Productive Performance of Broiler Chicks Fed Supplemental Levels of Dry Guava (*PsidiumGuajava*) Leaf Meal.

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Abstract:
Issues: Potential side and residual effects of synthetic antibiotic growth promoter both in humans and animals have become a real public health concern globally. This scenario has triggered an explosion of interest in the use of herbs and spices and their products as supplements in animal rations. These new class of natural feed additives are currently referred to as "phytogenics"; guava leaf fits into this class. **Methods:** The paper objective was to determine the productive performance of starter chicks fed diets supplemented with graded levels of dry guava (*Psidiumguajava L*) leaf meal (DGLM) as a phytogenic feed additive. The study was conducted at the livestock experimental unit of National Veterinary Research Institute Vom, Plateau State. A total of 240 unsexed day old cobb broiler chicks were used for the study for a period of 4 weeks. The chicks were randomly allotted to 4 dietary treatments (T_1, T_2, T_3 and T_4) comprising of 60 chicks per treatment. Each treatment was replicated thrice with 20 chicks of similar mean live weight per replicate using a completely randomized design (CRD). T_1 (control), T_2 ,T_3 and T_4 received 0g , 150g , 300g and 450g of DGLM per 100kg basal diets respectively. The diets were iso-nitrogenous and iso-caloric. The diets and water were served to the birds *ad libitum.* The research methodologies were carried out following standard protocols. Performance indices and cost analysis data were collected. **Findings:** Results showed that, though the average daily feed intakes of all the treatments were the same($P>0.05$), the final body weights of birds fed T_4 diets were significantly ($P<0.05$) higher than those fed other diets. Feed conversion ratio, protein efficiency ratio and feed cost ₦/kg weight gain followed similar trend as in body weight gain. **Conclusion:** The study concluded that supplementation at 450g of DGLM per 100kg in chick's diets results in impressive productive performance and could be used in place of synthetic antibiotics/ growth promoter.

Key Words: Broiler Chick, Dry Guava (*PsidiumGuajava L*) Leaf Meal, Performance Indices, Cost Analysis.

1. Introduction

In recent years, phytogenic feed additives have attracted increasing interest as an alternative feeding strategy to replace antibiotic growth promoters. Antibiotics and other synthetic compounds were hitherto, used globally as feed additives. (1) Although these substances achieved good performances, their potential side and residual effects both in humans and animals have become a real public health concern globally. (2) This eventually, led to the ban of the products especially in the Western World and specifically in Sweden since 198). (3) Some of the banned growth promoting antibiotics as indicated by(4) include: avoparcin, tylosin-phosphate, virginiamycin, Zn-bacitracine, spiramycin, olaquindox and carbadox. This scenario has triggered an explosion of interest in the use of herbs and spices and their products as supplements in animal rations (5) (6) (7).The outcome of this study will assist to validate previous claims and reports on the properties and uses of guava (*Psidiumguajava*) plant leaves. This will increase the availability of cheaper and locally available feed additives in broiler chicken production.

2. Literature Review

Poultry farmers are generally faced with the challenge of improving the performance of their birds in order to ensure more net returns. So many research and production strategies have been employed, including the use of antibiotics and other synthetics as performance promoting feed additives to achieve this aim. Feed additives, according to [8] are pro nutrients which are defined as "micro feeding stuff" used orally in a relatively small amount to improve the intrinsic value of the nutrient mix in an animal diet without changing its composition. Feed additives are used to improve the health status, fertility and performance of farm animals. They fortify feed nutrients; improve the feed conversion ratio mainly by regulating feed intake and increasing digestibility of nutrient energy (8).The primary mode of action of phytogenic feed additives arises from beneficially affecting the ecosystem of gastrointestinal microbiota through controlling potential pathogens. Guava (*Psidiumguajava*) plants are widely and locally available and they have long history of nutritional and medicinal properties like the earlier mentioned phytogenic already in use. All the body parts of guava plant as well as the by-products have been used effectively and scientifically validated both for nutritional and medicinal purposes except the leaf meal(9).

3. Objective of the study

The aim of this study was to determine the effect of dry guava (*Psidiumguajava*) leaf meal (DGLM) on the productive performance of broiler chick

4. Methods of the Study

Study Setting and Period of Study: The study was conducted at the experimental unit of Livestock Investigation Division (L.I.D); National Veterinary Research Institute (NVRI) Vom, Plateau State during the periods of 20 October to 18 November, 2015. Vom is located between latitudes 9^0 50' and 10^0 North and longitudes 8^0 55'and 9^0 East. Vom has a cold climatic condition due to its high altitude measuring over 1290 meters above sea level. The average rainfall is between 1,300 mm to 1500 mm and the rainy season extends from late March to early October, July and August being the wettest months. The average daily maximum temperature is 28.6^0C, average minimum temperature is 17^0 C while the mean relative humidity at noon varies between 14 and 17 % (10).

Study design: The study was basically a feeding trial conducted using guava (*Psidiumguajava*) leave to evaluate its' potency as phytogenic feed additive on the performance of broiler chick.

Collection and processing of guava (*Psidiumguajava*) leaves: Fresh and matured green guava leaves used for the experiment were harvested in Vom and its environs in Jos South Local Government Area of Plateau State in the month of October. Leaves were washed and air dried for 7 days to moisture content less than 10% for prolonged storage. They were then milled, using a hammer mill with 2 mm sieve to produce dry guava leaf meal. The leaf meal was weighed, carefully packed in clean polythene bags, labeled and stored under room temperature until use as prescribed by(9).

Plate 1.0: Guava (*Psidiumguajava Linnaeus*) leaves in dry state.

Plate 2.0 Dry guava (*Psidiumguajava Linnaeus*) leaf meal (DGLM)

Nutrient composition of guava (*Psidiumguajava*) leaf meal (DGLM): The guava leaf meal sample was analyzed to determine the proximate constituents like moisture, protein, ether extract, ash and crude fiber according to [11] at the Science Laboratory Technology Unit, University of Jos, Plateau State.

Sample Size: Two hundred and forty (240) unsexed cobb day old broiler chicks were purchased from Zartech farms – Jos, Plateau State for the experiment. The birds were raised in deep litter system following standard brooding, management and biosecurity practices specified for broiler chicken production as described by.[12] This experiment was conducted in the months of October to November and lasted for 4 weeks(starter phase).

Sampling Design: Broiler chicks, upon arrival, were randomly distributed into 4(four) dietary treatments comprising of 60 (sixty) chicks per treatment. Each treatment was replicated thrice with 20(twenty) chicks per replicate using a completely randomized design (CRD). The initial weight of each chick was determined with the aid of electronic weighing scale. Water and feed were made available to the chicks *ad libitum* throughout the period of study.

Study Variables: Four (4) experimental diets were formulated for starter phase in accordance with the nutrient requirements for broiler chicks. (13)The experimental diets were designed thus:

Treatment (T_1) = 0 g DGLM/100 kg basal diet as control; Treatment (T_2) = 150 g DGLM/100 kg basal diet Treatment (T_3) = 300 g DGLM/100 kg basal diet; Treatment (T_4) = 450 g DGLM/100 kg basal diet

Ingredients and their proximate compositions are presented in Tables 1and, 2.

Table 1: Composition of broiler starter diet (Kg)

Ingredients (kg)	Quantity	
Maize	44.50	
Wheat offal	6.60	
Rice offal	4.50	
Soybean cake	39.10	
Fishmeal	2.00	
Bone ash	1.50	
Lime stone	1.00	
Common salt	0.25	
Lysine	0.10	
Methionine	0.20	
Premix	0.25	
Total	**100**	

Calculated Nutrients:

ME/Kcal/kg 2782.78

Crude Protein (%) 23.30

Crude Fiber (%) 4.55

Calcium (%) 1.13

Phosphorus (%) 0.60

Feed Cost ₦/kg 98.29

Bio-mix starter Premix supplied /kg: Vit A = 100000iu, Vit E = 23000mg, Vit. K_3 = 2000mg, Vit B_1 = 1800mg, Vit. B_2 = 5500mg, Niacin = 27,500mg, Panthotenic Acid – 7500mg, Vit B_6 = 3000mg, Vit B_{12} = 15mg, Folic Acid = 750mg, Biotin H_2 = 60mg, Choline Chloride = 300000mg, Cobalt = 200mg, Copper = 3000mg, iodine = 1000mg, Iron = 20000mg, Manganese = 40000mg, Zinc = 300000mg, Selenium = 200mg, Anti-oxidant = 1250mg

Table 2: Percentage composition of broiler starter diets supplemented with graded levels of dry guava leaf meal (DGLM)

Parameters	T1 (+0g DGLM)	T2 (+150g DGLM)	T3 (+300g DGLM)	T4 (+450g DGLM)
Moisture	8.93	8.93	8.95	8.94
Crude protein	22.86	22.87	23	23.03
Crude fibre	5.87	5.87	5.65	5.67
Crude Fat	3.56	3.55	3.57	3.58
Ash	8.87	8.87	8.89	8.68
NFE	49.91	49.89	50.07	50.10
ME Kcal/kg	2909	2908	2921	2924

NFE: = Nitrogen free extract

ME: = Metabolizable energy, calculated using the formula 37×% CP+81.8×% EE+35.5×NFE [14].

5. Data used

Performance indices

Average daily feed intake (ADFI) = quantity of feed served – left over feed

Average daily weight gain (ADWG) = final body weight – initial body weight

Feed conversion ratio (FCR) = feed intake/weight gain

Protein efficiency ratio (PER) = weight gain/protein intake

Mortality = number of dead birds/ Number of birds housed x100

Cost variables: The market cost of the ingredients at the time of experiment were used to calculate the cost of feed per kilogram (₦), total cost of feed consumed (₦) and cost of feed per kilogram weight gain (₦). Productive performance data is presented in Table3.

6. Data Analysis

All data collected were subjected to one -way analysis of variance (NOVA)(15) (using SPSS 17 Software). Means showing significant differences were separated using the Duncan's Multiple Range Test (16).

Table3: productive performance of starter broiler fed diets supplemented with dry guava leaf meal (DGLM)

Parameters	Treatment Levels				
	T_1	T_2	T_3	T_4	SEM
Final body weight (g/b)	673.17[b]	676.17[b]	676.83[b]	684.33[a]	2.134
Average daily weight gain (g/b)	22.28[b]	22.39[b]	22.40[b]	22.68[a]	0.813
Average daily feed intake (g/b)	31.75	31.74	31.75	31.74	0.245[ns]
Feed conversion ratio	1.43[a]	1.42[a]	1.42[a]	1.40[b]	0.041
Protein efficiency ratio	3.05[c]	3.07[b]	3.06[bc]	3.11[a]	0.006
Cost of feed consumed (₦/b)	349.52	349.41	349.52	349.41	NA
Feed Cost/Kg (₦)	98.29	98.29	98.29	98.29	NA
Feed Cost ₦/kg weight gain	139.90[a]	139.20[a]	139.20[a]	137.64[b]	0.28
Mortality (%)	1.67	3.33	1.67	1.67	NA

a, b, c = *Means in the same row with different superscripts are significantly (P < 0.05) different*
NS = *Not significant (P > 0.05)*

SEM = *Standard error of mean*
g/b = *Gram per bird*

NA = *Not analyzed*
₦/b = *Naira per bird*

Results and Discussion

Results:The growth performance indices measured were the final body weight and average daily body weight gain, average daily feed intake, feed conversion ratio (FCR) protein efficiency ratio (PER), feed cost ₦/kg weight gain cost of feed consumed and mortality percentage. The results are as shown in Table 3. The final body weight and average daily weight gain (684.33g and 22.68g) for birds in treatment 4 fed diet supplemented with 450g DGLM/100kg starter ration were significantly (P<0.05) higher than the birds in treatments 1 (control group), 2 and 3 fed diets supplemented with 0 g DGLM, 150 g DGLM and, 300 g DGLM per 100kg of starter ration respectively. The final body weight and daily body weight gain of birds in T_1, T_2, and T_3were statistically the same (P>0.05). The average daily feed intake of all the treatments were also the same (P>0.05) across treatments. The results further showed that the FCR of 1.40, PER of 3.11 and feed cost (₦)/kg weight gain of ₦137.64 recorded in T_4 were significantly ($P<0.05$) better than FCR 1.42, PER 3.05, 3.07, 30.06 and, feed cost ₦/kg weight gain of 139.90, 139.20 and, 139.20 recorded in T_1, T_2 and T_3 respectively. Mortality percentage of 1.67 was observed in T_1, T_3 and T_4 respectively while T_2 had 3.33% mortality.

Discussion

During the starter phase, the mean final body weight and the mean body weight gain increased with corresponding increase in the level of dietary supplementation with DGLM up to 450g/100kg basal diet. This is an indication that broiler chickens could tolerate this level of DGLM in their basal diet. The observed body weight gains met the expected broiler starter performance as indicated by (17).(18) reported similar findings of significant mean final body weight and mean body weight gain increase as the level of dietary DGLM supplementation increased. However, (19) reported that there were no significant differences ($P > 0.05$) across treatments in mean final body weight and mean body weight gain. The variance in the effects of these phytogenic additives could be attributed to differences in methodology, and the level of inclusion (20). Feed intake was not affected by DGLM and there was no significant difference ($P>0.05$) across treatment groups. This observation corroborates the earlier reports of (19). It further suggests that guava leaf meal up to 450g /100kg dietary supplementary inclusion level had no detrimental effects on feed consumption. The birds fed 450g of DGLM per 100kg basal diet had better FCR and PER ($P < 0.05$) than the other groups. FCR depends on two major factors; growth rate and feed intake and both are affected by the quality of the diet.(21) The trends of response observed in this study negate the findings of (19) and (18) who had reported fluctuating effects of DGLM probably due to methodology differences and inclusion levels. The observation made in this study suggest that DGLM improved the FCR and PER of the birds especially at the supplementary level of 450g of DGLM per 100 kg basal diet.(22) indicated that the positive effect which plant feed additives (like DGLM) exert on gastrointestinal tract enzymatic activity, enhances nutrient absorption and digestion. The treatment group fed diet supplemented with 450 g DGLM/100 kg basal diet had a better ($P<0.05$) feed cost₦/weight kg gain than the other groups. This could be due to better FCR, PER and final weight gain influenced by the DGLM inclusion level. For mortality values, negligible percentages were observed across the treatment groups and they ranged from 1.67 to 3.33%. DGLM like other validated phytogenic feed additives contains very active substances which improve digestion, metabolism and have antimicrobial and immune stimulant activities.(19) The low mortality percentage recorded in this study implies that DGLM did not have any detrimental effect on the birds.

6. Conclusion

The study concluded that supplementation at 450g of DGLM per 100kg in chick's diets results in impressive productive performance.

Ethical Approval: All authors hereby declared that "Principles of laboratory animal care" (NIH publication No. 85-23, revised 1985) were followed as well as specific national laws where applicable. All experiment have been examined and approved by the appropriate ethics committee.

Conflict of Interest Statement:

Authors have declared that no competing interests exist.

Funding Statement

The research was funded by personal efforts of the authors.

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