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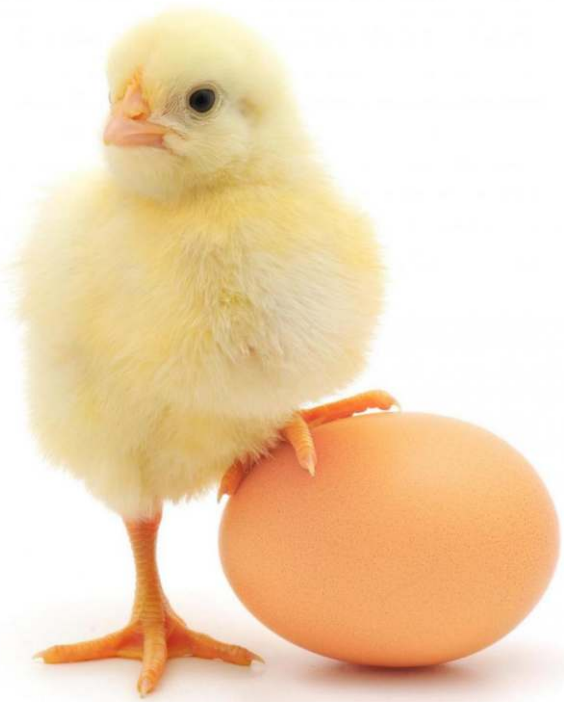

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Effects of Lemmon Grass (*Cymbopogon citratus*) Leaf Meal Feed Supplement on Growth Performance of Broiler Chicks

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Abstract: An experiment was conducted to evaluate the effects of dietary inclusion of Lemmon Grass (*Cymbopogon citratus*) Leaf Meal (LGLM) on growth performances of broiler chickens and its ability to be utilized as a viable alternative to antibiotic growth promoters. The experiment involved two hundred and seventy day-old Abor-acre broiler chickens randomly separated into 3 experimental diet groups, with each being replicated 3 times. Ninety day-old birds were randomly allocated to each group and thirty birds per replicate. The diet groups were: Diet 1 (D 1 = control = basal diet), Diet 2 (D 2 = basal diet +1% LGLM) and Diet 3 (D 3 = basal diet+1% Teramycin antibiotic growth promoter). The birds were brood-reared for six weeks. At day-old the birds were weighed to obtain the initial weight and subsequently weighed weekly to determine weekly body weights and weekly body weight gains. Other parameters taken weekly included feed intake, feed conversion ratio and mortality rates. All the parameters were subjected to statistical analysis using SPSS 2006. The results obtained indicate that the performances of the birds placed on control diet (D1) were significantly ($p<0.05$) lower in all parameters than those placed on D2 and D3. The results further indicated that, although the final body weight of the birds on D2 (1895.56 g) was quantitatively higher than that of the birds in D3 (1875.92 g), the difference was not significant ($p>0.05$). With respect to feed intake and feed conversion ratio, it was observed that there were no significant differences between the birds in D2 and D3. At the end of the experiment the cumulative mortality rate in D2 (3.67%) was found to be significantly ($p<0.05$) lower than the mortality rate for the birds in D3 (3.98%). Based on these results, it can be concluded that, considering the risk of drug resistance which the antibiotics tend to impose on broilers, Lemmon grass leaf meal can be considered as a viable alternative to antibiotics growth promoters.

Key words: Lemmon grass, leaf meal, broiler chickens

INTRODUCTION

For many decades, antibiotics have widely been used as growth promoter to enhance growth and the overall performance in poultry and livestock production The use of antibiotics especially at subtherepeutic levels as a growth promoter has led the to the development of bacterial resistance, cross resistance and multiple resistance (Gould, 2008). W.H.O. defined resistance to antibiotics as the ability of the bacterial population to survive the inhibitory effect of an antimicrobial agent resulting from the previous exposure to, perhaps, sub therapeutic levels of the antimicrobial agent. (Catry *et al*., 2003). The dangers posed by the development of resistance in poultry, livestock and human beings have been documented. Van de Bogaard and Stobberingh (2000) showed that resistant bacteria can be transferred from poultry products to human population through consumption or handling of poultry meat contaminated with the resistant pathogen. De Leener (2005) stressed that once acquired; the resistant bacteria can colonize the human intestines and the genes coding bacteria belonging to the endogenous flora of humans thereby jeopardizing the effective treatment of the bacterial infection. The development of resistance among bacterial populations previously exposed to subtherepeutic dosages has become a growing public issue because the emerging resistant bacterial strains have seriously affected the effectiveness of therapeutic handling of such diseases caused by these resistant bacterial strains. (Anonymous, 2006; Hastre, 2008). However, in 2006, the European Union and many countries including USA banned the use of antibiotics as a growth promoters. (Gould, 2008). As a result of this ban placed on antibiotic growth promoters, a lot of interests were now focussed on search for alternatives to antibiotic growth promoters. Rangasamy and Kaliaiarasil (2007) conducted an experiment to evaluate the effects of *Panchagavya* and *Andrographis paniculata* as alternatives to antibiotic growth promoters on the haematological, serum biochemical parameters and immune status of broilers and concluded that dietary supplementation of *Panchagavya* and *Andrographis paniculata* not only compared very well with the antibiotic growth promoters in terms of weight improvement but also showed significant superiority over the antibiotic growth promoters in terms of immunomodulatory effects on the broilers. El-Hussein *et al*. (2008) also conducted a similar experiment and concluded that performance and immune response of chicks fed on biological feed additives were equivalent or even superior to that of antibiotic promoters. Similarly, Mehala and Moorthy (2008) conducted an experiment to evaluate the effects of *Aloe vera and Curcuma longa* (Turmmeric) as alternatives to antibiotic growth promoters. Based on the results they obtained it was concluded that *Aloe vera* alone or in combination with *Curcuma longa* could effectively be utilized to replace antibiotic growth promoters in broiler production. Kumar *et al.* (2003) also observed that when herbal supplements were included in broiler diets, mortality rates were reduced in the treated groups as compared to the birds fed on control diet. There have been similar experiments with similar results leading to similar conclusions that natural feed supplements can effectively be utilized to promote growth in poultry and livestock while avoiding the dangerous phenomenon of encouraging drug resistant bacteria as in the case of antibiotic growth promoters. (Demir *et al.*, 2003; Cross *et al.*, 2007). It is on this continuous search for more suitable, cheaper and more available bioactive feed additive within the local environment which could be used to replace antibiotics growth promoters, that this experiment was mounted. The experiment was, therefore, designed to evaluate the effects of dietary inclusion of Lemmon grass (*Cymbopogon citratus*) leaf meal on growth performances of broiler chickens and its ability to be utilized as a viable alternative for antibiotic growth promoters. Lemmon grass is an aromatic perennial tropical plant that can grow as high as 3.5 meters with long thin leaves. Lemmon grass was originally found growing wild in India. It produces a network of roots and rootless that rapidly exhaust the soil. In human medicine, Lemmon grass has the following therapeutic properties: analgesic, anti-depressant, antimicrobial, antipyretic, antiseptic, bactericidal, diuretic, fungicidal, insecticidal and nervous system sedative and tonic. (Leite *et al.*, 1986). With all these remedies credited to Lemmon grass it is believed that some of these advantages can be harnessed and brought to bear generally in livestock production and particularly in broiler production to enhance growth and the overall production performance and thus replace the antibiotic growth promoters. Therefore, in conducting this experiment, an approach was adopted so that the outcome of this investigation will have practical application to the farmer. If the results of the experiment are positive, the use of Lemmon grass leaf meal could have the potential for diminishing or even eliminating the adverse effects of using antibiotics and some other biologically active agents as growth promoters. In addition, the use of Lemmon grass leaf meal may also improve feed conversion ratio and so help reduce feed costs in broiler production especially as it is quite inexpensive and it is abundantly available.

MATERIALS AND METHODS

A total of 270 day-old Abor Acre broiler chicks procured from a very reputable Hatchery in Delta State-Nigeria were involved in the experiment. On arrival, the birds were randomly allocated to the 3 test diets. The 3 diet trials were as follows:

Diet A = Control diet- the usual broiler feed without growth promoter.

Diet B = The usual broiler feed + 1% Lemmon Grass Leaf Meal (LGLM).

Diet C = The usual broiler feed + 1% T/M soluble powder (antibiotic growth promoter)

Ninety birds were randomly allocated to each diet group made up of 3 replicates with each replicate having 30 birds. The birds were brooded and reared in brood-rear deep litter pens which were demarcated according to the diet groups and their replicates. The ingredients composition and proximate analysis of the diets (starter and finisher) are presented on (Table 1 and 2) respectively. The leaf meal was prepared by harvesting an orchard and sun-drying the leaves to 79% moisture content. The dried leaves were then milled to get the desired leaf meal. All the birds involved in the experiment were treated equally in all respects except that Diet A (control) does not contain any growth promoter, Diet B contains LGLM while Diet C contains antibiotic growth promoter. At day-old the birds were weighed to obtain the initial weight and subsequently weighed weekly to obtain the weekly body weights and body weight gains. The experiment lasted for 6 weeks. Other parameters measured during this period include feed intake, feed conversion ratio and mortality rates. The data on body weight, body weight gains and mortality rates were transformed into log10 while the data on percentages were transformed into arcsine before being subjected to statistical analysis (Snedeccor and Cochran, 1994). All the data collected were subjected to analysis of variance using the GLM procedure of Statistical Package of Social Sciences (SPSS, 2006). Significant means were separated using Duncan's Multiple Range Test of the same package.

RESULTS AND DISCUSSION

The ingredient composition and the proximate analysis of the experimental diets are presented on (Table 1 and 2) while the results on weekly body weights and weekly body weight gains, feed intake, feed conversion ratio and mortality rates are presented on Table 3.

Body weight and body weight gains: The results as shown on Table 3 have revealed that the dietary inclusion of the growth promoters (Lemmon grass leaf meal and Teramycin soluble Powder) resulted in significantly ($p<0.05$) higher body weight and body weight gains when compared with the birds fed control diet. The higher body weight and weight gains in the treated groups started in week 1 and continued to the end of the experiment at week 6. Although the body weights and the weight gains of the birds treated with

Table 1: Proximate composition of the experimental feeds

	T1		T2		T3	
Ingredients	Starter	Finisher	Starter	Finisher	Starter	Finisher
Lemmon Grass Leaf Meal (LGLM)	-	-	1.0	1.0	-	-
T/M SOL. Powder	-	-	-	-	1.0	1.0
Maize	52.5	57.5	51.50	56.5	51.5	56.5
Soya Bean Meal (SBM)	35.5	30.5	35.5	30.5	35.5	35.5
Beniseed	5.0	5.0	5.0	5.0	5.0	5.0
Blood meal	3.0	3.0	3.0	3.0	3.0	3.0
Bone meal	3.0	3.0	3.0	3.0	3.0	3.0
V/Premix	0.5	0.5	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5	0.5	0.5

Table 2: Calculated nutrient analysis

	Treatment 1		Treatment 2		Treatment 3	
	Starter	Finisher	Starter	Finisher	Starter	Finisher
Crude protein (%)	24	20.44	23.9	20.35	23.90	20.0
M.E (kcal/kg)	2864	2965	2786	2878	2816	2876
Crude fibre (%)	3.58	3.65	3.79	3.81	3.65	3.69
Total Ash	6.65	6.72	6.72	6.78	6.60	6.67
E.E.	2.65	2.60	2.72	2.75	2.69	2.71
NFE	64.68	66.65	63.80	65.63	64.64	66.24
Calcium	1.07	1.12	1.12	1.09	1.18	1.07
Total phosphorus	0.63	0.71	0.82	0.87	0.64	0.73
Lysine	1.59	1.62	1.62	1.59	1.59	1.63
Methionine	0.38	0.35	0.38	0.39	0.35	0.37

Lemmon Grass Leaf Meal (LGLM) were quantitatively higher than those of the birds treated with Teramycin soluble powder (T/M), the difference was not significant ($p>0.05$). At the end of the experiment, the final body weights in Diet 1 (control = 1856.75 g) was significantly ($p<0.05$) lower than those birds treated with LGLM (Diet 2 = 1895.65 g) and those treated with T/M (Diet 3 = 1875.92 g). However, the difference between the body weights of birds in Diet 2 (1895.65 g) and Diet 3 (1875.92 g) was not significant ($p<0.05$). The body weight gains of the treated birds (Diet 2 and Diet 3) continued to be significantly ($p<0.05$) higher than those of the birds fed with control diet (Diet 1). At the end of the experiment, the cumulative weight gains in Diet 1 (control = 1810.36 g) was significantly ($p<0.05$) lower than those of Diet 2 (1849.20 g) and those in Diet 3 (1828.77 g). These results are consistent with those obtained by Rangasamy and Kaliaiasil (2007) who observed that the dietary inclusion of *Andrgraphis paniculata* not only compared very well with antibiotic growth promoters in terms of growth improvement but also showed significant superiority over the antibiotic growth promoters in terms of immunomodulatory effects on the broiler chickens. Similar observations have been made by many scholars who have done a lot of work on substituting antibiotic growth promoters with herbs and other biological feed additives. (El-Hussein *et al*., 2008; Mehala and Moorthy, 2008; Moorthy *et al*., 2009).

Feed intake: Analysis of data on mean cumulative feed intake as shown on Table 3 revealed that, with the exception of week 2, there were significant ($p<0.05$) differences in feed intake between the birds on control diet (Diet 1) and those fed on diets treated with either Lemmon grass leaf meal (Diet 2) or those placed on antibiotics growth promoter. This result is at variance with the observation made by Mehala and Moorthy (2008). They claimed that there were no significant ($p>0.05$) differences between the control and treated groups, probably due to the iso-caloric and iso-nitrogenous nature of the experimental diets. Moorthy *et al*. (2009) similarly observed no significant ($p>0.05$) differences between the control and the treated groups. However, the difference between the result obtained in this experiment and the other previous experiments may be attributed to the differences in the herbs used in the experiments. While the previous experiments used Aloe vera, this experiment utilized Lemmon grass leaf meal.

Feed conversion ratio: Table 3 also presents the result on Feed Conversion Ratio (FCR) for the experimental broiler chickens. From the table it can be observed that FCR was significantly ($p<0.05$) poorer in the birds on control diet than the birds in the other treatment groups. The implication of this is that the quantity of feed consumed to gain 1 kg of body weight was significantly ($p<0.05$) higher in the birds fed control diet than in the birds fed diets containing growth promoters. This trend continued to the 6^{th} week when the experiment terminated. During this period also, it was observed that, with the exception of week 3, there were no significant ($p<0.05$) differences in FCR between the birds placed on

Table 3: Weekly performance parameters of the experimental broiler chickens

Age (weeks)	Parameters	Treatments Diet 1	Diet 2	Diet 3
	Hatch weight (g)	46.39ᵃ±0.39	46.45ᵃ±0.45	46.65ᵃ±0.55
1	Body weight (g)	156.72ᵇ±1.73	166.55ᵃ±1.95	165.78ᵃ±1.86
	Weight gain (g)	110.33ᵇ ±1.35	120.10ᵃ±2.10	119.13ᵃ±1.25
	Feed intake (g)	135.40ᵃ±2.65	132.06ᵇ±2.05	133.45ᵇ±2.11
	Feed conversion ratio (r)	1.23ᵇ±0.02	1.10ᵃ±0.02	1.12ᵃ±0.02
	Mortality (%)	0.10ᵃ±0.00	0.00ᵇ±0.00	0.00ᵇ±0.00
2	Body weight (g)	354.85ᵇ±9.65	365.45ᵃ±9.50	370.45ᵃ±10.06
	Cumulative weight gain (g)	308.46.b±6.55	319.00ᵃ±7.19	323.80ᵃ±8.25
	Cumulative feed intake (g)	499.65ᵃ ±8.24	498.65ᵃ±9.25	501.36ᵃ±10.26
	Cum. feed conversion ratio (r)	1.61ᵃ±0.01	1.56ᵇ±0.01	1.55ᶜ.±0.01
	Cumulative mortality (%)	4.40ᵃ±0.05	1.69ᵇ±0.06	1.85ᶜ±0.04
3	Body weight (g)	708.54ᵇ±10.45	724.42ᵃ±11.50	721.52.ᵃ±9.50
	Cum. Body weight gain (g)	662.15ᵇ±8.74	677.97ᵃ±9.65	674.87ᵃ±8.75
	Cum. feed intake (g)	1132.26ᵃ±18.50	1095.86ᵇ±18.55	1098.76ᵇ±17.25
	Cum. feed conversion ratio (r)	1.71ᵇ±0.02	1.62ᵃ±0.01	1.63ᵃ±0.01
	Cumulative mortality (%)	5.56.ᵃ±0.08	3.70ᶜ±0.05	3.96ᵇ±0.04
4	Body weight (g)	1120.59ᵇ±11.32	1136.11ᵃ±11.65	1128.51ᵇ±10.56
	Cum. body weight gain	1074.20ᵇ±8.75	1089.66ᵃ±7.78	1081.86ᵃ±7.75
	Cum. feed intake (g)	1856.62ᵃ±18.55	1811.55ᵇ±16.45	1825.85ᵇ±17.75
	Cum. feed conversion ratio (r)	1.73ᵇ±0.02	1.66ᵃ±0.03	1.69ᵃ±0.02
	Cumulative mortality (%)	6.50ᵃ±0.28	3.50ᶜ±0.18	3.90ᵇ±0.21
5	Body weight (g)	1456.78ᵇ±15.65	1478.69ᵃ.±15.95	1465.42ᵃ±18.56
	Cum. weight gain (g)	1410.39ᵇ±12.75	1432.24ᵃ±17.75	1418.77ᵃ±15.65
	Cum. feed intake (g)	2676.75ᵃ±18.75	2655.35ᵇ±16.35	2645.95ᵇ±17.25
	Cum. Feed conversion ratio (r)	1.90ᵃ±0.03	1.85ᵇ±0.02	1.86ᵇ±0.02
	Cumulative mortality (%)	6.67ᵃ±0.51	3.65ᶜ±0.35	4.40ᵇ±0.37
6	Body weight (g)	1856.75ᵇ±21.55	1895.65ᵃ±24.52	1875.92ᵃ±23.43
	Cum. weight gain (g)	1810.36ᶜ±16.75	1849.20ᵃ±18.76	1829.77ᵇ±15.76
	Cum. feed intake (g)	3498.25ᵃ±17.86	3484.65ᵃ±17.55	3479.67ᵇ±16.95
	Cum. feed conversion ratio (r)	1.92ᵇ±0.03	1.88ᵃ±0.02	1.90ᵃ±0.03
	Cumulative mortality (%)	6.67ᵃ±0.86	3.67ᶜ±0.22	3.98ᵇ±0.25

[a,b,c]Means within the same row with different superscripts are significantly different (p<0.05)

T2 and T3. This observation appears to be at variances with those expressed by Mehala and Moorthy (2008) and Moorthy *et al.* (2009). They explained that it was only in week 1 that the FCR in Diet 1 was significantly (p< 0.05) poorer than in the other diet groups, thereafter and up to the end of 6 weeks when the experiment terminated, there were no significant (p>0.05) differences among the various treatments. These variations in the response of the experimental broiler chickens may be a reflection of the differences in the nutrient and chemical compositions of herbs used or may due to breed differences of the broilers used in this experiment.

Mortality rates: The results on the cumulative mean mortality rates are also presented on Table 3. From this table it can be observed that significant (p<0.01) differences exist between the birds fed control diet and those fed diets containing growth promoters. At the end of the experiment (6 weeks), the mortality rate for the birds on control diet was 6.67% which was significantly (p>0.01) higher than those placed on diet containing Lemmon grass leaf meal (Diet 2 = 3.67%) and those placed on diet containing antibiotic growth promoter (Diet 3 = 3.98%). The result also shows that the difference between the mortality rates in D2 (3.67%) and in D3 (3.98%) differed significantly (p<0.05). This result is consistent with the conclusion drawn by Kumar *et al.* (2003). They observed that when the birds were fed diets containing growth promoters, mortality rates were reduced as compared with those birds placed on control diet. This reduction in mortality is a manifestation of the ability of the growth promoters to check the microbial activities and thus reduce infections and mortality rates.

Conclusion: Based on the available results so far, it can be concluded that Lemmon Grass Leaf Meal (LGLM) used in this experiment gave similar and in some cases better performance than the antibiotic growth promoter. Feeding broiler on diets containing antibiotic growth promoter had no superiority over diets containing LGLM in terms of body weights and body weight gains, feed intake, feed conversion ratio and mortality rates. Taking into consideration, the possible risk of antibiotic growth promoters on human and livestock health, inclusion of Lemmon grass leaf meal in the diets of broilers is recommended as a viable alternative to antibiotic growth promoters.

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