

NUTRIENT DIGESTIBILITY OF WEANER RABBITS FED VARYING LEVELS OF KENAF SEED MEAL AS A REPLACEMENT FOR SOYABEAN MEAL

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ABSTRACT

This study evaluated the nutrient digestibility of weaner rabbits fed varying levels of kenaf seed meal (KSM) as a replacement for soybean meal. Thirty weaner rabbits, aged 5–6 weeks, were randomly assigned to five dietary treatments with six rabbits per treatment, and the study lasted six weeks. The experimental diets replaced soybean meal with KSM at inclusion levels of 0%, 25%, 50%, 75%, and 100%. Digestibility trials were conducted to assess the utilization of nutrients such as crude protein, crude fiber, dry matter, ether extract, and nitrogen-free extract (NFE). The results indicated that dry matter and crude fiber digestibility showed no significant differences across the treatments ($p>0.05$), demonstrating that rabbits can utilize KSM efficiently without adverse effects. However, crude protein and ether extract digestibility differed significantly ($p<0.05$), with the highest protein digestibility observed in the control diet (77.04%) and the lowest in the 100% KSM replacement (68.36%), likely due to anti-nutritional factors in KSM. Ether extract digestibility peaked at the 50% KSM level (89.26%) but declined at 100% KSM, suggesting limitations in fat utilization at higher inclusion levels. In conclusion, KSM can be used as an alternative feed ingredient in weaner rabbit diets, though higher inclusion levels may reduce protein and fat digestibility.

Keywords: Kenaf seed meal, Weaner rabbits, Nutrient digestibility, Soybean meal

INTRODUCTION

In recent years, there has been a growing interest in exploring alternative feed resources in rabbit nutrition to reduce reliance on conventional feed ingredients like maize, soybean meal and other costly protein sources. Rabbits, particularly during the weaner stage, require well-balanced diets to support rapid growth, development and efficient nutrient utilization (Akinfala *et al.*, 2017; Omole *et al.*, 2019). One potential alternative feed resource is kenaf seed meal (KSM), a byproduct of *Hibiscus cannabinus*, known for its high protein content and nutrient profile (Mohammed & Ajayi, 2020). Kenaf seed meals have been primarily used in industries such as paper and textile production, but recent studies have highlighted its potential as a livestock feed ingredient due to its rich composition of proteins, essential amino acids and fats (Morrison *et al.*, 2021; Adekunle & Oluwatosin, 2020). However, limited research has been conducted on the digestibility and nutrient availability of KSM in weaner rabbits, an animal species known for its ability to utilize fibrous materials efficiently (Ekenyem & Madubuike, 2016). Weaner rabbits, defined as young rabbits recently weaned from their mother's milk, have specific dietary requirements that must be met for optimal growth and health (Ajayi *et al.*, 2020). The inclusion of alternative ingredients like kenaf seed meal in their diets offers the possibility of reducing feed costs and enhancing sustainable livestock production (Adewumi *et al.*, 2019). This study aims to evaluate the digestibility of nutrients by weaner rabbits fed varying levels of kenaf seed meal in their diets as a replacement for soyabean meal.

MATERIALS AND METHODS

Study Area

The experiment was conducted at the Abubakar Tafawa Balewa University Research Unit, Bauchi, Bauchi State. Bauchi is located in the northeastern part of Nigeria, with coordinates 10°18'N and 9°50'E. The area experiences a tropical climate, characterized by a hot dry season and a cooler wet season, with an annual rainfall range of 700–1300 mm. The temperature ranges from 21°C to 35°C, which provides a favorable environment for conducting animal studies, including rabbit nutrition experiments.

Experimental Rabbits and Their Management

The feeding trial was conducted using thirty (30) mongrel weaner rabbits obtained from various local rabbit farmers and open markets in Bauchi. The rabbits were between 5–6 weeks of age at the start of the experiment, with an average initial weight of approximately 500–600 grams. The weaner rabbits were randomly assigned to five dietary treatments, with six rabbits per treatment. Each treatment was replicated three times, with two rabbits per replicate in a completely randomized design (CRD). The rabbits were housed in standard cages with appropriate space for ventilation, and they were managed intensively throughout the study. Water and feed were provided *ad libitum* and the animals were dewormed using recommended veterinary drugs. Prophylactic treatments were administered when necessary to prevent common diseases associated with rabbits. The trial lasted for six weeks.

Acquisition and Processing of the Test Ingredient

Kenaf seeds used in this study were purchased from the Muda Lawal Market in Bauchi, Bauchi State. Upon acquisition, the seeds were processed through toasting to reduce anti-nutritional factors and to enhance nutrient availability. The toasted seeds were then milled to obtain kenaf seed meal (KSM). The processed kenaf seed meal was incorporated into the experimental diets.

Experimental Diets and Design

Five experimental diets were formulated to meet the energy and protein requirements of weaner rabbits. The main test variable was the replacement of soybean meal with kenaf seed meal at varying inclusion levels of 0%, 25%, 50%, 75%, and 100%. These diets were labeled as follows T1, T2, T3, T4 and T5 respectively. The composition of the diets was designed to meet the crude protein requirement of weaner rabbits, ensuring that they received adequate nutrients for growth.

Table 1: Ingredients and Composition (%) of the Experimental Diet

Ingredients (%)	Diets				
	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	31.35	31.35	31.35	31.35	31.35
Soyabean meal	20.00	15.00	10.00	5.00	0.00
Kenaf seed meal	0.00	5.00	10.00	15.00	20.00
Wheat offal	25.00	25.00	25.00	25.00	25.00
GNH	20.00	20.00	20.00	20.00	20.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100
Calculated Analysis					
Crude protein	17.85	17.40	16.95	16.50	16.05
ME (kcal/kg)	2700.74	2700.02	2634.67	2623.01	2605.09
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

GNH=Groundnut haulms

Digestibility Trial

A digestibility trial was conducted during the seventh week of the experiment to assess nutrient utilization by rabbits. Two rabbits were randomly selected from each treatment for the trial, and their weights were measured prior to the trial to ensure accurate assessment of feed intake and nutrient digestibility. Known quantities of the respective experimental diets were fed to the selected rabbits. The total fecal output from each treatment group was collected daily for seven days. The collected droppings were dried, weighed and pooled for analysis. Representative samples from the pooled feces were taken for proximate analysis to determine nutrient digestibility. The proximate composition of both the feed and fecal samples was analyzed using standard procedures described by the Association of Official Analytical Chemists (A.O.A.C., 1990). The parameters analyzed included crude protein, crude fiber, ether extract, ash, and nitrogen-free extract (NFE). Digestibility coefficients were calculated for each nutrient.

Statistical Analysis

The data generated from the experiment were subjected to statistical analysis using Analysis of Variance (ANOVA), following the procedures outlined by Steel and Torrie (1990). Treatment means were separated using Duncan's New Multiple Range Test (Duncan, 1995) to determine the significance of differences between dietary treatments. Statistical significance was considered at $p < 0.05$.

RESULTS AND DISCUSSION

The results in Table 2 show the nutrient digestibility of weaner rabbits fed varying levels of kenaf seed meal (KSM) as a replacement for soybean meal. The result revealed that dry matter digestibility across the diets showed no significant differences, with values ranging from 88.00% to 89.73%. This suggests that the inclusion of KSM up to 100% replacement for soybean meal did not negatively impact the rabbits' ability to digest the overall nutrients in the diet. This finding aligns with Omoikhoje *et al.* (2021), who reported that alternative feed

ingredients like kenaf seed meal generally do not affect dry matter digestibility significantly when included in balanced diets for rabbits. Similar results were also observed by Adekunle and Oluwatosin (2020), who found that rabbits efficiently digest diets with fibrous materials like KSM. Crude protein digestibility showed significant differences ($p<0.05$) across the treatments. The highest digestibility was recorded for the control group (T1: 77.04%), while the lowest was observed in the group with 100% KSM replacement (T5: 68.36%). As the level of KSM increased, crude protein digestibility decreased significantly. This reduction in protein digestibility with higher KSM inclusion is likely due to the presence of anti-nutritional factors such as tannins, which are known to reduce protein availability (Mohammed & Ajayi, 2020). No significant differences were observed in crude fiber digestibility among the treatments, with values ranging from 62.27% to 65.16%. This indicates that the inclusion of KSM did not adversely affect fiber utilization in the rabbits, a result that is consistent with previous studies on the fiber digestion abilities of weaner rabbits. Rabbits are known for their ability to digest fibrous materials efficiently, and Morrison *et al.* (2021) found that rabbits can handle diets with relatively high fiber content when the diet is properly balanced. Ether extract digestibility showed significant differences ($p<0.05$), with the highest value recorded in the 50% KSM replacement group (T3: 89.26%) and the lowest in the 25% replacement group (T2: 83.52%). The high digestibility of fats at the 50% replacement level could be attributed to the optimal balance of fat content in the diet at this inclusion level, as kenaf seeds are known to contain essential fatty acids that may enhance fat absorption in rabbits. However, the decrease in ether extract digestibility at the 100% KSM replacement suggests that high levels of KSM might limit fat utilization, possibly due to its high fiber content, which can interfere with lipid digestion (Adewumi *et al.*, 2019). Nitrogen-free extract (NFE) digestibility, representing the digestibility of the carbohydrate fraction of the diet, did not show any significant differences across the treatments, with values ranging from 63.67% to 64.74%. This stability suggests that the carbohydrate components in the diets were effectively utilized by the rabbits regardless of the KSM inclusion level. Similar results were found by Akinfala *et al.* (2017), who reported that carbohydrate digestibility in rabbits tends to remain stable even with varying levels of alternative feed ingredients.

Table 2: Nutrient Digestibility of Weaner Rabbits Fed Varying Levels of Kenaf Seed meal as Replacement for Soyabean Meal

Parameters	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM
Dry matter	88.62	89.73	88.73	88.00	89.52	0.02 ^{ns}
Crude protein	77.04 ^a	75.44 ^{ab}	73.06 ^b	71.43 ^{bc}	68.36 ^c	0.72 [*]
Crude fibre	65.16	62.27	63.57	63.46	64.81	1.86 ^{ns}
Ether extract	86.16 ^{ab}	83.52 ^b	89.26 ^a	87.77 ^{ab}	86.14 ^{ab}	1.29 [*]
Ash	58.51	57.23	57.43	59.44	58.75	2.53 ^{ns}
Nitrogen free extract	63.67	63.96	64.25	64.74	64.38	1.34 ^{ns}

^{abc} - Means bearing different superscripts within a row are significantly different ($* = p<0.05$) SEM - Standard error of means; NS: Non-significant difference

CONCLUSION AND RECOMMENDATION

Kenaf seed meal can replace up to 50% of soybean meal in weaner rabbit diets without negatively impacting nutrient digestibility, though higher levels reduce protein absorption. Further processing to reduce anti-nutritional factors and additional research on its long-term effects and economic feasibility are recommended.

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