Carcass Traits, Sensory Attributes, and Meat Lipid Profile of Rabbits Fed a Synergistic Diet of *Vernonia amygdalina* Leaf Meal and *Mucuna pruriens* Seed Meal

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Abstract

This study explored *Vernonia amygdalina* leaf meal (VALM) and *Mucuna pruriens* seed meal (MPSM) as alternative protein sources in rabbit diets. Thirty-six weaner rabbits were assigned to four treatments in a Completely Randomized Design: control (0% VALM + 0% MPSM), and test diets with 7.5% VALM + 2.5% MPSM, 5% VALM + 5% MPSM, and 2.5% VALM + 7.5% MPSM. Fed ad libitum for 8 weeks, data on carcass characteristics, sensory properties, and lipid profiles were collected. No significant differences ($p>0.05$) occurred in live weight or visceral organ weights. However, the 2.5% VALM + 7.5% MPSM diet improved dressed weight, carcass yield, and loin weight. Sensory evaluation showed significant differences in juiciness and tenderness. The lipid profile indicated reduced triglycerides, total cholesterol, and LDL-cholesterol, with increased HDL-cholesterol in VALM-MPSM groups. Synergistic VALM and MPSM inclusion enhances carcass quality meat's nutritional profile, while the sensory properties was unaffected supporting sustainable livestock production.

Keywords: *Vernonia amygdalina*, *Mucuna pruriens*, rabbit production, alternative protein, carcass quality, sensory evaluation, lipid profile, synergy

Description of Problem

Nigeria's protein deficit, with a per capita intake of 45.4g against the FAO's 53.8g recommendation [1], which highlights the need for solutions like rabbit production, which offers high-quality, low-fat, low-cholesterol protein [2]. However, feed costs hinder production, necessitating cost-effective, nutrient-rich alternatives. *Vernonia amygdalina* (bitter leaf) and *Mucuna pruriens* (velvet bean) are promising due to their high protein, fiber, polyunsaturated fatty acids, and antioxidants, which modulate lipid metabolism [3]. While studied individually, their combined effects are underexplored. This study investigates the synergistic benefits of combining VALM and MPSM on rabbit carcass traits, sensory attributes, and meat lipid profiles, hypothesizing that their combined impact exceeds individual contributions, supporting sustainable and economical rabbit production.

Materials and Method

Site of experimental study

The experiment was carried out at Department of Animal Production, School of Agriculture and Agricultural Technology. Federal University of Technology. Minna has land area of 6784 km and it is situated between latitude 9° 37 North and South equator and longitude 60 33 East with mean annual temperature of 28 - 40°C and mean annual rainfall of 1000 - 1500mm [4].

Source and Processing of Experimental Materials

Fresh *Vernonia amygdalina* leaves were procured from a local market in Minna and dried at room temperature to preserve their green pigmentation before being ground into a meal. *Mucuna pruriens* seeds were obtained from the National Animal Production Research Institute (NAPRI), Zaria, Nigeria. To reduce anti-nutritional factors, the seeds underwent a triple-combination treatment: soaking in warm water for 24 hours, boiling for 1 hour at 100°C, sun-drying to 90% dry matter, and finally roasting for 15 minutes before being ground into a meal.

Experimental animals, management and design

Thirty-six weaner rabbits (5-6 weeks old, 450-700g) were purchased from Bunny Hub Farm, Abeokuta, Nigeria. Upon arrival, they were treated

with anti-stress and prophylactic medications, acclimatized for seven days, and gradually transitioned to experimental diets. The rabbits were housed in individual cages and randomly allotted to four dietary treatments with three replicates each (3 rabbits/replicate) in a Completely Randomized Design (CRD). The diets were formulated as follows and as shown in Table 1: **T1 (Control):** 0% VALM + 0% MPSM: **T2:** 7.5% VALM + 2.5% MPSM: **T3:** 5% VALM + 5% MPSM: **T4:** 2.5% VALM + 7.5% MPSM. Feed and water were provided *ad libitum* twice daily for 56 days.

Collection of data

At the end of the trial, three rabbits per treatment were fasted, slaughtered, and eviscerated. Carcass and organ weights were recorded. Sensory evaluation (colour, flavour, juiciness, tenderness, overall acceptability) was conducted by a 20-member panel on cooked meat samples using a 9-point hedonic scale. Meat lipid profile was analysed from loin samples using standard methods [5].

Table 1: Gross Composition of experimental diet (%)

Ingredient	T1 (%)	T2 (%)	T3 (%)	T4 (%)
Maize	27.09	25.21	25.21	25.21
SBM	25.91	21.79	20.79	20.00
Maize offal	24.00	20.00	21.00	21.79
Rice husk	20.00	20.00	20.00	20.00
VALM	0.00	2.50	5.00	7.50
MPSM	0.00	7.50	5.00	2.50
Bone meal	1.50	1.50	1.50	1.50
Methionine	0.30	0.30	0.30	0.30
Lysine	0.60	0.60	0.60	0.60
Premix	0.30	0.30	0.30	0.30
Salts	0.30	0.30	0.30	0.30
Total	100	100	100	100
	Calculated composition of experimental diets (%)			
Crude protein	17.00	16.98	16.62	16.45
Crude fibre	11.83	11.94	12.10	11.83
Calcium	0.30	0.33	0.32	0.34
Phosphorus	0.37	0.34	0.34	0.34
ME (kcal/kg)	2664	2484	2527	2551

SBM: Soya bean meal, VBM=Velvet bean meal**,** BLM= Bitter leaf meal, NFE= Nitrogen Free Extract.

Statistical analysis

Data were analysed using one-way ANOVA in SPSS software. Treatment means were separated using Duncan's Multiple Range Test at a 5% significance level.

Results and Discussion

Carcass Characteristics

Table 2 shows carcass characteristics with no significant differences ($p>0.05$) in live weight, slaughtered weight, fleeced weight, dressed weight, or carcass yield across treatment groups. Except for rib weight, cut-up parts (head, neck, foreleg, hind leg, loin) showed no significant differences ($p>0.05$), consistent with [6], who found similar results in rabbits fed *Mucuna prurien*. Visceral organ weights (liver, kidney, heart, lungs) were unaffected, indicating that VALM and MPSM inclusion had no adverse effects on organ development, confirming effective processing to reduce anti-nutritional factors. Despite no significance, notable trends emerged. Treatment T4 (2.5% VALM + 7.5% MPSM) recorded the highest dressed weight (889.5 g) and carcass yield (51.40 %), suggesting improved nutrient utilization, particularly protein and nitrogen-free extracts. This aligns with [7], noting that better slaughter yield reflects beneficial dietary protein-energy interactions. T4's superior performance indicates that a higher MPSM proportion, balanced with moderate

VALM, optimizes muscle deposition and carcass development.

Sensory Evaluation

Table 3 presents sensory properties of rabbit meat. Significant differences ($p<0.05$) occurred in juiciness and tenderness, with the control diet (T1) scoring highest and T3 (5% VALM + 5% MPSM) lowest. No significant differences ($p>0.05$) were found for colour, flavour, or overall acceptability. Reduced juiciness and tenderness in treatment groups' likely stem from VALM and MPSM's fat-lowering properties [8], as dietary fat enhances these attributes. Higher fibre in T2-T4 diets may also contribute to firmer texture, as fibre is linked to reduced tenderness [9]. Notably, unchanged colour, flavour, and acceptability indicate that up to 10% VALM and MPSM inclusion produces sensorial comparable meat, ensuring consumer acceptability.

Meat Lipid Profile

The lipid profile results (Table 4) revealed highly significant ($p<0.05$) improvements due to dietary treatments. Rabbits fed the control diet (T1) had the highest values for total cholesterol (TC), triglycerides (TGL), and very low-density lipoprotein (VLDL). In contrast, all treatment groups (T2, T3, T4) showed markedly reduced levels of these atherogenic lipids. Notably, high-density lipoprotein (HDL) – the "good" cholesterol – was significantly increased in all treatment groups compared to the control.

Synergistic Effects:

Lipid profile results reveal a strong synergistic effect between VALM and MPSM, driven by their bioactive compounds. VALM's antioxidants (flavonoids, vernoniosides) and fibers inhibit cholesterol synthesis and absorption [10], while MPSM's L-Dopa enhances lipid metabolism and fat mobilization [8]. Together, they reduce cholesterol synthesis, absorption, and enhance its breakdown and excretion. Treatment T4 (2.5% VALM + 7.5% MPSM) showed the most balanced reduction in atherogenic lipids (TGL, VLDL) and the best carcass yield, indicating that higher MPSM with moderate VALM optimizes both production and health benefits. This diet lowers LDL and triglycerides while raising HDL, reducing cardiovascular risks. This approach offers a Promising strategy for producing functional rabbit meat with significant health benefits.

Table 2: Carcass Characteristic of Weaner Rabbits Fed Diet Containing Leaf and Velvet Bean Seed Meals in Pelleted Diets.

Parameter	T1	T2	T3	T4	SEM	PV	LS
Weight parameter (g)							
LW	1600.0	1754.0	1815.5	1724.0	86.59	0.90	NS
SW	1509.0	1697.5	1760.0	1671.0	87.32	0.85	NS
FW	1193.0	1603.5	1519.0	1448.0	72.56	0.21	NS
DW	733.5	844.5	844.50	852.0	889.5	0.88	NS
CY	45.80	47.13	46.96	51.40	1.36	0.59	NS
Cut up Part (%)							
Head	18.95	19.24	19.06	18.25	0.57	0.96	NS
NECK	6.47^{a}	6.11^{ab}	5.74^{b}	6.08^{a}	0.11	0.09	NS
Fl	21.50	21.62	21.34	19.54	0.39	0.31	NS
Hl	28.01	26.18	27.74	27.88	0.40	0.40	NS
Rib	14.16^{b}	15.32^{a}	12.74^{c}	13.76^{b}	0.35	0.01	**
Loin	28.37	29.80	28.66	31.56	0.65	0.34	NS
Visceral organs (%)							
Liver	6.20	9.01	7.49	6.39	0.70	0.58	NS
Kidney	1.72	1.23	1.18	1.40	0.31	0.33	NS
Hearts	0.57	0.63	0.52	0.47	0.08	0.28	NS
Lungs	1.52	1.11	1.14	1.28	0.09	0.53	NS

LW: Live weight, SW: Slaughtered Weight, FW: Fleeced weight, DW: Dressed Weight, CY: Carcass yield, FL: Fore leg, HL: Hind leg

Table 3: Sensory profile of Weaner Rabbits Fed Diet Containing Bitter Leaf and Velvet Bean Seed Meals in Pelleted Diets.

Parameter	T1	T2	T3	T4	SEM	PV	LS
Colour	7.21	7.08	7.04	6.93	0.05	0.34	NS
Flavour	6.55	7.93	7.23	7.11	0.26	0.41	NS
Juiciness	7.55[a]	6.33[b]	6.23[b]	6.32[b]	0.21	0.04	*
Tenderness	6.57[a]	5.85[b]	5.65[b]	6.48[a]	0.15	0.01	*
Acceptability	7.40	7.20	7.18	7.06	0.13	0.91	NS

[ab] Means in the same row having different superscripts are significantly different ($P \leq 0.05$)

Table 4: Meat Lipid of Weaner Rabbits Fed Diet Containing Bitter Leaf and Velvet Bean Seed Meals in Pelleted Diets.

Parameter	T1	T2	T3	T4	SEM	PV	LS
TC (mmol/l)	58.42[a]	44.63[d]	46.57[c]	48.53	2.00	0.00	**
TGL (mmol/l)	100.57[a]	86.99[b]	84.41[bc]	82.55[b]	2.44	0.01	**
HDL (mmol/l)	13.27[b]	16.13[a]	15.80[a]	15.70[a]	0.43	0.05	**
VLDL (mmol/l)	12.11[a]	10.94[bc]	11.28[bc]	11.52[b]	1.16	0.00	**
LDL (mmol/l)	19.11	17.07	17.18	17.60	4.03	0.99	NS

TC: Total cholesterol, TGL: Triglyceride, HDL: High density lipoprotein, VLDL: Very low-density lipoprotein, LDL Low density lipoprotein, **SEM:** Standard Error of Mean: **PV:** Significant difference, **LS:** Level of significance: **NS:** Not significant **** :** Significant.

Conclusion and Application

The synergistic inclusion of 2.5% *Vernonia amygdalina* leaf meal and 7.5% *Mucuna pruriens* seed meal (T4) in rabbit diets enhances dressed weight and carcass yield without harming animal health, as shown by normal visceral organ development. While juiciness and tenderness slightly decrease, sensory acceptability remains unaffected. Notably, this combination improves meat's nutritional quality by lowering triglycerides, total cholesterol, and LDL-cholesterol while raising HDL-cholesterol, promoting cardiovascular health. VALM and MPSM serve as functional ingredients, supporting sustainable livestock production using local resources.

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