GROWTH PERFORMANCE AND COST-BENEFIT ANALYSIS OF BROILER CHICKENS FED *Moringa oleifera* DRIED LEAF MEAL AS A PHYTOGENIC REPLACEMENT OF SYNTHETIC PREMIX

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ABSTRACT

*Global focus on organic food products and the search for alternative replacement of synthetic feed supplements and additives especially in Low – Income Food Deficit Countries (LIFDCs) necessitated the evaluation of performance and cost of broilers fed Moringa oleifera dried leaf meal as a phytogenic replacement of synthetic premix using a total of one hundred (100) Anak 2000 strain of day old broilers that we re randomly assigned to five treatment groups of two replicates each representing 0, 25, 50, 75 and 100% replacement by weight of synthetic premix with Moringa oleifera. Experimental diets were formulated to provide crude protein (CP%) and metabolizable energy (ME) of 22% CP and 3200 kcal/kg ME and 20% CP and 3000 kcal/kg ME and the feeding trail lasted (1- 28 d) and (29- 52 d) for starter and finisher phases, respectively. Performance and cost parameters (average body weight gain (BWG) feed intake, FCR, the Performance index (PI), cost of feed per kilogramme (kg) diets, total cost of feed consumed, cost of feed per kilogramme kg body weight gain, total cost of production, revenue and gross margin) evaluated in this study showed no significant (P>0.05) difference for both starter and finisher phases. However, T_3 group gave the best value for gross margin when compared with T_1 and T_5 (516.46 **vs** 504.19 **vs** 477.80) recorded in this experiment. It was concluded that Moringa oleifera dried leaf meal can serve as a cost effective phytogenic replacement of synthetic premix in broiler feeds.*

Keywords: *Moringa oleifera*, Broilers, synthetic premix, performance parameters, cost

INTRODUCTION

Synthetic feed supplements and additives have continued to fill the micro nutrient deficiency gaps associated with macro ingredients like grain cereals and oilseeds in the animal feed industry. The key objective of using these synthetic feed supplements and additives is to deliver the micro nutrients / ingredients needed by animals that cannot be obtained in sufficient supply from major feed ingredients.

A lot of synthetic premixes have therefore dominated the feed industry serving as major gap fillers for micro nutrient deficiencies. However the issues of cost, sustainable supply, safety and quality have remained a source of concern especially among small holder broiler producers. Similarly, global focus on organic food products and the application of phyto-chemical nutrients and additives (Ogbe and Affiku, 2011; Ari *et al.*, 2012 and Musa-Azara *et al.*, 2013) has encouraged the search for alternative replacement of synthetic feed supplements and additives. This is even more applied in Low – Income Food Deficit Countries (LIFDCs) where the recommended policy is to identify and use locally available feed resources to formulate diets that are as balanced as possible (Sonaiya and Swan, 2004).

Therefore, the explorations of the use of non conventional feed resources that have the capacity to yield the same output as conventional feeds, and perhaps at cheaper rate remains key strategy that could help reduce the cost of production, and ensure cheaper meat production, thus making available more for human consumption (Ari and Ayanwale, 2012). Recent interest in the utilization of moringa (*Moringa oleifera*) commonly called horse radish tree or drumstick tree, as a protein and micro nutrient source for livestock has been reported (Marker and Becker, 1997). This can be accounted for by its nutritional and phytobiotic characteristics (Mapiye *et al.*, 2010; Olugbemi *et al.*, 2010, Ogbe and Affiniki 2011) thus, this brings to focus the quality attributes that make moringa leaves a potential replacement for plant and animal proteins as well as serving as feed additives in non ruminant diets. The objective of this study was to evaluate growth performance and cost-benefit analysis of broiler chickens fed *Moringa oleifera* dried leaf meal as phytogenic replacement of synthetic premix.

MATERIALS AND METHODS

Experimental location, collection and processing of *Moringa oleifera* leaves sample

The experiment was carried out at the Poultry Unit of the Livestock Complex, College of Agriculture Lafia, Nasarawa State which is located along Latitude $08^0$35'N and Longitude $08^0$33'E in the Guinea savanna zone of North Central Nigeria. *Moringa Oleifera* leaves were harvested from the same location at early flowering stage, spread out under the sun to dry 3-5 days according to the methods described by Ogbe and Affiniki (2011). The leaves were hand plucked (manually) and ground into powdery form by milling.

Source of synthetic premix
The synthetic premix used in this experiment was procured from a major distributor of Animal Care premix located along Jos Road Lafia.

Experimental treatment:
A total of one hundred (100) Anak 2000 strains of broilers procured from Agrited Farm Ibadan, South West Nigeria, were used for this experiment. The birds were randomly divided into five (5) experimental groups of two replicates each. The dietary treatments were designated as T (control), T_1, T_2, T_3 and T_4 representing 0, 25, 50, 75 and 100% replacement by weight of synthetic premix with *Moringa Oleifera* in diets formulated using *feedwin* (least cost feed formulation software) to provide crude protein and metabolizable energy of 22% CP and 3200 kcal/kg ME and 20% CP and 3000 kcal/kg ME of feed respectively for starter and finisher phases. The effects of experimental treatments were evaluated through feeding trials which lasted (1- 28 d) and (29- 52 d) at starter and finisher phases, respectively. All experimental birds were given feed and water *ad libitum* while routine management and vaccinations were uniformly undertaken.

Data collection
Performance parameters
The following parameters were measured and computed from the data generated from daily and weekly recordings during the feeding trials: feed intake, body weight, bodyweight gain, feed conversion ratio (feed: gain), mortality, survival percentages and performance index according to the methods adopted by Ari *et al.* (2012) .

Cost evaluation
The cost evaluation was done according to the methods described by Yakubu *et al.* (2011) and Ari *et al.* (2012b). The cost of feed per kilogram of the experimental broiler feed was calculated as an output from *Feedwin* (least cost formulation soft ware). Feed intake per bird for the experimental period was used to multiply by the cost per kilogram feed to obtain the cost of feed consumed by birds. The cost per kilogram weight gain was calculated by taken the product of the cost per kilogram feed and feed conversion ratio of birds. The cost of production was estimated as the product of cost per kilogram weight gain and mean total weight gain, total cost of production is the summation of fixed cost (management, housing, medication, labour etc) and the cost of production (feeds dependent) while revenue was calculated as price of meat (naira per kilogram) multiplied by mean total weight gain. he gross margin (naira) was calculated as the difference between revenue and total cost of production. The gross margin (naira) was calculated as the difference between revenue and total cost of production.

Chemical analysis
The chemical composition of each of the experimental diets was determined according to AOAC (1995).

Statistics
Data collected were subjected to One-way Analysis of Variance (ANOVA), means were separated ($P<0.05$) where there were significant differences using Duncan's Multiple Range Test (Duncan, 1955) using SPSS 16.0 version (SPSS, 2007).

RESULTS
The composition of the experimental diets at both starter and finisher phases was presented in Table 1. The determined composition of the starter diets presented showed that the dry matter percentage ranged from 88.4 to 88.65% in T_4 and T_1 respectively while crude protein percentage ranged from 21.01 to 21.06% in T_1 and T_5. The crude fibre on the other hand had values ranging from 5.30 to 5.35% in T_1 and T_5 respectively. The highest value of ether extract was obtained in T_3 (8.07) while the least (7.69%) was obtained in T_1. The total ash percentages ranged from 1.63% (T_5) to 1.67 % (T_1). Similarly, the determined composition of the finisher diets (Table 1) showed the dry matter percentage ranged from 89.02 to 90.12% in T_2 and T_5 respectively while crude protein percentage ranged from 19.03 to 19.09% in T_2 and T_5. The crude fibre on the other hand had values ranging from 5.51 to 5.58% in T_1 and T_4 respectively. The highest value of ether extract was obtained in T_5 (8.04) while the least (7.83%) was obtained in T_1 and T_2. The total ash percentages ranged from 1.92% (T_5) to 1.99 % (T_1)

Table 2 showed the performance parameters of broilers fed graded levels of moringa as a phytogenic replacement of synthetic premix. The average body weight gain (BWG) feed intake, FCR and the Performance index (PI) showed no significant ($P>0.05$) difference for both starter and finisher phases of the experiment. While survival percentage showed significant ($P<0.05$) difference at both the starter and finisher phases with treatments T_5 (97.34%) and T_1 (98.80%) showing the best values recorded at the starter and finisher phases, respectively.

There was no significant ($P>0.05$) difference in the cost of feed per kilogramme diets, total cost of feed consumed and cost of feed per kilogramme body weight gain as indicated in Table 3. Similarly, total cost of production, revenue and gross margin showed no significant ($P>0.05$) difference among experimental groups fed graded levels of the test material. However, T_3 group gave the highest value for gross margin.

DISCUSSIONS
Results obtained from this study indicated that the determined composition of the experimental diets at both starter and finisher phases are consistent with NRC (1994) recommended feeding standards for broilers. The increase in values of crude protein, crude fibre, and ether extract for both starter and finisher diets with increasing replacement of synthetic premix with moringa observed in this study was attributable to the composite nutrients in moringa as reported by Abbas (2013) while the highest value of total ash observed for T_1 was an indication of deficiency of some micro and macro minerals in moringa as indicated by Mapiye *et al.* (2010).

Table 1:Composition of experimental diets

	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
	Starter Diets					Finisher Diets				
Bone meal	2	2	2	2	2	2	2	2	2	2
Fish meal	4.3	4.3	4.3	4.3	4.3	4	4	4	4	4
GNC	15	15	15	15	15	15	15	15	15	15
Maize	38.88	38.88	38.88	38.88	38.88	45	45	45	45	45
Maize bran	15	15	15	15	15	16.8	16.8	16.8	16.8	16.8
Rice bran	3	3	3	3	3	3.1	3.1	3.1	3.1	3.1
SBC	16	16	16	16	16	8	8	8	8	8
Palm oil	4.02	4.02	4.02	4.02	4.02	4.3	4.3	4.3	4.3	4.3
Limestone	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Meth	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.19	0.13	0.06	0	0.25	0.19	0.13	0.06	0
Moringa	0	0.06	0.13	0.19	0.25	0	0.06	0.13	0.19	0.25
Total	100	100	100	100	100	100	100	100	100	100
Feed cost/unit	93.06	92.67	92.25	91.83	91.44	91.34	90.95	90.53	90.10	89.71
Calculated composition										
ME Kcal/Kg	3000.21	3001.44	3002.77	3004.11	3005.34	3100.14	3101.38	3102.71	3104.04	3105.27
DM	87.97	87.91	87.84	87.78	87.72	87.99	87.93	87.86	87.80	87.74
CP	22.02	22.04	22.06	22.08	22.10	19.10	19.11	19.13	19.15	19.17
CF	6.32	6.32	6.32	6.32	6.32	6.15	6.15	6.15	6.15	6.15
EE	5.26	5.40	5.55	5.70	5.84	0.43	0.43	0.43	0.43	0.43
Ash	1.14	1.14	1.14	1.14	1.14	5.50	5.63	5.78	5.93	6.07
Lysine	1.13	1.13	1.13	1.13	1.13	1.08	1.08	1.08	1.08	1.08
Meth.	0.47	0.47	0.47	0.47	0.47	0.91	0.91	0.91	0.91	0.91
Ca	1.10	1.08	1.06	1.04	1.02	1.08	1.05	1.03	1.01	0.99
P	0.69	0.69	0.69	0.70	0.70	0.66	0.66	0.66	0.66	0.66
Determined analysis										
DM%	88.65	88.61	88.44	88.41	88.53	90.02	89.02	89.61	89.55	90.12
CP%	21.01	21.02	21.04	21.05	21.06	19.05	19.03	19.07	19.08	19.09
CF%	5.30	5.32	5.31	5.33	5.35	5.58	5.51	5.58	5.58	5.57
EE%	7.69	7.74	8.07	7.89	7.96	7.83	7.83	7.89	7.97	8.04
Ash	1.67	1.66	1.64	1.64	1.63	1.99	1.97	1.95	1.94	1.92

***Synthetic Premix to provide the following per KG of diet:** Vitamin A, 9,000 IU; Vitamin D3, 2,000,IU; vitamin E, 18 IU; vitamin B1, 1.8 mg; vitamin B2, 6.6 mg B2,; vitamin B3, 10 mg; vitamin B5, 30 mg; vitaminB6, 3.0 mg; vitamin B9, 1 mg; vitamin B12, 1.5 mg; vitamin K3, 2 mg; vitamin H2, 0.01 mg; folic acid, 0.21 mg;nicotinic acid, 0.65 mg; biotin, 0.14 mg; Choline chloride, 500 mg; Fe, 50 mg; Mn, 100 mg; Cu, 10 mg; Zn, 85 mg;I, 1 mg; Se, 0.2 mg.*

***** Moringa to provide the following per KG of diet Mineral** *Macro – elements: Ca %,3.65; P %,0.30; Mg %,0.50; K %,1.50; S%,0.63;Na%,0.164;* ***Micro-elements:** Zn ,31.03mg/kg; Cu ,8.25mg/kg; Fe, 490mg/kg; Mn, 86.8 mg/kg; Se, 363.00mg/kg; Bo, 49.93mg/kg;* ***Crude protein,** 30.3 %; Amino acid %,19; Alanine , 3.033%; Cystein , 0.01%; Vit E, 77mg; Beta- carotene V.T.E, 18.5;* ***Fatty acid,** 17; d-Linolenic acid, 44.57 %; Palmatic, 0.17; Capric acid, 0.07 ; g-linolenic, 0.17*

**(18) **(7)*

Table 2: Performance of Broilers fed graded levels of moringa as a phytogenic replacement of synthetic premix

Treatment	Initial weight	Average Weight	Feed intake	Weight gain	FCR	survival percentage	performance index
	Starter phase						
T1	44.17	589.99	592.34	545.82	1.08	95.33^{ab}	481.46
T2	44.67	548.74	588.17	504.07	1.17	94.00^{a}	406.26
T3	41.50	642.25	750.34	600.75	1.28	96.84bc	470.58
T4	40.17	710.07	709.50	669.90	1.06	96.17b^{c}	608.96
T5	41.50	717.67	767.17	676.17	1.14	97.34^{c}	580.09
SEM	±0.82	±28.73	±31.16	±29.39	±0.03	±0.42	±32.41
	Finisher phase						
T1	589.99	1990.40	1486.00	1400.42	1.06	98.80^{c}	1304.36
T2	548.74	1921.25	1471.17	1372.52	1.08	98.17b^{c}	1259.94
T3	642.25	2106.00	1536.33	1463.75	1.05	95.50^{ab}	1332.28
T4	710.07	2077.09	1403.00	1367.02	1.03	94.67^{a}	1260.26
T5	717.67	2078.34	1392.67	1360.67	1.03	97.34^{ab}	1294.14
SEM	±28.73	±54.25	±40.28	±41.49	±0.01	±0.58	±44.16

abc means in the same column with the same superscript are not significantly (P>0.05) different; SEM Pooled Standard Error of Mean

Table 3: Cost evaluation of Broilers fed graded levels of moringa as a phytogenic replacement of synthetic premix

	T1	T2	T3	T4	T5	SEM
Cost of feed /kg diet (₦)	0.91	0.91	0.91	0.90	0.90	±0.01 NS
Total cost of Feed consumed(₦)	13.57	13.38	13.91	12.64	12.49	±0.58 NS
Cost of feed / Kg body weight gain(₦)	14.39	14.45	14.60	13.02	12.87	±0.80 NS
Cost of production(₦)	20.15	19.83	21.38	17.80	17.51	±1.55 NS
Total cost of production(₦)	504.19	501.04	516.46	480.69	477.80	±15.47 NS
Revenue (₦)	1400.42	1372.52	1463.75	1367.02	1360.67	±40.00 NS
Gross margin (₦)	504.19	501.04	516.46	480.69	477.80	±15.47 NS

NS: No Significant Difference (P>0.05); SEM: Pooled Standard Error of Mean

The performance and cost parameters of broilers fed graded levels of moringa as a phytogenic replacement of synthetic premix evaluated in this study showed no significant (P>0.05) difference for both starter and finisher phases. These include average body weight gain (BWG) feed intake, FCR and the Performance index (PI) as well as bioeconomic indicators like cost of feed per kilogramme diets, total cost of feed consumed, cost of feed per kilogramme body weight gain, total cost of production, revenue and gross margin.

These results are consistent with the findings of Olugbemi *et al.* (2010) who reported that there was no significant (P > 0.05) effect on weight gain, feed conversion ratio, final body weight, and feed cost per kilogram of weight gain when 5% Moringa oleifera leaf meal was added to cassava-based broilers' diet and compared to 0%, 20% and 30% Moringa oleifera leaf meal diets. Similar findings on broilers' production performance by Paguia *et al.* (2014) who reported that the addition of Moringa leaf powder on broiler diets did not (P>0.05) significantly influence the broiler's feed intake, ADG, feed conversion ratio (FCR), feed intake (FI) final weight, feed cost per kg of broiler produced and Income over feed and chick cost. However, inclusion levels above 5% of *Moringa oleifera* leaf meal were observed (Oludoyi and Toye, 2012; and Paguia *et al.*

(2014) to decrease broilers' performance especially at the early feeding of Moringa oleifera Leaf Meal. This is in contrast to the results obtained in this study.

It must be noted that while survival percentage showed significant ($P<0.05$) difference at both the starter and finisher, but however does not follow any particular trend. Even though performance and cost parameters measured were statistically comparable among the treatment groups, T3 group gave the highest value for gross margin.

CONCLUSION

This study concluded that *Moringa oleifera* dried Leaves can serve as a cost effective phytogenic replacement of synthetic premix in broiler feeds. This also has the potentials of meeting the growing market for organic poultry products. Thus it can be inferred that *Moringa oleifera* dried Leaf Meal has enormous potentials as phytogenic feed additive in the poultry feed industry.

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