the spice. Thereby, suggesting its use for profitable rabbit farming. This is an agreement with the report of [34] who fed weaned rabbits similar diet and recorded return in the diet with spice supplementation.

In conclusion, the findings of this experiment suggested that bovine blood rumen content mixture can be incorporated in weaned rabbit diets without any adverse effect on production parameters. For enhancing performance and optimizing the profits from feeding of BBRCM, it should be supplemented with spices.

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Table 1: Ingredient composition and calculated analysis of the experimental weaned rabbits diets

Ingredients	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**
Maize	42.00	34.00	34.00	34.00	34.00
Soyabean meal	22.00	10.00	10.00	10.00	10.00
BBRCM	0.00	20.00	20.00	20.00	20.00
Maize	42.00	34.00	34.00	34.00	34.00
SBM	22.00	10.00	10.00	10.00	10.00
BBRCM	0.00	20.00	20.00	20.00	20.00
PKC	14.00	14.00	14.00	14.00	14.00
Maize offal	18.00	18.00	18.00	18.00	18.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.50	0.50	0.50	0.50	0.50
Premix*	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00
			+ginger	+garlic	+thyme
Chemical composition (%) of the experimental diet					
Nutrients					
Crude protein	18.18	19.28	19.28	19.28	19.28
Crude fibre	7.58	10.02	10.02	10.02	10.02
Ether extract	3,78	4.63	4.63	4.63	4.63
Total Ash	2.68	4.53	4.53	4.53	4.53
NFE	54.73	48.88	48.88	48.88	48.88
ME (Kcal/kg)	3095.91	2677.91	2677.91	2677.91	2677.91

*Each 1 kg of vitamins and minerals premiix contain Vitamin A 500,000 IU; Vitamin D_3 800,000 IU; Vitamin E 12,000mg; Vitamin K 1,500mg; Vitamin B_1 1,000mg; Vitamin B_2 2,000mg; Vitamin B_6 1,500mg; Niacin 12,000mg; pantothentic acid 20.00mg; Biotin 10.00mg; Vitamin B_{12} 300.00mg; folic acid 150,000mg; cwhlorine 60,000mg; manganese 10,000mg; iron 15,000mg; zinc 800.00mg; Copper 400.00mg; Iodine 80.00mg; cobalt 40mg; selenium 8,00mg. BBRCM = Bovine blood-rumen content mixture, PKC= Palm kernel cake, SBM= Soya bean meal.

Table 2: Growth performance traits of rabbit fed the experimental diets

Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	SEM
Initial bodyweight(G)	613.77	623.72	590.50	611.20	606.78	11.74
Final weight gain(G)	1240.43^{c}	1225.38^{c}	1425.50^{a}	1382.37^{ab}	1333.4^{b}	50.35
Body weight gain(G)	626.67^{c}	601.67^{c}	835.00^{a}	771.67^{ab}	726.67^{b}	58.33
Daily weight gain(G)	11.19^{c}	10.74^{c}	14.91^{a}	13.78^{ab}	12.98^{b}	1.04
Total feed intake(G)	2869.7^{b}	2707.6^{b}	3269.5^{a}	3193.9^{a}	3130.4^{a}	134.69
Daily feed intake(G)	51.25^{b}	48.35^{b}	58.38^{a}	57.03^{a}	55.90^{a}	2.41
Conversion ratio	4.60	4.50	3.96	4.14	4.31	0.21
Daily protein intake	9.32^{b}	9.32^{b}	11.26^{a}	10.99^{a}	10.78^{a}	0.53
Protein efficiency ratio	1.20	1.15	1.33	1.25	1.20	0.06

$^{a, b, c}$ Means with different superscript on same row differ significantly ($P<0.05$)

Table 3: Economics of Production of weaned rabbits fed the experimental diets

Parameter/Diet	T_1	T_2	T_3	T_4	T_5
Total feed consumed (g)	2869.7[b]	2707.6[b]	3269.5[a]	3193.9[a]	3130.4[a]
Cost of feed/kg	96.00	60.00	62.00	62.00	62.00
Total cost of feeding (₦)	275.49	162.46	196.17	191.63	187.82
Cost of stock animal (₦)	1,250	1,250	1,250	1,250	1,250
Miscellaneous* (₦)	130	138	138	138	138
Total cost of production (₦)	1,655.5	1,550.5	1,584.2	1,581.6	1,577.8
Cost/kg meat (₦)	1,700	1,700	1,700	1,700	1,700
Average body weight (g)	1240.4[c]	1230.4[c]	1425.5[a]	1382.9[ab]	1333.4[b]
Revenue (₦)	2108	2091	2423	2349	2266
Benefit (₦)	452.51	540.54	830.83	767.40	688.20
Benefit ratio	3.65	2.86	1.91	2.06	2.29

*medication and labour