ORGAN PHYSIOLOGY AND TISSUE DEVELOPMENT OF RABBITS BUCKS FED CLOVE (*syzygium aromaticum*) AS A PHYTOGENIC FEED ADDITIVE

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Abstract

This study investigates inclusion level of Syzygium aromaticum as a phytogenic feed additive to enhance organ physiology and tissue development in rabbit bucks. Thirty-six (36) rabbits bucks 2–3 months old, average weight (600–650 g) were allotted into four dietary treatments (T1: 0 g, T2: 5 g, T3: 7.5 g, T4: 10 g clove/kg diet) in a completely randomized design. Data on growth traits, carcass yield, and relative organ weights were analyzed using ANOVA. Carcass characteristics showed significantly higher slaughter weight (2053.47 g) and carcass weight (1806.80 g) in T3, Significant ($p < 0.05$) differences occurred in the heart, kidneys, spleen, stomach, and intestines, particularly at T4, while liver and lung weights were not significantly affected. Relative heart weight was highest in T4 (0.25%). In conclusion, dietary inclusion of S. aromaticum at 7.5 g/kg optimized growth and carcass physiology in buck rabbits, supporting its use as a natural feed additive for sustainable rabbit production.

Keywords: *Syzygium aromaticum*, tissue development, organ physiology, phytogenics

Description of Problem

Global demand for safe, affordable, and sustainable animal protein requires natural growth promoters that enhance productivity without compromising health (1). Phytogenic feed additives (PFAs) such as clove (*Syzygium aromaticum*) have gained interest due to their bioactive compounds, particularly eugenol, which possess antimicrobial, antioxidant, and immunomodulatory properties (2, 3). Rabbits provide high-quality lean meat and play a strategic role in food security, especially in developing countries where smallholder systems dominate (4). Understanding their physiological responses to Phytogenic feed additives (PFAs) is critical for improving carcass physiology and organ function, thereby linking animal physiology to sustainable rabbit production. This study assessed the impact of *S. aromaticum* inclusion on tissue development, and organ physiology of rabbit bucks.

Materials and Methods

Experimental Site:

The study was conducted at the Rabbit Unit of the Teaching and Research Farm, College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The location, in southeastern Nigeria.

Dried *Syzygium aromaticum* (clove) buds were purchased from the local market in Umuahia Abia State, Nigeria. The cloves were thoroughly selected to remove stones and foreign matter, milled using a hammer milled into powder, and stored in an air tight containers then incorporated into the experimental diet.

Experimental Animals and Management:

Thirty-six rabbit bucks (average 663 g initial weight) were placed on a three-week period to acclimatize. Prophylactics were administered. The experimental rabbits were individually housed in newly-built single-cell hutches made of wood, a wire mesh floor with an in-built waste tray, they were allocated into four treatments (T1–T4) with three replicates each. Diets were supplemented with 0, 5, 7.5, and 10 g/kg clove powder. Feed and water were provided *ad libitum*. At the end of the trial, bucks were euthanized for carcass evaluation and organ weight determination. Data were analyzed using one-way ANOVA, and means were separated using Duncan's test at $p < 0.05$.

Table 1: Composition of experimental Diets for rabbits

Ingredients	**T_1(0g/kg)**	**T_2(5g/kg)**	**T_3(7.5g/kg)**	**T_4(10g/kg)**
Maize	44.94	44.94	44.94	44.94
Soya bean meal	17.31	17.31	17.31	17.31
Rice husk	32.00	32.00	32.00	32.00
Fishmeal	2.00	2.00	2.00	2.00
Bone meal	1.00	1.00	1.00	1.00
Limestone	2.00	2.00	2.00	2.00
Vit/min Premix*	0.25	0.25	0.25	0.25
Common salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Syzygium aromatium bud powder(g/kgfeed)	0.00	5.00	7.50	10.00
Crude Protein (%)	17.00	17.00	17.00	17.00
Metabolizable Energy (ME) (Kcal/kg diet)	2505.42	2505.42	2505.42	2505.42
Crude fiber (%)	11.36	11.36	11.36	11.36
Lysine (%)	0.514	0.514	0.514	0.514
Methionine (%)	0.199	0.199	0.199	0.199

*Premix composition (per kg of diet): vitamin A, 12,500 IU; vitamin D3, 2500 IU; vitamin E, 50.00mg; vitamin K3, 2.50mg; vitamin B1, 3.00mg; vitamin B2, 6.00mg; vitamin B6, 6.00mg; niacin, 40mg; calcium pantothenate, 10mg; selenium, 0.10mg; biotin, 0.08mg; antioxidant,200mg;vitamin B12, 0.25mg; folic acid, 1.00mg; chlorine chloride,300mg; manganese, 100mg; iron, 50mg; zinc, 45mg; copper, 2.00mg; iodine, 1.55mg; cobalt, 0.25mg.

Results and Discussion

Carcass traits in (Table 2) reflects tissue development.T3 recorded the highest slaughter (2053.47 g; 98.07%) and carcass weights (1806.80 g; 86.29%). Dressing percentage and prime cuts (loin, ribs, and hind limbs) were also superior in T3, indicating better muscle accretion. In contrast, T4 had the lowest carcass yield (1318.17 g; 66.07%), suggesting inefficiency in nutrient partitioning. Similar improvements in meat yield with phytogenic additives have been reported in poultry and rabbits (5, 6). The effects can be attributed to antimicrobial and antioxidant actions of *Syzygium aromaticum*, which enhances absorption and muscle deposition (7).

Table 2: Effect of feeding different levels of *Syzygium aromaticum* on tissue characteristics of rabbit bucks

Parameters (g)	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Final live weight	1901.14^{b}	1992.67^{ab}	2093.88^{a}	1995.11^{ab}	22.59
Slaughter weight	$1799.62(94.66\%)^{b}$	$1929.70(96.84\ \%)^{ab}$	$2053.47(98.07\%)^{a}$	$1903.11(95.39\%)^{ab}$	85.83
Carcass weight	$1487.07(78.22\%)^{b}$	$1528.77\ (76.72\ \%)^{b}$	$1806.80(86.29\%)^{a}$	$1318.1(66.07\ \%)^{c}$	66.13
Dressed weight	$534.93(27.23\ \%)^{b}$	$1003.98\ (44.86\ \%)^{a}$	$532.90(33.67\%)^{ab}$	$491.83(27.17\ \%)^{b}$	85.92
Skin weight	$237.97(12.11\ \%)^{a}$	$200.49(9.29\ \%)^{c}$	$180.97(11.43\ \%)^{b}$	$152.00(8.39\ \%)^{d}$	10.01
Right forelimb weight	$95.99\ (4.88\ \%)^{b}$	$82.49\ (3.84\ \%)^{c}$	$90.98\ (5.75\ \%)^{a}$	$71.00\ (3.92\ \%)^{c}$	3.00
Left forelimb weight	$85.98\ (4.38\ \%)^{b}$	$89.99\ (4.15\ \%)^{c}$	$84.98\ (5.37\ \%)^{a}$	$67.00\ (3.70\ \%)^{d}$	3.24
Right hind limb weight	$136.98(6.97\ \%)^{b}$	$139.49(6.51\ \%)^{bc}$	$127.97\ (8.08\ \%)^{a}$	$112.59(6.22\ \%)^{c}$	3.43
Left hind limb weight	$142.98(7.28\ \%)^{b}$	$132.49(6.18\ \%)^{c}$	$142.97\ (9.03\ \%)^{a}$	$113.00(6.24\ \%)^{c}$	3.87
Fore feet weight	$14.99\ (0.76\ \%)^{c}$	$18.49\ (0.86\ \%)^{b}$	$14.99\ (0.95\ \%)^{a}$	$10.00\ (0.55\ \%)^{d}$	0.93
Hind feet weight	$37.99\ (1.93\ \%)^{a}$	$34.49\ (1.62\ \%)^{b}$	$30.99\ (1.96\ \%)^{a}$	$25.00\ (1.38\ \%)^{c}$	1.46
Head weight	$202.97(10.33\ \%)^{a}$	$198.99(9.31\ \%)^{b}$	$169.97(10.74\ \%)^{a}$	$157.00(8.67\ \%)^{b}$	5.93
Loin weight	$127.98(6.51\ \%)^{a}$	$88.49(4.10\ \%)^{d}$	$100.98(6.38\ \%)^{b}$	$95.00\ (5.25)^{c}$	4.78
Rib weight	$182.97(9.31\ \%)^{c}$	$211.49(9.84\ \%)^{c}$	$201.96(12.76\ \%)^{a}$	$194.00(10.72\ \%)^{b}$	4.12

Back cut weight	219.97(11.19 %)[b]	254.99(12.01 %)[b]	225.96(14.28 %)[a]	197.00(10.88 %)[b]	6.24

[abcd] values in a row with different superscript are significantly different ($p < 0.05$) and SEM: Standard error of treatment means.

Organ responses (Table 3) showed significant ($p < 0.05$) variations. Heart and kidney weights increased at higher inclusion (T4), reflecting adaptive physiological responses to greater metabolic demand and phytochemical clearance (8). Liver weights (2.46–3.11%) were unaffected, aligning with (6), suggesting hepatic adaptation without pathological enlargement. Stomach and large intestine weights increased at T4, indicating prolonged digestion and fiber retention, while T3 had the lowest small intestine weight, suggesting enhanced absorption efficiency. The spleen weight was slightly elevated in T4, hinting at possible immunomodulation (9). While *Syzygium aromaticum* appears beneficial at moderate doses, excessive inclusion (T4) may induce metabolic stress or compensatory organ growth. These results emphasize the importance of optimizing inclusion levels to maximize physiological benefits while avoiding potential adverse effects.

Table 3: Effect of feeding different levels of *Syzygium aromaticum* on relative organ weight of rabbit bucks

Parameters (%)	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Heart	0.21^{b}	0.17^{c}	0.17^{c}	0.25^{a}	0.01
Kidney	0.43^{d}	0.55^{b}	0.50^{c}	0.61^{a}	0.02
Liver	2.46	3.11	2.85	2.93	0.13
Lungs	0.57	0.60	0.45	0.54	0.02
Spleen	0.03^{b}	0.03^{b}	0.03^{b}	0.04^{a}	0.00
Stomach	3.92^{ab}	4.40^{ab}	3.42^{b}	4.74^{a}	0.21
Small intestine	2.95^{a}	2.90^{a}	2.21^{b}	2.59^{ab}	0.11
Large intestine	6.77^{b}	5.99^{c}	5.80^{c}	8.78^{a}	0.37

[abc] values in a row with different superscript are significantly different ($p < 0.05$) and SEM: Standard error of treatment means.

Conclusion and Application

Clove (*Syzygium aromaticum*) inclusion enhances rabbit buck productivity through improved growth performance, carcass yield, and dose-dependent organ physiological adaptations. Optimal benefits were achieved at 7.5 g/kg diet, organ physiology and tissue development were maximized without undue organ changes.

This demonstrates clove's potential as a sustainable phytogenic additive in rabbit production, linking animal physiology to food security and safe rabbit production. Further studies on long-term reproductive and metabolic effects are recommended.

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