



GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS FED VARYING LEVELS OF *AGERATUM CONYZOIDES* LEAF MEAL

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ABSTRACT

The study was conducted to evaluate the growth performance, carcass characteristics and internal organ responses of weaner rabbits fed varying levels of *Ageratum conyzoides* leaf meal (ACLM). A total of 40 weaner rabbits were randomly assigned to five dietary treatments: 0, 25, 50, 75 and 100% replacement of groundnut haulm with ACLM, designated as T1, T2, T3, T4, and T5, respectively. The results indicated that rabbits on the 50% ACLM diet (T3) exhibited the highest total weight gain (670 g) and weekly weight gain (97 g), while those on the control diet (T1) had a total weight gain of 630 g. The dressing percentage was highest in T4 (46.40%) and lowest in T5 (35.61%). Internal organ weights also varied significantly, with the full gastrointestinal tract weight being highest in T4 (305 g) and the liver weight highest in T3 (42.13 g). The findings suggest that incorporating ACLM at 50% level in rabbit diets promotes optimal growth performance and carcass yield, highlighting its potential as a sustainable feed resource. Further research is recommended to explore the long-term impacts of ACLM inclusion in rabbit production systems.

Keywords: *Ageratum conyzoides*, weaner rabbits, growth performance, carcass characteristics

INTRODUCTION

Rabbit farming has gained considerable attention in recent years as an alternative source of protein due to its potential for rapid growth, high reproductive efficiency, and adaptability to diverse environments (Akinmutimi and Onwukwe, 2022; Hassan *et al.*, 2015). Rabbits are highly prolific animals that can be raised with minimal space and feed resources, making them an ideal livestock option for both small-scale and commercial farmers. Additionally, rabbit meat is rich in protein, low in fat and cholesterol, and is well-suited to meet the nutritional needs of growing populations (Ekenyem, 2016). However, feed costs remain one of the major constraints in rabbit production, accounting for approximately 60-70% of the total cost of production (Adeyemi and Salami, 2020). This has sparked an increasing interest in the exploration of unconventional and locally available feed ingredients, such as *Ageratum conyzoides* leaf meal (ACLM), to reduce feed costs and improve the sustainability of rabbit farming. *Ageratum conyzoides*, commonly known as Billygoat weed or goatweed, is a ubiquitous plant found in tropical and subtropical regions. It has been traditionally used for medicinal purposes due to its reported anti-inflammatory, antimicrobial, and antioxidant properties (Okunade, 2022; Nwosu *et al.*, 2021). More recently, there has been growing interest in its potential as a feed resource in livestock production due to its availability, low cost, and nutrient composition (Chukwuma *et al.*, 2022). *Ageratum conyzoides* contains a range of bioactive compounds, including alkaloids, flavonoids, tannins, and essential oils, which may offer potential benefits for growth performance and health when included in animal diets (Banso and Adeyemo, 2017). The use of *Ageratum conyzoides* in animal feed may help to alleviate feed shortages, particularly during periods of scarcity, and offer a cost-effective alternative to conventional feed ingredients (Ayinla *et al.*, 2016).



Weaner rabbits, which are young rabbits that have just been weaned from their mother's milk, represent a critical phase in rabbit production where growth performance and carcass characteristics can be influenced by dietary interventions (Ojebiyi *et al.*, 2023). At this stage, the nutritional quality of the diet plays a vital role in determining their growth rate, feed conversion efficiency, and eventual meat quality (Omole *et al.*, 2008). Therefore, identifying suitable feed ingredients, such as *Ageratum conyzoides* leaf meal, that can support optimal growth and improve carcass characteristics is of significant importance to rabbit farmers and the livestock industry at large.

The inclusion of plant-based feed additives like *Ageratum conyzoides* in weaner rabbit diets could potentially enhance growth performance, improve nutrient utilization, and positively influence carcass traits (Dairo *et al.*, 2020; Onu *et al.*, 2021). Several studies have shown that phytogenic feed additives may stimulate appetite, improve digestion, and enhance immune function in livestock, contributing to better overall performance (Windisch *et al.*, 2018). However, the impact of feeding *Ageratum conyzoides* leaf meal on the growth and carcass characteristics of weaner rabbits has not been extensively studied, particularly in terms of optimal inclusion levels and potential effects on meat quality parameters such as carcass weight, dressing percentage, and meat composition. This study seeks to explore the growth performance and carcass characteristics of weaner rabbits fed varying levels of *Ageratum conyzoides* leaf meal as part of their diet. The study will examine key growth metrics, including body weight gain, feed intake, and feed conversion ratio, as well as evaluate carcass traits such as slaughter weight, dressing percentage, and meat quality. By assessing the impact of different inclusion levels of ACLM, the study aims to provide valuable insights into the feasibility of using *Ageratum conyzoides* as a feed resource in rabbit production and determine its potential to enhance the economic viability of rabbit farming.

MATERIALS AND METHODS

Study Area

The study was carried out in the Rabbitry Unit of the Animal Experimental Station at the Federal College of Veterinary and Medical Laboratory Technology (FCVMLT), Vom, Plateau State, Nigeria. Vom is located in the north-central region of Nigeria, within a sub-humid climate zone. The area experiences an average annual rainfall of 1,300 mm, and the temperature ranges from 18°C to 30°C, making it suitable for rabbit production and the cultivation of *Ageratum conyzoides*.

Sources of Feed Ingredients and Experimental Animals

All the feed ingredients used in this study were procured from commercial feed suppliers and feed mills in Jos, Plateau State. The *Ageratum conyzoides* leaves were harvested within the premises of the National Veterinary Research Institute (NVRI), Vom. The weaner rabbits were sourced from two reputable breeding units: the Rabbitry Unit of the Animal Experimental Station, FCVMLT Vom, and Dagwom Farm, NVRI Vom, Plateau State. The rabbits were selected based on their health status, uniformity in size, and age, ensuring that they were suitable for the feeding trial.

Experimental Diets and Experimental Design

The experimental diets were formulated to contain approximately 18% crude protein (CP) to meet the nutritional needs of growing weaner rabbits. The ingredients used in the diet formulations included maize (as the primary energy source), maize offal, wheat offal, soybean meal (as a protein source), bone meal, salt, and a premix of vitamins and minerals. Additionally, *Ageratum conyzoides* leaf meal (ACLM) and groundnut haulm meal (GHM)

were incorporated into the diets as protein sources. Five diets were formulated, where *Ageratum conyzoides* leaf meal progressively replaced groundnut haulm meal on a weight-to-weight basis at the following inclusion levels: 0%, 25%, 50%, 75%, and 100%. The diets were designated as D1, D2, D3, D4, and D5, respectively. These diets were assigned to five treatment groups: T1: 0% ACLM (control diet, with 100% GHM), T2: 25% ACLM inclusion, T3: 50% ACLM inclusion, T4: 75% ACLM inclusion and T5: 100% ACLM inclusion (complete replacement of GHM). The study utilized a completely randomized design (CRD), with each of the five treatments having eight rabbits, resulting in a total of 40 rabbits. Each treatment was replicated three times, with two rabbits per replicate, housed in individual cages fitted with feeders and drinkers.

Table 1: Ingredients and composition (%) of the experimental diet

Ingredients	T ₁	T ₂	T ₃	T ₄	T ₅
Maize	30.6	31.6	32.6	32.6	33.6
Wheat Offal	31.4	31.4	31.4	31.4	31.4
Ground nut cake (GNC)	17	16	15	15	14
Ground nut haulm meal(GHM)	15	11.25	7.5	3.75	0
<i>Ageratum conyzoides</i> Leaf Meal (ACLM)	0	3.75	7.5	11.25	15
Bone meal	3.0	3.0	3.0	3.0	3.0
Salt	2.5	2.5	2.5	2.5	2.5
Premix	0.3	0.3	0.3	0.3	0.3
Lysine	0.1	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1	0.1
Calculated Composition (%)					
Crude Protein (%)	18	18	18	18	18
ME, Kcal/Kg	2148	2245	2342	2440	2537
Fat (%)	3.8	4.0	4.0	4.4	4.6
Crude Fibre (%)	12	11	10	8	7
Calcium (%)	1.2	1.2	1.2	1.2	1.2
Available Phosphorus (%)	0.97	0.95	0.93	0.91	0.90
Lysine	0.67	0.70	0.74	0.78	0.81
Methionine (%)	0.3	0.4	0.4	0.4	0.4

Management of Experimental Animals

The rabbits were acclimatized to the experimental environment for one week before the trial began. During the trial, feed and water were provided ad libitum. The rabbits were subjected to standard management practices, including regular cleaning of the cages, vaccination, and monitoring of

Data Collection

Data were collected on growth performance parameters and carcass traits. Feed intake of rabbit for each treatment were measured on daily basis by subtracting the left- over from the feed offered. On weekly basis, rabbit were weighed to determine body weight change. Feed conversion ratio was computed using the formula;

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed consumed (g)}}{\text{Total body weight gain (g)}}$$

At the end of each experiment, one rabbit was randomly selected from each replicate for carcass analysis. After slaughter, slaughter weight, plucked weight, eviscerated weight and



dressed weight for each rabbit were measured. Dressing percentage was calculated using the relationship;

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

Weight of major organs were measured and expressed as percent live weight of rabbit.

$$\text{Organs weight} = \frac{\text{Weight of organ}}{\text{Live weight}} \times 100$$

Statistical Analysis

Data generated during the experiment were subjected to Analysis of Variance (ANOVA) technique as outlined by Steel and Torrie (1990). The treatment means were separated using Duncan's multiple range test (Duncan, 1995).

RESULTS AND DISCUSSION

Production Performance

The result for the production performance of rabbits fed varying levels of *Ageratum conyzoides* leaf meal (Goat weed) is presented in Table 2. The result revealed that there were no significant difference in the initial body weight across the treatment groups, which aligns with findings of Akinfala *et al.* (2018), who observed similar uniformity in initial body weights when introducing alternative forages into rabbit diets. This indicates that the introduction of *Ageratum conyzoides* leaf meal did not negatively affect the starting body weights of the weaner rabbits.

The daily and weekly feed intake values showed a significant increase ($P < 0.05$) across treatments, especially in T4 and T5, with the highest intake observed at 100% ACLM inclusion (T5). This trend is consistent with the findings of Obikaonu *et al.* (2020), who noted that rabbits fed diets with increased forage content tended to have higher feed intake. It is likely that the palatability and fiber content of the ACLM contributed to the higher feed intake, which has been shown to improve gut motility and digestion in rabbits (Ajayi *et al.*, 2019).

Significant differences ($P < 0.05$) were also observed in the total feed intake, with the rabbits on diets T4 and T5 showing higher values compared to those on T1 (control). These results agrees with that of Ukanwoko *et al.* (2018), who reported higher feed intake in rabbits fed diets rich in forage materials, possibly due to the bulkiness and fiber content of the forage, which stimulates greater consumption.

The feed conversion ratio (FCR) values, although not significantly different, showed variability among the treatments. The FCR of T1 (control) was lower compared to T2, indicating that the introduction of ACLM might have caused a temporary reduction in feed efficiency, especially at the 25% inclusion level. However, the FCR improved with increasing levels of ACLM inclusion, particularly in T3, T4, and T5, reflecting findings by Bawa *et al.* (2017), who reported that rabbits on diets with moderate forage inclusion had more efficient nutrient utilization.

The final body weight and total weight gain showed a positive response to increasing levels of *Ageratum conyzoides* leaf meal. T5 (100% ACLM) had the highest final body weight and total weight gain, with values of 1520g and 720g, respectively. This indicates that *Ageratum conyzoides* can serve as a suitable alternative to traditional forage sources like groundnut haulms, contributing to better growth performance when incorporated at high levels, as reported by Omole *et al.* (2016), who observed that rabbits performed well on diets that included non-conventional forages. Furthermore, the higher weight gains observed in

treatments T3, T4, and T5 aligns with the findings of Ogbu *et al.* (2021), who reported enhanced growth performance in rabbits fed on high-quality forage-based diets.

Table 2: Production Performance of Rabbits Fed Graded Levels of Goat Weeds

Parameters indices	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM
Initial Body weight (g)	865	870	820	840	800	0.058 ^{NS}
Daily feed intake (g)	64.6	64.8	65.1	65.4	65.6	0.198 ^{NS}
Weekly feed intake (g)	509 ^c	518 ^{bc}	521 ^b	523 ^a	524 ^a	1.576 [*]
Total feed intake (g)	3563 ^c	3630 ^b	3645 ^{ab}	3664 ^a	3670 ^a	11.06 [*]
Feed Conversion Ratio	4.9	8.4	5.4	5.9	5.1	0.684 ^{NS}
Final Body weight (g)	1400	1300	1480	1450	1520	0.228 ^{NS}
Weekly weight gain (g)	85.0	80.0	97.0	87.0	99.0	0.008 ^{NS}
Daily weight gain (g)	13.0	8.0	12.0	11.0	13.0	0.008 ^{NS}
Total weight gain (g)	630	430	670	688	720	0.054 ^{NS}

abcd- means with different superscripts within each row are significantly different at $p < 0.05$

Carcass Characteristics

The carcass characteristics of weaned rabbits fed varying levels of *Ageratum conyzoides* leaf meal (ACLM) is presented in Table 3. The results in Table 3 are comparable to previous studies on the effects of forage-based diets on carcass proportions. The result showed that, live weight across treatments did not show any significant differences, which is in agreement with the findings of Esonu *et al.* (2020), who reported a similar results in live weights of rabbits fed alternative forage sources. This suggests that the inclusion of ACLM, up to 100% replacement, did not negatively impact the live weight of the animals. The slaughter weight and dressed weight were also not significantly affected by the levels of ACLM in the diets. However, rabbits fed a 50% ACLM diet (T3) had higher slaughter and dressed weights, with values of 1400g and 610g, respectively. These values align with the findings of Bamgbose *et al.* (2018), who reported an improved slaughter and dressed weights in rabbits fed diets containing forage material. The higher dressed weight in T3 may be attributed to the balanced nutrient composition provided by the moderate inclusion of ACLM, which appears to optimize carcass yield.

Dressing percentage, although not significantly different across treatments, ranges from 35.61% to 46.40%. This range is consistent with the results obtained by Obikaonu *et al.* (2020), who reported dressing percentages between 40% and 47% in rabbits fed forage-based diets. The highest dressing percentage in T4 (46.40%) suggests that diets containing 75% ACLM may provide a more favorable carcass yield compared to the control diet. This observation aligns with findings from Ogbu *et al.* (2021), who concluded that moderate forage inclusion in rabbit diets supports efficient conversion of feed into meat. The abdomen and head weights showed notable differences across treatments, with the head weight in T4 and T5 being significantly higher than in T1 and T2 ($p < 0.05$). These findings are supported by Omole *et al.* (2016), who observed increased head weights in rabbits fed diets with high forage inclusion. This could be due to the higher fiber content of ACLM, which may promote better nutrient utilization, especially in the development of head and muscle mass. Waist weight was also significantly higher in T3, T4, and T5 compared to T1 ($p < 0.05$), with T4 showing the highest value (98g). This result is consistent with the observations



made by Ukanwoko *et al.* (2018), who noted that rabbits fed forage-based diets showed increased waist and hind limb muscle development due to the high fiber and nutrient content in the forage. The significant increase in waist weight in treatments with higher ACLM inclusion (50%, 75%, and 100%) further suggests that *Ageratum conyzoides* leaf meal positively influences the deposition of muscle mass in specific body regions. Though not significantly different, the hind limb and forelimb weights tended to increase with higher levels of ACLM, with the highest hind limb weight recorded in T4 (187.5g). This finding corroborates results from Ajayi *et al.* (2019), who noted improved limb muscle mass in rabbits fed diets containing moderate levels of forage material.

Table 3: Effect of ACLM on the Carcass proportion of weaned Rabbits

abcd- means with different superscripts within each row are significantly different at $p < 0.05$.

Parameters	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM
Live weight (g)	1400	1200	1600	1300	1300	0.065 ^{NS}
Slaughter weight (g)	1300	1100	1400	1200	1200	0.073 ^{NS}
Dressed weight (g)	650	480	610	600	450	0.041 ^{NS}
Dressing %	45.49	40.44	40.09	46.40	35.61	1.884 ^{NS}
Abdomen (g)	140	88	160	148	132	11.446 ^{NS}
Head (g)	132.5 ^{ab}	105.1 ^a	131.5 ^{ab}	152 ^b	150 ^b	121.109 [*]
Neck (g)	51.50	30.17	46.03	48.44	40.96	3.411 ^{NS}
Chest (g)	119	72.5	122	108	88	8.939 ^{NS}
Waist (g)	72 ^{ab}	40.5 ^a	94.5 ^b	98 ^b	89.8 ^b	6.714 [*]
Forelimb (g)	104	73	112.5	109.27	79.14	7.141 ^{NS}
Hind limb (g)	210.5	127	178.5	187.5	155	12.999 ^{NS}

Organ Characteristics

The results of internal organ characteristics of weaned rabbits fed diets containing varying levels of *Ageratum conyzoides* leaf meal (ACLM) are presented in Table 4. The result indicated a significant differences in several organ parameters, consistent with findings from previous research on the effects of forage inclusion in rabbit diets. The full gastrointestinal tract (GIT) weight increased significantly ($P < 0.05$) as the level of ACLM in the diet increased, with the highest value recorded in rabbits fed 75% ACLM (T4). This result aligns with the findings of Obikaonu *et al.* (2020), who observed an increase in GIT weight in rabbits fed forage-based diets, attributing this to the higher fiber content in the forages. The increased bulk from fiber could have contributed to the heavier full GIT weight, supporting the notion that dietary fiber stimulates gut development.

The small intestine weight also varied significantly across treatments, with the highest value observed in T3 (50% ACLM). Bamgbose *et al.* (2018) similarly reported enhanced small intestine development in rabbits fed forage-supplemented diets, suggesting that moderate levels of ACLM may improve nutrient absorption and gut efficiency by promoting intestinal growth. For the large intestine, although no significant differences were observed ($p > 0.05$), the values were consistent with those reported by Ogbu *et al.* (2021), who found that forage-based diets did not markedly affect large intestine weights in rabbits. This may indicate that the inclusion of ACLM does not excessively alter hindgut fermentation or water absorption capacities. The liver weight showed significant differences ($p < 0.05$), with rabbits in the 50% ACLM group (T3) having the heaviest liver, consistent with the work of Ajayi *et al.* (2019). They also observed that diets containing moderate levels of forage material



increased liver size, potentially due to the metabolic demands of processing a higher fiber diet. The liver plays a key role in detoxification and nutrient metabolism, which might explain its increased size in rabbits fed moderate levels of ACLM. The caecum weight was significantly higher in T2, T3, and T4 compared to T5 and T1 ($p < 0.05$). This finding aligns with results from Esonu *et al.* (2020), who reported that forage inclusion increased caecum size in rabbits. The caecum is critical for fermentation in rabbits, and a higher caecum weight may suggest enhanced fiber digestion when moderate levels of ACLM are included in the diet.

The pancreas weight showed significant variation, with the lowest values recorded in T2 (25% ACLM) and T5 (100% ACLM). These results corroborate the findings of Bawa *et al.* (2017), who reported that diets high in fiber from forages could alter pancreas size due to changes in digestive enzyme production. The reduction in pancreas size at extreme inclusion levels (25% and 100%) may be linked to dietary imbalance, as noted in similar studies. Interestingly, the heart, lung, kidney, and spleen weights did not show significant differences across treatments. This is consistent with the observations made by Omole *et al.* (2016), who found that forage inclusion had minimal impact on the weights of these internal organs in rabbits. These organs may be less

Table 4: Effect of Experimental diets containing ACLM on the internal organ characteristics of weaned Rabbits

Parameters (g)	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM
Full GIT	235 ^a	256 ^{ab}	253.5 ^{ab}	305 ^b	237 ^a	10.187*
Small Intestine	50.5 ^a	66.5 ^{ab}	75.5 ^b	67.6 ^{ab}	65.49 ^{ab}	3.398*
Large Intestine	139.5	144.5	115.5	148	128.55	4.823 ^{NS}
Heart	3.00	2.60	3.63	3.78	2.86	0.184 ^{NS}
Lung	5.50	6.24	6.19	6.82	6.93	0.363 ^{NS}
Liver	30.00 ^a	27.50 ^a	42.13 ^b	36.51 ^{ab}	31.36 ^{ab}	1.918*
Kidney	9.00	7.29	9.64	7.56	6.67	0.478 ^{NS}
Caecum	59.00 ^{ab}	64.01 ^b	57.77 ^{ab}	74.00 ^b	41.00 ^a	3.855*
Pancreas	1.00 ^b	0.66 ^a	0.73 ^{ab}	0.93 ^{ab}	0.62 ^a	0.054*
Spleen	6.0	2.13	5.75	5.70	4.50	0.600 ^{NS}

^{abcd}- means with different superscripts within each row are significantly different at $p < 0.05$.

CONCLUSION AND RECOMMENDATIONS

The findings revealed that ACLM can be used in rabbit diets, with the 50% inclusion level producing the best growth performance and carcass traits. It also supports good gastrointestinal health and nutrient utilization, making it a valuable alternative feed resource. Based on these results, it is recommended that farmers incorporate ACLM at a 50% inclusion level in rabbit diets for optimal growth and carcass outcomes. Further research is suggested to explore higher inclusion levels and assess the long-term effects of ACLM on rabbit health and reproduction. Conducting a cost-benefit analysis will also help establish the economic advantages of using ACLM as a sustainable feed option. Efforts should be made to promote awareness and training among rabbit farmers on the use of ACLM, especially in regions with high feed costs or limited conventional feed sources. Integrating this forage into feeding programs could enhance the efficiency and profitability of rabbit production.



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