

EFFECTS OF GENOTYPE, PLANTAIN PEEL (*Musa paradisiaca*) AND AFRICAN BLACK PLUM LEAF (*Vitex doniana*) ON BODY WEIGHT GAIN, LIPID PROFILE, AND GLUCOSE TOLERANCE IN CHICKENS

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ABSTRACT

This study investigated the effects of plantain peel (PP) and Vitex doniana (VD) leaf supplementation on body weight gain (BWG), lipid profile, and glucose metabolism in three chicken genotypes: FUNAAB Alpha, Ross 308, and Marshall. A 3 × 2 × 2 factorial design was used with 144 birds assigned to four dietary treatments: control, 2.5% PP, 2.5% VD, and a combination of 2.5% PP + 2.5% VD leaf. Data were analyzed using ANOVA. Genotype significantly affected BWG ($p < 0.05$), with Ross (1872.11 ± 25.49 g) and Marshall (1880.15 ± 25.49 g) chickens outperforming FUNAAB Alpha (508.15 ± 25.49 g). Marshall had higher HDL levels (14.46 ± 1.16 mg/dL) than FUNAAB Alpha (8.49 ± 1.16 mg/dL) and Ross (8.67 ± 1.16 mg/dL) ($p < 0.05$), while LDL, total cholesterol, and triglycerides were unaffected by PP or VD. Glucose tolerance varied by genotype, with FUNAAB Alpha showing higher peak glucose (189.05 ± 5.13 mg/dL) than Ross (148.25 ± 5.13 mg/dL) and Marshall (168.55 ± 5.13 mg/dL). PP improved glucose clearance (K 15–30 min), while VD reduced initial clearance (K 0–15 min). These results suggest that PP and VD leaf influence metabolic parameters in chickens, with Ross and Marshall showing superior BWG, and PP + VD leaf improving glucose clearance in Ross chickens. Further research is needed to understand their long-term metabolic effects.

Keywords: Plantain peel, *Vitex doniana* leaf, Body weight gain, Lipid profile, Glucose tolerance, Poultry metabolism.

INTRODUCTION

Poultry farming is essential for global food production, yet rapid genetic selection for growth has led to metabolic disorders such as obesity and hyperlipidemia, increasing cardiovascular disease (CVD) risks in broilers (Melnik *et al.*, 2021). This affects feed efficiency, meat quality, and poultry farmers' profitability (Arthur and Albers, 2003). Natural feed supplements, including plantain peel (PP) and *Vitex doniana* (VD) leaf, are rich in bioactive compounds that may aid lipid metabolism and glucose regulation (Agama-Acevedo *et al.*, 2016; Agbafor and Nwachukwu, 2011), while *Vitex doniana* leaf has been traditionally used for its anti-inflammatory and cardiovascular-protective properties (Adeyina *et al.*, 2017). However, their effects on body weight gain, lipid profile, and glucose tolerance in poultry remain underexplored. This study examines how PP and VD leaf influence BWG, lipid profile, and glucose tolerance in FUNAAB Alpha, Ross 308, and Marshall breeds, potentially offering sustainable dietary solutions to metabolic challenges in poultry.

MATERIALS AND METHODS

The study was conducted at the Teaching and Research Farm, University of Ilorin, over six weeks. A total of 144 birds (48 per genotype) were assigned to four dietary treatments: control, 2.5% PP, 2.5% VD, and a combination of 2.5% PP + 2.5% VD leaf. The birds received commercial starter and finisher diets, with water provided *ad libitum*. Body weight gain (BWG) was recorded weekly and analyzed for three periods: week 0–2, week 2–5, and week 0–5. At week 6, blood samples were collected from five randomly selected birds per treatment for lipid profile analysis, including LDL, HDL, and total cholesterol. The intraperitoneal glucose tolerance test (IPGTT) was conducted at week 6 after a fasting period of 16–18 hours. Five birds per treatment were injected intraperitoneally with 20% glucose solution (2 g/kg BW), and blood glucose levels were measured at 0, 15, 30, and 75 minutes. Glucose clearance rate (K), glucose delta (Δ), and area under the curve (AUC) were calculated using the trapezoidal method (Pruessner *et al.*, 2003).

Statistical analysis was performed using ANOVA to determine the effects of genotype, PP, VD leaf, and their interactions using the following model: $Y_{ijkl} = \mu + B_i + P_j + V_k + (BP)_{ij} + (BV)_{ik} + (PV)_{jk} + E_{ijkl}$, where Y_{ijkl} = weight (g) or percentage of the component Y of the ijkl bird; μ = overall

mean; Bi = fixed effect of the breed group (i= 1,2); Pj = fixed effect of the plantain peel (j= 1,2); Vk = fixed effect of the *Vitex doniana* (k=1... 4); (BT) ij = the interactions between breed and plantain peel; (BW)ik = the interactions between breed and *Vitex doniana*; (TW) jk = the interactions between plantain peel and *Vitex doniana*; (BTW) ijk = the interactions between breed, plantain peel and *Vitex doniana*; Eijkl = the random error assumed N.I.D. (0, $\sigma^2 \epsilon$). Duncan's Multiple Range Test was used for mean separation at a significance level of $p < 0.05$.

RESULTS AND DISCUSSION

Ross and Marshall chickens had significantly higher BWG than FUNAAB Alpha ($p < 0.05$), confirming their genetic advantage in agreement with Udeh *et al.* (2011). PP and VD leaf had no significant effect on BWG, indicating that while these supplements may improve metabolic health, they do not enhance growth at the tested levels. Marshall chickens had significantly higher HDL than Ross and FUNAAB Alpha ($p < 0.05$). LDL and total cholesterol were not significantly affected by genotype or supplementation. As noted by Akintunde and Toyé (2019), breed-specific differences in lipid metabolism can affect chicken susceptibility to cardiovascular issues. FUNAAB Alpha had the highest peak glucose and slowest clearance, indicating reduced insulin sensitivity. PP + VD leaf improved glucose clearance, particularly in Ross, supporting their potential role in carbohydrate metabolism and insulin sensitivity enhancement. These findings highlight PP and VD leaf as promising natural supplements for metabolic health improvement in poultry. While they do not directly enhance BWG, their effects on glucose metabolism and lipid profile suggest their usefulness in reducing metabolic risks in broilers.

TABLE 1. EFFECT OF GENOTYPE, PLANTAIN PEEL AND *VITEX DONIANA* ON BODY WEIGHT GAIN IN CHICKENS (0-5 WEEKS)

	FUNAAB Alpha	Ross	Marshall	0% Plantain Peel	2.50% Plantain Peel	0% <i>Vitex Doniana</i>	2.50% <i>Vitex Doniana</i>
BWG_wk0-2 ±	108.26 ± 5.41	389.68 ± 5.41	404.36 ± 5.41	298.76 ± 4.69	300.30 ± 4.72	302.99 ± 4.75	296.21 ± 4.65
SEM (N)	(47) ^a	(47) ^b	(47) ^b	(71)	(70)	(69)	(72)
BWG_wk0-5 ±	508.15 ± 25.49	1872.11 ± 25.49	1880.15 ± 25.49	1394.92 ± 34.25	1385.40 ± 34.46	1387.33 ± 34.73	1392.93 ± 33.99
SEM (N)	(47) ^a	(47) ^b	(47) ^b	(71)	(70)	(69)	(72)
BWG_wk2-5 ±	399.89 ± 22.93	1482.43 ± 22.93	1475.79 ± 22.93	1101.68 ± 28.36	1089.21 ± 28.54	1094.20 ± 28.77	1096.72 ± 28.15
SEM (N)	(47) ^a	(47) ^b	(47) ^b	(71)	(70)	(69)	(72)

^{a, b} means with different superscript along the same row are significantly different. BWG_wk0-2; Body Weight Gain Week 0-2; BWG_wk0-5; Body Weight Gain Week 0-5; BWG_wk2-5; Body Weight Gain Week 2-5; N; Sample number

Table 2: Effect and interaction of breed, plantain peel and *vitex doniana* on lipid profile levels in chicken (funaab alpha, ross and marshall)

Trait	LDL	HDL	Triglyceride	Total Cholesterol	
111	32.14 ± 8.03 (5)	8.54 ± 2.31 (5) ^{ab}	6.87 ± 1.73 (5) ^{ab}	42.06 ± 8.11 (5)	
112	9.53 ± 8.03 (5)	8.44 ± 2.31 (5) ^{ab}	6.88 ± 1.73 (5) ^{ab}	19.34 ± 8.11 (5)	
121	34.18 ± 8.03 (5)	10.00 ± 2.31 (5) ^{ab}	8.05 ± 1.73 (5) ^{ab}	45.79 ± 8.11 (5)	
122	20.20 ± 8.03 (5)	6.98 ± 2.31 (5) ^a	7.54 ± 1.73 (5) ^{ab}	28.69 ± 8.11 (5)	
Breed x Plantain Peel x <i>Vitex doniana</i>	211	26.58 ± 8.03 (5)	7.83 ± 2.31 (5) ^a	6.98 ± 1.73 (5) ^{ab}	35.81 ± 8.11 (5)
212	25.55 ± 8.03 (5)	9.71 ± 2.31 (5) ^{ab}	12.13 ± 1.73 (5) ^b	37.69 ± 8.11 (5)	
221	26.53 ± 8.03 (5)	7.59 ± 2.31 (5) ^a	6.39 ± 1.73 (5) ^{ab}	35.40 ± 8.11 (5)	
222	34.66 ± 8.03 (5)	9.54 ± 2.31 (5) ^{ab}	7.82 ± 1.73 (5) ^{ab}	45.76 ± 8.11 (5)	
311	17.02 ± 8.03 (5)	16.03 ± 2.31 (5) ^b	7.24 ± 1.73 (5) ^{ab}	34.49 ± 8.11 (5)	
312	23.07 ± 8.03 (5)	13.86 ± 2.31 (5) ^{ab}	5.66 ± 1.73 (5) ^a	38.05 ± 8.11 (5)	
321	16.75 ± 8.03 (5)	15.73 ± 2.31 (5) ^b	8.36 ± 1.73 (5) ^{ab}	34.15 ± 8.11 (5)	
322	30.97 ± 8.03 (5)	12.22 ± 2.31 (5) ^{ab}	8.45 ± 1.73 (5) ^{ab}	44.88 ± 8.11 (5)	
Interaction	Ns	Ns	Ns	Ns	

CONCLUSION RECOMMENDATION

Ross and Marshall broilers should be prioritized for commercial production due to superior BWG and better glucose metabolism. FUNAAB Alpha chickens require dietary adjustments for improved metabolic efficiency. The inclusion of 2.5% PP and 2.5% VD leaf should be considered for enhanced

glucose metabolism and HDL levels without affecting weight gain. These natural supplements may reduce fat accumulation and improve poultry metabolic health, warranting further long-term studies.

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