# EVALUATING PHYTOGENIC COMPOSITION OF ORANGE PEELS, LEMON PEEL, LEMON GRASS, CURRY LEAVES, THEIR COMBINATIONS AND RESULTANT EFFECT ON BROILER CHICKEN PERFORMANCE

*****Aderibigbe, A.E., *Fafiolu, A.O., *Oso, A.O. and **Akamo, J.A.**
*Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, Nigeria.
**Department of Biochemistry, Federal University of Agriculture, Abeokuta, Nigeria.
*** Graduate student, Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, Nigeria.
*Corresponding author: Aderibigbe, A.E, Email- ochabaadedoyin@gmail.com. 08131363113*

**ABSTRACT**
*Phytogenics are becoming increasingly acceptable as alternative to in-feed growth promoters in farm animals. Some of the phytogenics identified included orange peel (OP), lemon peel (LP), lemon grass (LG) and curry leaf (CL). Therefore, the aim of this study is to assess the phytochemical composition of the test ingredients and the impact of dietary additives of selected phytogenics in different combination and equal quantity to determine their resultant synergistic effects on broiler chickens performance. A total of 320 day-old (Ross 308) broiler chickens were allotted to 8 dietary treatments with four (4) replicates of ten (10) birds each. Dietary treatments included basal diet without additive (negative control; T1), with antibiotics (positive control; T2), 50% LP+ 50% OP (T3), 50% LP+50% LG (T4), 50% LP+50% CL (T5), 50% OP+50% LG (T6), 50% OP+50% CL (T7), and 50% LG+50% CL (T8). The experiment lasted for 42 days. Analytical screening of test ingredients and growth performance were evaluated. Data obtained were subjected to one-way Analysis of Variance (ANOVA). Results obtained revealed that the test ingredients contain substantial quantities of phytochemicals including flavonoid, terpernoid, steroid and alkaloid. Feed conversion ratio was significantly reduced ($p<0.05$) in birds fed LP + CL supplemented diet at 3 weeks which resulted in the increased ($p<0.05$) final weight gain of birds in this treatment at 6 week. In conclusion, combinations of selected phytogeniics improved their phytochemical content such as tannin in LP + LG and improved final weight gain (LP + CL) better than the control groups.*

## INTRODUCTION
A growing number of studies have found that adding plant-derived substances i.e phytogenic feed additives (PFAs) to animal's diet improves zootechnical, animal health indices, cost benefit and also assured the safety of the consumers (Murugesan *et al.*, 2015;Hendersona *et al.*, 2018). They contain phytochemical compounds which are generally considered safe, natural, less toxic, residue free and ideal feed additives for an animal when compared to synthetic antibiotics or inorganic chemicals. They have been proved to have a wide range of benefits such as improving feed properties, performance and productivity of livestock and their products through the improvement of digestibility, nutrient absorption and elimination of pathogens in the animal gut (Windisch *et al.*, 2008). Orange peels (OP), lemon peels (LP), lemon grass (LG) and curry leaves (CL) have been reported to have these phytochemicals abundantly (Syed *et al.*, 2015; Rehab *et al.*, 2018), they are readily available and cost effective. In view of their several individual benefits, the present study was conducted to evaluate the phytogenic composition and effects of different combination of the selected phytogenics on performance of the broiler chickens.

## MATERIALS AND METHODS
### *Experimental location*
The study was carried out at the Poultry Unit, Teaching and Research Farms, Federal University of Agriculture Abeokuta, Ogun State.

### Experimental birds and design management
Three hundred and twenty (320), a day old, unsexes, broiler chicks (Ross strain) with similar hatching weight were randomly allotted in a completely randomized design to eight dietary treatments. Each treatment had four replicates of ten chicks each. All the chicks were raised in an adjustable cage system under standard management conditions throughout the experimental period of 42days. The

birds had unrestricted access to feed offered in mash form and clean water during the study. Biosecurity measures and vaccination programme was strictly adhered to.

Basal diets were formulated in accordance with the NRC (1994) specifications for starter and finisher phases (Table 1). Dietary treatments include basal diet without additive (-ve control; T1), with antibiotics (+ve control; T2) (Keproceryl(R)), LP+OP (T3), LP+LG (T4), LP+CL (T5), OP+LG (T6), OP+CL (T7), and LG+CL (T8), 1g of each treatment per kg of feed were include

**Table 1: Diets composition and calculated nutrient contents of the basal diets**

| Ingredients (g/kg) | Starter (1 – 21 d) | Finisher (22 – 42 d) |
|---|---|---|
| Maize | 52.55 | 57.30 |
| Soybean Meal | 37.50 | 31.35 |
| Fish meal (72% CP) | 1.50 | 0.00 |
| Vegetable oil (PK oil) | 2.00 | 3.00 |
| GNC | -- | 2.50 |
| Limestone | 3.50 | 3.00 |
| Bone meal | 2.00 | 2.00 |
| Salt (NaCl) | 0.35 | 0.30 |
| L-Lysine HCL | 0.10 | 0.10 |
| DL-Methionine | 0.15 | 0.15 |
| Vitamins & Minerals Premix* | 0.35 | 0.30 |
| **Total** | **100.0** | **100.0** |
| **Determined nutrient level** | | |
| ME (Kcal/kg) | 2902.11 | 3012.09 |
| Crude protein | 22.78 | 20.41 |
| Ether extract | 4.42 | 5.59 |
| Crude fibre | 3.69 | 3.64 |
| Lysine | 1.36 | 1.14 |
| Methionine | 0.51 | 0.46 |

**Premix contains vitamin A: 12,000,000IU, Vit D3: 2, 5000, 000IU, Vit K: 2,000mg, Vit B1: 2,250mg, Vit B2: 6,000mg, Vit B6:4,500mg, Vit B12:15mg, Niacin 40,000mg, Panthothenic acid: 15,000mg, Folic acid: 1,500mg, Biotin: 50mg, Choline chloride: 300,000mg, Manganese: 80,000mg, Zinc: 50,000mg, Iron: 20,000mg, Copper: 5,000mg, Iodine: 1,000mg, Selenium: 200mg, Cobalt: 50mg, Antioxidant: 125,000mg, PK oil- palmkernel oil, GNC- groundnut cake, ME- metabolizable energy*

***Growth performance***

Birds were weighed on a weekly basis to determine daily weight gain. Feed intake record was taken as the difference between the feed offered and leftovers for each replicate on weekly basis to obtain daily feed intake. Feed conversion ratio (FCR) was estimated as the ratio of feed consumed to weight gain and was adjusted for mortality.

**Chemical analysis**

Phytochemical screening for major constituents were determined using standard qualitative procedures as previously described (Mordi and Akanji, 2012). Proximate composition of individual phytogenic, formulated blends, compounded feeds and feacal samples were determined following the standard procedures of the Association of Analytical Chemists (AOAC, 2000)

**Statistical analysis**

All data collected were subjected to One Way Analysis of Variance (ANOVA) in a Completely Randomized Design (CRD) using SAS (2007) procedure. Significant means were separated using Duncan Multiple Range Test at 5% level of significance.

**RESULTS AND discussion**

As presented in table 2, phytochemical composition screening of the test ingredients revealed that all test ingredients contain substantial amount of measured parameters (tannin, saponin, alkaloid, phenol, steroid, reducing sugar, cardiac glycoside, terpernoid, steroid, Phlobatanin and flavonoid) and that orange peel, lemon peel and combinations of some selected phytogenics were rich in all measured

phytochemicals than their individuals. Combinations of LP+OP had the highest flavonoid content (83.70 mg/100g), LP+OP highest alkaloid (100.31 mg/100g) and LP+CL had the highest reducing sugar (77.76 mg/100g) content, highest tannin (57.70 mg/100g) and phenol (79.32 mg/100g) were obtained in OP+LG and OP+CL had highest saponin and cardiac glycoside 83.38 mg/100g and 63.89 mg/100g respectively. However, OP (orange peel) had the highest value of terpernoid (49.80 mg/100g) and LP had the highest value of steroid (48.03 mg/100g) among other test ingredients while curry leaves (CL) lack tannin, saponin, phenol and reducing sugar and lemon grass (LG) lack saponin and phenol**.** This is in agreement with this study Josephine and Ngozi (2015) who reported that synergistic combination of peel extracts (orange, lemon, lime, tangerine, grapefruit) in equal ratio used in their study were most beneficial and Cross *et al.* (2007) reported that synergistic or antagonistic interactions of plant extracts may influence their potentials.

**Table 2: Phytochemical composition of the selected phytogenics**

| Treatment (mg/100g) | Tannin | Saponin | Alkaloid | Phenol | Reducing sugar | cardiac glycoside | Terpernoid | Steroid | Flavonoid |
|---|---|---|---|---|---|---|---|---|---|
| LP | 43.53 | 53.68 | 79.59 | 59.84 | 41.21 | 50.95 | 44.45 | 48.03 | 80.52 |
| OP | 46.17 | 48.69 | 80.75 | 63.47 | 66.84 | 60.97 | 49.80 | 41.90 | 78.38 |
| CL | - | - | 78.46 | - | - | 41.70 | 34.17 | 31.96 | 67.08 |
| LG | - | 69.06 | 97.92 | - | 46.60 | 45.16 | 32.31 | 38.50 | 64.67 |
| LP+OP | 54.23 | 67.81 | 100.31 | 74.55 | 71.23 | 43.89 | 27.90 | 31.34 | 83.70 |
| LP+LG | 45.09 | 64.79 | 78.50 | 61.99 | 74.79 | 46.31 | 34.36 | 32.86 | 81.66 |
| LP+CL | 52.16 | 58.94 | 93.28 | 71.70 | 77.76 | 52.51 | 31.66 | 30.44 | 82.88 |
| OP+LG | 57.70 | 61.17 | 82.74 | 79.32 | 74.98 | 57.07 | 38.77 | 35.81 | 74.03 |
| OP+CL | 54.91 | 83.38 | 78.85 | 75.49 | 54.43 | 63.89 | 45.59 | 45.53 | 56.36 |
| LG+CL | 45.86 | 51.05 | 75.98 | 63.04 | 46.21 | 59.12 | 40.69 | 25.29 | 58.58 |

LG - Lemon grass, CL - Curry leaf, LP - Lemon peel, OP - Orange peel.

As presented in table 3, the weight gain, feed intake and survival rate of broiler chickens fed dietary treatments at 0-3weeks were not significantly (P>0.05) affected across the treatments, birds fed LP+CL supplemented diet had a significantly (P<0.05) improved FCR which in turn led to an increased in final weight gain at 6 weeks compared to other groups. this weight enhancement of lemon peel and curry leave might result from improved nutrient digestibility of the combination and the positive synergistic effect of curry leaves and lemon peels may be attributed to the biological function or pharmacological activities of the phytochemical components of the combination, this

**Table 3: Synergetic effect of selected Phytogenics on performance of broiler chickens (0-3weeks)**

| Parameters | T1 (-ve control) | T2 (+ve control) | T3 (LP+OP) | T4 (LP+LG) | T5 (LP+CL) | T6 (OP+LG) | T7 (OP+CL) | T8 (LG+CL) | SEM | P-VALUE |
|---|---|---|---|---|---|---|---|---|---|---|
| Final wt (g) | 698.86 | 723.86 | 704.09 | 709.09 | 721.71 | 699.66 | 687.12 | 663.18 | 19.07 | 0.428 |
| DFI (g/day) | 47.51 | 44.42 | 44.28 | 48.65 | 42.34 | 47.67 | 49.35 | 44.37 | 1.66 | 0.007 |
| FCR | 1.53$^{ab}$ | 1.38$^{ab}$ | 1.41$^{ab}$ | 1.54$^{ab}$ | 1.31$^{b}$ | 1.53$^{ab}$ | 1.62$^{a}$ | 1.51$^{ab}$ | 0.05 | 0.512 |
| SURV % | 97.73 | 97.73 | 97.73 | 100.00 | 90.91 | 90.91 | 95.46 | 88.64 | 4.35 | 0.428 |
| 4-6weeks | | | | | | | | | | |
| Final wt (g) | 2195.25ab | 2126.82ab | 2261.82ab | 2293.18ab | 2344.40a | 2145.00ab | 2041.77b | 2056.62ab | 61.73 | 0.016 |
| DFI (g/day) | 145.56 | 139.68 | 139.60 | 141.25 | 144.83 | 142.18 | 135.16 | 135.77 | 4.54 | 0.677 |
| FCR | 2.06 | 2.10 | 1.90 | 1.88 | 1.88 | 2.08 | 2.13 | 2.05 | 0.12 | 0.579 |
| SURV % | 97.73 | 97.73 | 100.00 | 100.00 | 95.23 | 100.00 | 97.73 | 96.88 | 2.03 | 0.650 |

abcde Mean values having different superscript along were significantly(P<0.05) different. SEM: Standard Error of Mean. SEM: Standard Error of Mean, FCR- Feed conversion ratio, DWG- Daily weight gain, DFI- Daily feed intake, LG - Lemon grass, CL - Curry leaf, LP - Lemon peel, OP - Orange peel., LG - Lemon grass, CL - Curry leaf, LP - Lemon peel, OP - Orange peel.

result partially disagreed with the study of Reihan and Majid (2017) who observed that feeding graded levels of dried lemon pulp (2.5% -12%) decreased daily feed (DFI) intake in broiler chickens but resulted in deteriorated FCR across various periods of production (starter to finisher stage) than the control and in agreement, with Sampath *et al.* (2011) who reported that feed conversion ratio in curry leaves supplemented diet were lower than that of basal diets group. However, birds fed orange peel

and curry leave supplemented diet had highest FCR at 3 weeks had lowest (P<0.05) and weight gain at 6 weeks.

## CONCLUSION

Synergistic combinations of orange peels, lemon peels, curry leaves and lemon grass were most beneficial, as they improved the phytochemical content than their individual usage. Combined phytogenic feed additives (orange peels, lemon peels, curry leaves and lemon grass) can be incorporated into the diets of broiler chickens to replace antibiotic in feed and enhance performance efficiency as they have similar or better results with the antibiotic group especially (LP+CL) improve feed conversion ratio of broiler chicks at 0-3weeks and final weight gain of 6 weeks broiler chickens.

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