Effects of graded levels of iron-fortified locally produced natural vitamin premix on the performance and carcass characteristics of broilers

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Abstract

A feeding trial was conducted using broilers to determine the optimum inclusion levels of locally produced natural vitamin premix (LPNVP) and compare the performance to a commercial vitamin-mineral premix (CVMP) commonly sold within Nigeria. Feed intake, weight gain and feed utilization efficiency varied ($P < 0.05$) among the various dietary treatments considered. Feed utilization efficiency and weight gain were inversely related to feed intake for birds fed LPNVP-based diets and these measurements were lower ($P < 0.05$) than values observed for birds fed CVMP based diets. Nutrient retentions were also not influenced ($P > 0.05$) by the various inclusion levels of LPNVP studied, although these criteria were also significantly lower for birds fed LPNVP-based diets compared with birds fed CVMP-based diets. Although, dressing percentage was not affected ($P > 0.05$) by the dietary levels, relative fresh organs and primal cut weights were different ($P < 0.05$) for birds fed the various levels of LPNVP and the control birds fed CVMP-based diets. It was however cheaper ($P < 0.05$) to use LPNVP than CVMP as a source of vitamin for broilers.

Keywords: Locally produced Natural vitamin premix, Commercial vitamin/mineral premix

Introduction

In an earlier study, Bolu and Balogun (1998) report that inclusion of locally produced vitamin premix (LPNVP) at 0.5% and 1.0% were optimum for layers; 0.5% was also reported as optimum for broilers. It was also reported that reduction of inclusion levels might be possible to enable the natural premix compete (in the provision of vitamins and cost of production) adequately with the commercial vitamin/mineral deficiency especially iron in the performance of broiler.

Commercially sold synthetic analogues differ in inclusion levels depending on the manufacturer. Most of the vitamin/mineral premixes are included at 2.5kg/ton of feed e.g. AGRICARE

(Pfizer), ANUPCO and DELAVIT premix; 3kg/ton for TOYOLA premix and 5.0kg/ton of feed for PETERHAND premix.

The current experiment was conducted to investigate the response of broilers to different inclusion levels and mineral fortification of iron from blood meal) of LPNVP. The inclusion levels of iron-fortified LPNVP studies were 0, 0.10, 0.15, 0.20, 0.25 and 0.30%.

Materials and Methods

One hundred and twenty (120) day-old and mixed sex Hubbard broiler chicks (34 – 40g) were housed in electrically heated battery cages and fed experimental diet as shown in (Table 1).

Table 1 *Composition of experimental diets (%)*

Item	Diets					
	1	2	3	4	5	6
Basal diet***	99.75	99.90	99.85	99.80	99.75	99.70
ANUPCO Premix*	0.25	-	-	-	-	-
LPNVP**	-	0.10	0.15	0.20	0.25	0.30
Total	100	100	100	100	100	100

***Contained:

Maize 40.0%; Soybean 15%; groundnut cake 10.13%; fishmeal 3.0%; oyster shell 1.1%; bone meal 2.5%; blood meal 2.50%; wheat bran 24.05%; methionine 0.20% and salt 0.30%. Analyzed nutrient content: crude protein (%), 24; crude fat (%), 2.5; Crude fibre (%) 3.6; total ash (%), 13. minerals (as calculated) Ca (%), 0.9; K(%), 0.2; Na (%) 0.15, Cl (mg), 800; Cu (mg), 4; Se (mg), 0.1; Zn (mg) 40.

*Contain (/kg):

Retinol, 4×10^6 i.u; cholecalciferol, 1.2×10^6 , α -tocopherol, 3200 i.u. Menadione, 800 mg; riboflavin, 2200 mg; thiamin, 3200mg; niacin, 400 mg; pyridoxine, 480 mg, Calcium pantothenate, 2800mg; folate 240 mg; choline chloride, 2×10^5 , mg; biotin, 12 mg; Se 40 mg; Mn 32000 Cu, 3200 mg; Zn, 2×10^5 mg; Co, 180 mg; Mg 400mg.

**Formulated to meet NRC (1994) requirement in addition to iron fortification with blood meal to supply 200 mg/kg.

They were allocated to a previously completely randomized design to a six (6) group of twenty (20) birds within the same mean weight among each group. Each was replicated in four (4) units. LPNVP based diets were formulated with LPNVP varied at five (5) levels (treatments) viz 0.10, 0.15, 0.20, 0.25 and 0.30%. The control diet contained ANUPCO broiler premix included at the dietary recommended level of 0.25%.

Weight gain and feed conversion efficiency was determined weekly. At the end of 8 weeks, 4 birds were selected from each group, starved for 10 hours, weighed, slaughtered and dressed. Dressed and carcass weights were recorded. Relative fresh organ and primal cut weights were also recorded. Feed conversion efficiency (FCE) and other related indices were also calculated.

Proximate analysis of the basal diet was carried out according to the method described by AOAC, (1980). Vitamin and Mineral analyses were carried out according to the methods described by Roche, (1990).

The data collected were subjected to analysis of variance using the model for completely

randomized design (Steel and Torrie, 1980). Difference between treatment means were determined by Duncan Multiple Range Test (Duncan, 1955).

Result

Feed intake, weight gained, protein efficiency ratio and feed utilization efficiency varied significantly ($P < 0.05$) among the treatments (Table 2). Birds fed diet containing LPNVP at 0.10% consumed more feed than did birds on other dietary treatments. Feed intake tended to decrease with increased inclusion levels of LPNVP. Weight gain and feed utilization efficiency was however, inversely related to the feed intake. Birds fed diet containing LPNVP at 0.10% inclusion level had lowest gains and consequently feed utilization efficiency while birds fed diet containing commercial premix (CVMP) recorded highest value for these measurements. Feed utilization efficiency of diet containing LPNVP at 0.30% compared favourably with those of CVMP-based diets. Although not significantly different ($P > 0.05$), protein and fat retention followed similar pattern recorded for feed intake (Table 2).

Iron fortified locally produced natural vitamin premix in broiler nutrition

Table 2 *Effect of varying levels of iron fortified LPNVP on the performance of broilers.*

Item	Diets					
	1	2	3	4	5	6
Feed intake (kg/bird)	4.46 ^b	5.46 ^b	4.54 ^b	4.42 ^b	3.45 ^a	3.58 ^a
Average initial weight (g/bird)	45	52	45	44	45	42
Final body weight (kg.bird)	2.27 ^b	1.51 ^a	1.50 ^a	1.59 ^a	1.49 ^a	1.80 ^a
Av. Total body weight gain (kg/bird)	2.23 ^b	1.47 ^a	1.46 ^a	1.55 ^a	1.45 ^a	1.76 ^a
Cost:benefit ratio (N)	25.0 ^a	11.2 ^b	11.2 ^b	11.2 ^b	11.2 ^b	11.2 ^b
Protein retention (%)	89.1	76.3	78.5	78.6	80.5	88.9
Fat retention (%)	94.3	82.2	84.9	82.3	86.8	94.2
Protein efficiency ratio	2.07	1.78	1.81	1.89	1.92	2.05
Feed utilization efficiency	0.50	0.27 ^c	0.31 ^a	0.35 ^a	0.42 ^{ab}	0.49 ^b
Mortality (%)	0	0.4	0.4	0	0	0
Dressing percentage (%)	75.8	73.9	74.5	75.2	75.4	75.0

a,b,c Treatment means within rows followed by different letter are significantly different ($P < 0.05$)

Fat and protein retention for LPNVP-based diet at 0.10% inclusion level were lowest and were 82.21 and 76.30% respectively. Birds fed diet containing CVMP recorded highest nutrient retention and were not significant. These values observed for birds fed CVMP based diet were closely followed by birds fed diet containing LPNVP at 0.30%.

Variability among birds fed the different dietary treatments for dressing percentage was small. The lowest value recorded for dressing was 73.9% observed at 0.10% LPNVP inclusion level. Cost benefit ratio was significantly affected ($P < 0.05$). comparatively, it was more cost effective to feed birds using diets

containing LPNVP. From the report (Table 2) at least ₦ 13 was saved per bird for every 1 kg liveweight gained when used compared to CVMP.

Fresh organ weights varied ($P < 0.05$) among dietary treatments (Table 3). There tended to be hypertrophies among the weight reported for birds fed LPNVP based diets as compared with those on CVMP, especially for values reported for gizzard and GIT. However, values reported for the primal cuts favoured birds fed LPNVP based diets especially for back, wings, shank, head and thigh for which variabilities observed were not significant ($P > 0.05$).

Table 3 Effect of varying levels of iron fortified LPNVP on the relative fresh organ weights and primal cuts(g/100g body weight)

Item	Diets					
	1	2	3	4	5	6
Liver	2.42	2.66	2.43	2.93	2.52	2.98
Kidney	0.09	0.10	0.10	0.10	0.10	0.10
Heart	0.50 ^a	0.68 ^b	0.66 ^b	0.67 ^b	0.74 ^b	0.77 ^b
Proventriculus	0.58 ^a	0.81 ^b	0.89 ^b	0.87 ^b	0.83 ^b	0.85 ^b
Pancreas	0.30	0.44	0.47	0.49	0.41	0.49
Gizzard	2.96 ^a	4.38 ^b	3.64 ^{ab}	4.57 ^b	4.21 ^b	4.08 ^b
Lung	0.59	0.63	0.88	0.68	0.67	0.88
GIT	6.37 ^a	7.0a ^b	8.64 ^b	9.14 ^b	6.78 ^a	11.7 ^b
Keel	17.6	15.0	14.3	14.9	16.7	13.7
Thigh	10.6	10.91	10.79	10.0	11.0	10.6
Neck	5.67	4.83	5.21	4.14	4.21	4.46
Head	2.96	3.38	3.89	4.00	3.46	4.15
Drumstick	10.7	10.0	10.3	10.0	10.2	10.3
Shank	5.44	4.37	5.89	5.29	5.42	5.75
Wings	8.26	8.08	8.89	8.46	8.16	8.31
Back	13.5	0.14	0.13	0.14	0.13	0.14
Spleen	13.2	14.1	12.9	14.3	14.2	14.1

a,b,c Treatment means within rows followed by different letters are significantly different($P < 0.05$)

Discussions

Results observed in the study were a true reflection of the dietary conditions. Feed intake observed in this study was in agreement with the observations of Hughes and Wood-Gush (1971) that birds demonstrated acuity for vitamin deficient diets. Thus, as the level of vitamin deficiency increased, corresponding increases in dietary intake were recorded. However, the utilization of these feeds were low as reflected in the feed utilization efficiency and weight gain. As the level of LPNVP increased (signifying a decreasing vitamin deficiency), weight gain and feed utilization efficiency were observed to improve accordingly. Feed utilization efficiency has been reported to be a function of vitamin nutrition (Bains, 1998). Cumulative growth or final body weight has also been reported to be a function of the vitamin status of the animal (Foster and Albert, 1980). These observation were thought to involve the consequent interplay between feed intake and the digestive physiology requiring various enzymes for their pathways. Vitamins form an

important structural component of the most digestive enzymes. Nockels and Phillips (1971) reported that glucose economy was affected by dietary vitamin A via indirect effect of phosphorylase activity. That the dietary vitamin levels affected feed intake, weight gain and feed utilization efficiency was supported by the result of the various nutrient retention. It was obvious from this study that as the levels of LPNVP increased, there were vitamin activities to aid the utilization of feed and support consistent weight gains. LPNVP-based diet at the various levels studied did not adequately compare with CVMP-based diet for these measurements but as the levels increased, these responses were improved. These feeding discrepancies were however compensated for by the reduction in feed cost observed as cost:benefit ratio. This observation is in consonance with the views of Longe *et al.*, (1986) that the use of alternative livestock feed ingredients tended to reduce the overall cost of production with a concomitant improved profitability.

Dressing percentage has been reported to depend on the feeding regime, breed and age of

the bird (Bains, 1998). The feeding regime is of paramount importance to the present study. Although dressing percentage did not vary at the various dietary LPNVP levels, but evidences of lower dressing percentage was present at 0.20%. the relative fresh organ weight has been reported to be a function of vitamin availability and subsequent utilization (Budowski and Crawford, 1986). Bird fed LPNVP diets showed vitamin inadequacies that eventually resulted in hypertrophic tendencies consequent upon which specific relative weight of fresh organ were affected. Balalock and Thaxton (1984) reported marked hypertrophies for organs such as gizzard, crop, spleen and thymus consequent upon vitamin deficiencies.

Vitamin deficiencies were demonstrated at most levels of LPNVP inclusion investigated using the above indices. It was also observed that subsequent increase in the inclusion levels did improve the resultant values. Higher inclusion level may remedy the observed lower performance of LPNVP as recorded in earlier studies. However, the cost of production justifies the use of LPNVP relative to CVMP in broiler diets.

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