



RESPONSE OF WEANER RABBITS TO DIETARY LEVELS OF COWPEA HUSK AS REPLACEMENT FOR WHEAT OFFAL

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ABSTRACT

The study was carried out at, Departmental Teaching and Research farm Yelwa campus, Abubakar Tafawa Balewa University, Bauchi to determine the response of weaner rabbits to dietary levels of cowpea husk as replacement for wheat offal. A total of thirty (30) weaner rabbits were randomly allotted to five dietary treatments, replicated three times in a Completely Randomized Design, in which cowpea husk replaced wheat offal at 0, 25, 50, 75 and 100%, and designated as diets 1, 2, 3, 4 and 5 respectively. The results of the study revealed that, performance parameters such as the total weight gain (483.50 to 624.50g), total feed intake (4092.00 to 4362.16g), feed conversion ratio (7.03 to 9.02) and feed efficiency (0.12 to 0.14) were not significantly ($P>0.05$) affected by the dietary treatments. Nutrient digestibility indicated no significant ($P>0.05$) difference across the dietary treatments. The dry matter digestibility ranged from 85.20 to 87.06% on diets 2 and 1 respectively. Crude protein values varied between 81.90% on diet 5 and 82.20% on diet 4. Crude fibre ranged between 61.97 to 72.06% on diets 5 and 1 respectively... Total feed cost also ranged from ₦983.65 to ₦1397.38 on diets 5 and 1 respectively. Feed cost per kg gain had the highest value (₦2710.51) on diet 2 while the lowest (₦1844.67) was recorded for diet 4. Cost saving varied between -₦434.96 and ₦430.88 on diets 2 and 4 respectively. Based on the results obtained from this study, it can be concluded that cowpea husk can replace wheat offal up to 100% level in the diets of weaner rabbits without any adverse effect on their growth performance and nutrient digestibility. However, Diet 4 (75% cowpea husk) had a cost benefit of (₦430.88) with percent cost saving of 18.94% and is therefore recommended for rabbit production.

Keywords: Digestibility, Feed, Performance, Cost, Benefit

INTRODUCTION

The livestock sector serves a role in global food security, providing protein, income and livelihoods for millions of households, particularly in developing countries like Nigeria. Among the various livestock species, rabbits (*Oryctolagus cuniculus*) have gained increasing attention due to their fast growth rate, short generation interval, high reproductive potential and efficient feed conversion ability (Onifade *et al.*, 2016). Rabbit meat is lean, highly digestible and rich in protein, making it an important component in addressing malnutrition and the rising demand for animal protein in Africa (Akinmutimi & Udeh, 2018). Despite these advantages, the expansion of rabbit production in Nigeria is constrained largely by high cost of conventional feed ingredients such as maize and wheat offal. Feed accounts for approximately 60–70% of total production costs in rabbit production systems (Okoruwa *et al.*, 2020). Conventional feed ingredients like wheat offal, groundnut cake and maize are increasingly expensive because they are in high demand for both human consumption and industrial uses. Consequently, smallholder farmers face challenges sustaining profitable rabbit enterprises, leading to reduced production levels. In response, researchers and livestock nutritionists have increasingly turned their attention towards non-conventional feed resources that are abundant, cheap and nutritionally adequate to reduce feeding costs while maintaining acceptable growth performance and carcass quality of rabbits (Aduku & Olukosi, 2019).



Cowpea (*Vigna unguiculata*) is a leguminous crop widely grown in Nigeria and across West Africa. After threshing and processing, the husk remains as a by-product. Cowpea husk is usually discarded or underutilized as waste, contributing to environmental challenges. However, this by-product is fibrous, moderately rich in protein and available in large quantities at little or no cost to livestock farmers (Oloruntola *et al.*, 2016). Its use as a feed resource aligns with sustainable agriculture by promoting waste recycling and resource optimization. Substituting cowpea husk for expensive wheat offal could therefore represent a cost-effective and environmentally friendly strategy for rabbit production. Rabbits require diets rich in fiber to maintain optimal gut health and prevent digestive disorders such as enteritis. Unlike poultry and pigs, rabbits can effectively utilize fibrous feed resources due to their well-developed cecum, which harbors symbiotic microorganisms that break down fiber (Cheeke, 2018). Wheat offal has traditionally been included in rabbit diets because of its fiber and energy content. Its inclusion in rabbit diets could improve nutrient utilization and reduce production costs without compromising performance. Studies have demonstrated the feasibility of incorporating crop residues and agro-industrial by-products into rabbit diets. For instance, Oloruntola *et al.* (2018) reported that rabbits fed cassava peel meal or cowpea husk-based diets exhibited satisfactory growth performance and carcass yield.

Similarly, Omole *et al.* (2019) showed that replacing maize or wheat offal with unconventional feedstuffs reduced feed costs while maintaining acceptable meat quality. However, the extent to which cowpea husk can replace wheat offal in the diets of weaner rabbits without adverse effects on growth performance, carcass characteristics, nutrient digestibility and profitability remains underexplored. Growth performance indicators such as weight gain, feed intake and feed conversion ratio are critical in evaluating the suitability of cowpea husk as a feed ingredient (Igbokwe *et al.*, 2019). Nutrient digestibility trials provide insights into how efficiently rabbits can utilize nutrients from cowpea husk-based diets. Finally, the economic analysis or cost-benefit evaluation is essential for determining the profitability and sustainability of using cowpea husk as a feed replacement strategy. Nigeria is currently grappling with food insecurity, high unemployment and poverty, challenges that can be partly addressed by promoting small-scale livestock enterprises such as rabbit farming (FAO, 2021). By exploring cost-effective feeding strategies like replacing wheat offal with cowpea husk, rabbit production could become more affordable and accessible for smallholder farmers, contributing to household income and nutrition security. The utilization of cowpea husk supports environmental sustainability by reducing agricultural waste accumulation and promoting circular economic practices. Despite the high potential of rabbit production in Nigeria, feed scarcity and high cost of conventional feed ingredients such as maize and wheat offal remain major constraints. Cowpea husk is widely available and cheap, its potential as a replacement for wheat offal in weaner rabbit diets has not been adequately explored. Without scientific evaluation of its effects on growth, carcass quality, nutrient digestibility and cost efficiency, farmers are unlikely to adopt it confidently. Therefore, there is a need to investigate whether cowpea husk can serve as an economical and nutritionally adequate alternative to wheat offal. The aim of this study is to evaluate the growth performance, nutrient digestibility, and cost-benefit of weaner rabbits fed cowpea husk as a replacement for wheat offal.

MATERIALS AND METHODS

Experimental Site

The study was carried out at Abubakar Tafawa Balewa University, Bauchi, teaching and research farm Yelwa campus. The university is located at Yelwa along Tafawa Balewa Road, Bauchi. Bauchi lies between latitude of 10°, 17°N, longitude 9° 49'E and at attitude of 902 meters above the sea level. There are two distinct seasons in the area; rainy season, which usually starts in May and end in October, and dry season which starts from November to April. The mean annual rainfall is 1091mm (World Atlas, 2015).



Experimental Diets

Five isonitrogenous diets (16%CP) were formulated, where cowpea husk was incorporated to replace wheat offal at 0, 25, 50, 75 and 100% levels and coded as diets 1, 2, 3, 4 and 5 respectively. The percentage composition of the experimental diets is shown in Table 1.

Table 1: Percentage Composition of the Experimental Diets

Ingredients	Diets				
	1(0%)	2(25%)	3(50%)	4(75%)	5(100%)
Maize	40.00	40.00	40.00	39.00	39.00
SBM	16.00	16.00	16.00	17.00	16.50
Wheat offal	20.00	15.00	10.00	5.00	0.00
Cowpea husk	0.00	5.00	10.00	15.00	20.00
G/nut haulms	20.00	20.00	20.00	20.00	20.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Premix	0.30	0.30	0.30	0.30	0.30
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis (%)					
Crude protein	16.00	16.00	16.00	16.00	16.00
ME (Kcal/kg)	2510.40	2556.90	2603.40	2648.40	2694.30
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

SBM = Soya Bean Meal

Experimental Rabbits and their Management

A total of thirty (30) weaner rabbits of 6-8 weeks of age were purchased from a reliable rabbit keeper for this study. The weaner rabbits were allowed to acclimatize to the environment for a period of week, during which feed and water were given *ad libitum*. The rabbits were also administered multivitamins, antibiotics and ivermectin (against both internal and external parasites). After the acclimatization period, the rabbits were randomly allotted to five dietary treatments, replicated three times with two rabbits per replicate in a Completely Randomized Design. At the commencement of the experiment, each rabbit was weighed to determine its initial weight using EK3250 digital weighing scale there after weekly. The initial weight was balanced for treatments, and feed and water were offered *ad libitum*. Mortalities were recorded as they occur during the period of feeding trial.

Data Collection

Performance of weaner rabbits

Daily feed intake and daily weight gain were recorded throughout the experimental period. Feed conversion ratio (FCR) was calculated using the relationship:

$$FCR = \frac{\text{Feed intake}}{\text{Weight gain}}$$

While feed efficiency (FE) was calculated as;

$$FE = \frac{\text{Weight gain}}{\text{Feed intake}}$$

Nutrient digestibility of rabbits

During the last week of the feeding trial, the digestibility study was carried out. The total faeces voided were collected daily from each replicate for five (5) days and were air-dried in order to remove the moisture content. Fifty (50) grams of the total dried faeces for the five (5) days and for each replicate was taken to serve as representative sample for proximate analysis. The proximate analysis for the feed and faecal sample was carried out according to the method of the Association of



Official's Analytical Chemists, AOAC (2006). The apparent Nutrient digestibility of dry matter, crude protein, crude fibre, ash, ether extract and nitrogen free extract was calculated using the formula of Isikenuet *et al.* (2010).

$$\text{Nutrient Digestibility} = \frac{\text{Nutrient in feed} - \text{Nutrient in faeces}}{\text{Nutrient in feed}} \times 100$$

Data Analysis

Data obtained were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS, 2010) and mean differences were separated using Duncan's Multiple Range Test (Duncan, 1955).

Cost Benefit Analysis

Costs of feed were calculated using the prevailing market prices of ingredients at the time of the experiment for the economic appraisal of the feeds.

RESULTS AND DISCUSSION

Growth Performance of Weaner Rabbits Fed Dietary Levels of Cowpea Husk

The growth performance of weaner rabbits fed dietary levels of cowpea husk is presented in Table 2. The result indicated no significant difference ($P>0.05$) in the mean values across dietary treatments for all parameters observed. The result further showed that, total weight gain ranged from 548.60 to 624.50g on diets 2 and 1 respectively. Also, total feed intake ranged from 3957.00 to 4362.16g on diets 2 and 1. Feed conversion ratio was lowest (7.03) on dietary treatment 4 and highest (9.02) on dietary treatment 2. Feed efficiency ranged from 0.12 on diet 2 to 0.14 on diets 1, 3 and 4. This is an indication that dietary treatments supplied adequate nutrients which supported growth rate and had no adverse effect on the performance of the rabbits. This result is in conformity with the findings of Soji *et al.* (2025) on the performance of weaner rabbits fed graded levels of urea-treated cowpea husk diets who obtained no significant difference in all the growth parameters across the diets. The similarity in the performance among the dietary treatments may also be as a result of the similarities in nutrient utilization, which is a function of nutrient quality, since all the diets met the nutrient requirement of rabbits.

Table 2: Performance of Weaner Rabbits Fed Dietary Levels of Cowpea Husk

Parameters	Diets					SEM
	1 (0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)	
Initial weight (g)	858.83	849.83	853.50	855.16	860.50	3.47 ^{NS}
Final weight (g)	1483.33	1333.33	1428.33	1451.33	1423.33	4.68 ^{NS}
Total weight gain (g)	624.50	548.60	574.83	596.16	562.83	3.55 ^{NS}
Total feed intake (g)	4362.16	3957.00	4132.00	4127.83	4092.00	5.45 ^{NS}
Daily feed intake (g)	77.89	70.66	73.78	73.71	73.07	2.35 ^{NS}
Daily weight gain (g)	11.15	8.63	10.26	10.00	10.05	2.27 ^{NS}
Feed conversion ratio	7.10	9.02	7.24	7.03	7.87	1.56 ^{NS}
Feed efficiency	0.14	0.12	0.14	0.14	0.13	0.02 ^{NS}

SEM: Standard Error of the Means; NS: Not Significant.

Nutrient Digestibility of Weaner Rabbits Fed Dietary Levels of Cowpea Husk

The nutrient digestibility of weaner rabbits fed dietary levels of cowpea husk is presented in Table 3. The result obtained indicated no significant ($P>0.05$) difference across the dietary treatments. The dry matter digestibility values ranged from 85.20 to 87.06% on diets 2 and 1 respectively. Crude protein digestibility values varied between 81.90% on diet 5 and 82.20% on diet 4. Crude fibre ranged between 61.97 to 72.06% on diets 5 and 1 respectively. Ether extract ranged between 87.19% on diet 2 to 91.16% on diet 1. Ash values varied between 81.69 and 86.49% on diets 5 and 3 respectively. Nitrogen free extract ranged from 86.82 to 88.58% on diets 2 and 5 respectively. This means that the weaner rabbits were able to digest higher percent of the nutrients in all the diets, without any variation statistically. The result of this study is in agreement with Soji *et al.* (2025) who reported no significant

difference in all the nutrient digestibility parameters considered for rabbits fed fermented cowpea husk.

Table 3: Nutrient Digestibility of Weaner Rabbits Fed Dietary Levels of Cowpea Husk

Parameters (%)	Diets					SEM
	1 (0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)	
Dry Matter	87.06	85.20	86.41	86.02	86.26	1.30 ^{NS}
Crude Protein	81.11	82.10	82.05	82.20	81.90	0.66 ^{NS}
Crude Fibre	72.06	65.40	65.80	64.48	61.97	5.34 ^{NS}
Ash	91.16	87.19	89.42	90.83	88.74	3.30 ^{NS}
Ether Extract	85.90	82.07	86.49	86.01	81.69	3.25 ^{NS}
Nitrogen Free Extract	88.20	86.82	87.87	87.59	88.58	1.09 ^{NS}

SEM: Standard Error of the Means; NS: Not Significant.

Cost Benefit of Weaner Rabbits Fed Dietary Levels of Cowpea Husk

The cost benefit of weaner rabbits fed dietary levels of cowpea husk is presented in Table 4. The total feed intake ranged from 4.00 to 4.36kg on diets 2 and 1 respectively. Feed cost varied between ₦240.50/kg to ₦320.50/kg on diets 5 and 1 respectively. Total feed cost ranged from ₦983.65 to ₦1397.38 on diets 5 and 1 respectively. Total weight gain recorded lowest (0.55kg) on diet 2 while highest (0.62kg) was recorded for the control diet. Feed cost per kg gain had the highest value (₦2710.51) on diet 2 while the lowest (₦1844.67) was recorded for diet 4. Cost saving varied between -₦434.96 and ₦430.88 on diets 2 and 4 respectively. Percent cost saving recorded the highest (18.94%) for diet 4, followed by diets 5 (16.82%) and 3 (10.44%). The result showed that feed cost (₦/kg) and total feed cost (₦) decreased as the levels of cowpea husk increased progressively in the diets. This is attributed to the cost price of cowpea husk which is lower compared to wheat offal. This finding disagrees with the report of Soji *et al.* (2025).

Table 4: Cost Benefit of Weaner Rabbits Fed Dietary Levels of Cowpea Husk

Parameters	Diets				
	1 (0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)
Total feed intake (kg)	4.36	4.00	4.13	4.13	4.09
Feed cost (₦/kg)	320.50	300.50	281.50	262.40	240.50
Total feed cost (₦)	1397.38	1202.00	1162.60	1083.71	983.65
Total weight gain (kg)	0.62	0.55	0.57	0.60	0.56
Feed cost/ kg gain (₦)	2275.55	2710.51	2038.06	1844.67	1892.74
Cost saving (₦)	0.00	-434.96	237.49	430.88	382.81
Cost saving (%)	0.00	-19.11	10.44	18.94	16.82

CONCLUSION AND RECOMMENDATION

Based on the results obtained from this study, it can be concluded that cowpea husk can replace wheat offal at 100% level in the diets of weaner rabbits without any adverse effect on their growth performance and nutrient digestibility. However, Diet 4 (75% cowpea husk) had a cost benefit of (₦430.88) with percent cost saving of 18.94% and is therefore recommended for rabbit production.

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