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Research Article

Premix Graded Levels in Broiler Starter Diet and Their Effect on Broiler Performance and Market Weight

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Abstract: The experiment was aimed to increase profitability in the poultry production by determining the optimum level of minerals-vitamins premix supplementation for broiler chicks under the prevailing tropical conditions. The commercially produced minerals-vitamins premix used was NUTRIMIX Broiler Starter Premix. Sixty white unsexed chicks of Anak hybrid were used in 4 experimental diets with incremental levels of minerals-vitamins premix viz; 0.00%, 0.125%, 0.25%, and 0.375%. Completely randomized design (CRD) was used for the experiment. The treatment diets were fed to the broilers from week 2 – week 5. Average daily live weight gain; average feed intake and; final weight gain at week 9 were determined. Feed conversion ratio was calculated. Analysis of variable (ANOVA) test was used to analyze the parameters and Fisher's least significant difference (F-lsd) at 0.05 probability level was used to separate the treatment means that were significant. The results showed that there was no significant difference ($p>0.05$) in average feed intake among the broilers. There were significant differences ($p<0.05$) in average daily live weight gain, feed conversion ratio and final weight gain (market weight) among the broilers as influenced by different minerals-vitamins premix levels with improved performance recorded in 0.25% and 0.375% premix level. The least performance was obtained in 0.00% premix level. It was concluded that minerals-vitamins premix supplementation of broiler starter diet fed to Anak broilers from week 2 – week 5 was necessary for improved performance of the chickens. Optimum performance was obtained in 0.25% premix supplementation. 0.25% minerals-vitamins premix level could therefore be recommended for profitable production of broiler chickens in the prevailing tropical condition.

Keywords: Broiler performance, Broiler starter diet, Market Weight, Premix Graded level.

INTRODUCTION

Broiler is a young chicken of either sex, with soft smooth textured skin and flexible breastbone cartilage [1]. It is raised in the poultry for meat production. Commercial poultry is the fastest developing sector of the animal industry in the tropics [2]. Despite the potential economic benefits of poultry production, there is a recent decline in poultry production in Nigeria [3]. Obviously, the

high cost of production especially with regards to feed has reduced the profit of farmers thus, leading to a desertion of the once booming industry. Since poultry continues to supply substantially humans meat requirement and also useful to food manufacturing industries, there is need to resuscitate the industry. In the template region, the killing weight for broilers is 2.0 - 2.2 kg at 8 weeks of age. In Nigeria, the market preference is tougher meat hence, broilers greater than 10 weeks sells better. Diets lead to higher weight in broilers even in a short period, it is therefore imperative to consider diet in the production. Diet is a feed formulated for a special purpose. Diet can be defined as a mixture or blending of feedstuffs which has been formulated and compounded to fit the special nutrient requirements for a particular class of animal. Some of the major compositions of broiler starter diet are vitamins which function at cellular level and are broken down and lost after metabolism. Minerals are also needed for the utilization of food substances and their requirements for broiler chicken should be met for optimum growth and performance [5]. Although some mineral requirements are minimal, rapid growth and weather may increase the need for mineral supplementation hence, to ensure normal level of minerals, Premix is added to the ration [5]. The role of premix in broiler rearing cannot be overemphasized. Premix refers to the micronutrients (vitamins and minerals) used in small quantities [6]. Alongside with its numerous benefits, they act as coenzymes. Minerals have important roles as constituents of certain proteins like iron in haemoglobin. They also play important role in maintaining the osmotic pressure of the body tissue and body fluid [6]. Premix as the name implies is first mixed with portion of the feed before being introduced into the bulk of the feed. In formulating a premix, there is no fixed number of vitamins or minerals, and all this should be dictated by local demand or deficit in the basal diet [7]. One of such demands is disease resistance. This enables the premix meet all the functional elements. The premix used in this research includes Vitamins A, D, E, K and B-complex (consisting of nine Vitamins), with the macro (phosphorus, calcium, sodium, potassium) and micro (copper, zinc, manganese, magnesium, iodine, selenium, cobalt) mineral elements. There is a functional interaction between minerals and vitamins [8]. There are also sparing effect of selenium on vitamin in blood clotting and; effect of vitamin D on calcium and phosphorus absorption [8]. Excess vitamin A depresses vitamin E. Mineral imbalance especially when in excess also depresses magnesium. In the same way, excess iron lowers the level of phosphorus, while excess zinc depresses the copper level [9].

Therefore, it was imperative to prevent excessive micronutrients supplementation for an increase in profitability. Several researches aimed at reducing or withdrawing premix at different stages of broiler production have been carried out by many researchers [10; 11; 12; 13; 14]. Jafari *et al*., [12] reported that minerals-vitamins inclusion in broilers diet significantly influenced the performance of broiler chickens used in the study. Khajha *et al.* [15] in a study reported that removal of premix during the last two weeks of rearing period significantly reduced weight gain. The proprietary recommended inclusion rate for NUTRIMIX broiler starter premix and most of the commercially produced minerals-vitamins is 0.25% of the feed quantity; however mineral requirements are often determined in specially selected, appropriately managed and sufficiently fed animals without putting into consideration factors such as environmental variation and nutrients–mineral interactions [16]. Alaedein *et al*. [10] reported that feed manufacturers use much higher concentrations of minerals-vitamins premix than those specified by NRC [17] to avoid deficiency and that the cost of premix supplementation may contribute to 2-3% of the total cost of the feed. The 0.25 % premix level for commercially produced minerals-vitamins premix may therefore be ideal for chicken raised in optimum conditions different from open-sided poultry house commonly used by farmers. The objective of this research was therefore, to ascertain the optimum premix level for broiler starter diets under prevailing tropical conditions.

MATERIALS AND METHOD

Experimental Site and Duration of the Experiment

The experiment was carried out at the Research Unit of Ebonyi State University Poultry Farm. The experiment lasted eight (8) weeks. The first one week was used to equilibrate the birds. The treatments were applied during the subsequent four weeks (starter period). The birds were then finished during the last four weeks, without the treatments.

Source of Materials

The Premix used was commercially produced (Nutrimix) purchased from CORGIS NIGERIA LTD. The commercial feed used for the birds from day 1 – 2 weeks was Vital Feed which was purchased from Abakaliki Market, Ebonyi State, Nigeria. The feed ingredients used in the formulation of the diets used for the experiment were purchased from the market. The risk husk used was purchased from a rice mill in Abakaliki, Ebonyi State, Nigeria. The other materials were purchased from the market.

Preparation of the poultry house

A part of the house was partitioned into pens with each measuring 4m x 3m x 6m of length, width and height, respectively. The pens were separated from each other by wire mesh up to the ceiling, covered with short height of zinc of about 3m. The door also carried wire-mesh. The outside wall was 6m tall topped by wire mesh up to the eaves of the building. Polythene material was used to shield the building against draught and rain-splash and to conserve temperature during the early brooding stages of the broiler chicks. The pens were properly washed with disinfectant and the floor scrubbed with isol water and then left to dry, while a layer of new disinfected rice husk of about 3cm thick was spread on each of the pens. Cardboard papers and old Newspaper were used to cover the rice husk.

Experimental Animal

Sixty white unsexed chicks of Anak hybrid were procured from a reliable supplier. The average initial weight of each was measured (20.17grams).

Management of broiler chicks

A vaccination schedule and medication was worked out for the broiler chicks for 1 — 4 weeks of age as shown in Table 1:

Table-1: Medication / Vaccination Schedule for Chicks (1 — 4 weeks)

Age	Medication/Vaccination	Route
1st Day	Antibiotics (Oxytetracycline) + Glucose + Anti stress (vitalyte)	Drinking water
1-7 Days	Newcastle Disease (ND)	Intraocular (I/O)
2 Weeks	Newcastle Disease (ND) (Lasota)	Drinking water
3 Weeks	Gumboro	Drinking water
4 Weeks	Fowl pox	Wing Web

The Intraocular (i/o) vaccination was done on the arrival of the chicks, since one could not be sure whether the chicks were vaccinated against ND at the hatchery and later given glucose and vitalyte through drinking water. After this, all the broilers chicks were brooded together in a pen shortly before the chicks were replicated. Water was placed on plastic watering can and kept on top of cardboard paper on the ground to enable the chicks to drink from it. In the same way broiler starter feed was spread on the cardboard papers. Kerosene stove was placed at the centre of the hover to provide heat and maintain an initial temperature of 32°C. While heating was on a continuous basis throughout the brooding period, lighting was only done during the nights. Feed and water were given at all time (ad libitum) during the first one week of the arrival; the chicks were stabilized on a 25kg proprietary broiler starter diet (21% C.P) of vital feed.

Treatment Preparation

Three Premix graded levels *viz*; 0.00% (exclusion); 0.125% (half of the proprietary recommended level); 0.25% (proprietary recommended level) and; 0.375% (more than the proprietary recommended level) were used for the experiment. The formulation was done by pre-mixing the premix with small quantity of the broiler starter feed before adding the mixture to the whole feed. After the inclusion, the diets weighed 25kg each with Treatment 1 (T1) containing 0.00% of Premix; Treatment 2 (T2) containing 0.125% of Premix; Treatment 3 (T3) containing 0.25% of Premix and; Treatment 4 (T4) containing 0.375% of Premix. Each of the treatments were put in different jute-bags well labeled and stored on a raised platform to prevent the feed from soaking in moisture from the floor and to prevent pest attack.

Experimental Design

Completely Randomized Design (CRD) with three replications was used for the experiment. At the end of the first week, the broiler chicks (60 in number) were randomized into 12 pens with each pen containing 5 broiler chicks. The treatments were replicated three times.

Experimental Layout

Replicates	Broiler Starter Diets			
	0.00% premix	0.125% premix	0.25% premix	0.375% premix
1	5	5	5	5
2	5	5	5	5
3	5	5	5	5

Treatment application and procedures

Every morning, known quantities of the treatment diets were given to the chickens in each replicate. The feeder is refilled to one third of the feeder height to avoid wastages. Feed and water were supplied ad libitum. The treatments were applied until week 5 after which the experimental diet was withdrawn. Coccidiostat was also

administered to the chicks through the drinking water to help prevent coccidiosis disease.

DATA COLLECTION

The chicks in each replicate were weighed individually and the weights recorded. Measurements were done daily from week 2 to week 5. The feed intake was taken by subtracting the orts from the feed served for the day. The final weight gain (market weight) was taken at week 9 when the weights of the individual birds were taken and recorded appropriately.

The parameters evaluated were thus;

i. Average feed intake per bird (g) = Feed intake per replicate (g)
   No. of birds x No. of days of treatment
   Feed intake was recorded by subtracting the left over feed from the feed supplied.
ii. Average daily live weight gain per bird (g) = Total gain per replicate (g)
   No of bird x No of days of treatment
iii. Feed conversion ratio (FCR) = Total feed intake per replicate (kg)
   Total live weight gain per replicate (kg)
iv. Final weight gain (FWG) was determined by weighing the broilers at week 9.

STATISTICAL ANALYSIS

Analysis of variance (ANOVA) test for completely randomized design (CRD) was used to analyse the data in all the parameters. The means were separated where there was significant difference using F-LSD at 0.05 probability level as described by Obi [18] and Steel and Torrie [19].

RESULTS AND DISCUSSION

Results

The effects of different levels of minerals-vitamins premix inclusion on average daily live weight gain (ADLWG), average feed intake (AFI), feed conversion ratio (FCR) and final weight gain (FWG) of broilers fed with the experimental diet from week 2 to week 5 were shown in Table 2. The results showed that there was no significant difference ($p>0.05$) in AFI among the broilers fed with broiler starter diets containing different premix levels. However, there were significant differences ($p<0.05$) in ADLWG, FCR and FWG among the broilers as influenced by different Premix levels. The highest ADLWG (35.45g) was obtained in the broiler starter diet with the highest premix level (0.375%) though it was statistically at par with 35.29g obtained in 0.25% premix level. The least ADLWG (26.09g) was obtained in 0.00% premix though this was also statistically at par with 29.68g obtained in 0.125% premix level. Consequently, the highest FCR (4.283) was obtained in broiler starter diet with 0.00% premix while the least value (2.873) was obtained in 0.25% though it did not differ significantly with 2.983 obtained in 0.375 % premix level. In FWG, the highest value (2.960kg) was obtained in broilers fed with broiler starter diet supplemented with 0.25% premix but it was statistically at par with 2.950kg obtained in the highest premix level (0.375%). The least FWG (1.907kg) was obtained in 0.00% premix level.

Table-2: Average daily live weight gain, Average feed intake, Feed conversion ratio, and Final weight gain of broilers fed with experimental broiler starter diet from 2 weeks – 5 weeks

Premix level (%)	ADLWG (g)	AFI (g)	FCR	FWG (kg)
0.00	26.09^{b}	111.3	4.283^{a}	1.907^{c}
0.125	29.68^{b}	111.1	3.740^{b}	2.373^{b}
0.25	35.29^{a}	104.4	2.873^{c}	2.960^{a}
0.375	35.45^{a}	105.9	2.983^{c}	2.950^{a}
F-LSD$_{0.05}$	*4.75*	*NS*	*0.4933*	*0.3745*
Grand mean	*31.63*	*108.2*	*3.470*	*2.548*
p-value	*0.005*	*0.557*	*<0.001*	*<0.001*
S.E.M.	*1.457*	*4.16*	*0.1513*	*0.1148*
S.E.D.	*2.06*	*5.88*	*0.2139*	*0.1624*
S.E.	*2.523*	*7.20*	*0.2620*	*0.1989*
C.V. (%)	*8.0*	*6.7*	*7.6*	*7.8*

NB: Mean values within a column with different superscripts differ significantly ($p<0.05$).

ADLWG = Average daily live weight gain; AFI = Average feed intake; FCR = Feed conversion ratio; FWG = Final weight gained; NS = Non significant; F-LSD$_{0.05}$ = Fisher's least significant value at 0.05 probability level; F pr = Calculated probability value; S.E.M. = Standard errors of means; S.E.D. = Standard errors of differences of means; S. E. = Standard errors; C.V. = Coefficients of variation

DISCUSSION

The results of the study as presented in Table 2 revealed that average feed intake of broilers fed with broiler starter diet containing different levels of minerals-vitamins premix from week 2 to week 5 was not significantly affected. It showed that the chickens' daily feed consumption was not influenced by premix supplementation. However, significant effects of premix inclusion were observed in average daily weight gain, feed conversion ratio and final weight gain of broilers fed with the experimental diet. These findings were in agreement with the findings of [20; 21; 13]. The proprietary recommended minerals-vitamins premix level (0.25%) and the increased level (0.375%) produced statistically similar effects and significantly improved average daily live weight gain, feed conversion ratio and final weight gain (market weight) of the broiler compared to the lower mineral-vitamins premix level of 0.125%. The findings in the final weight gain (market weight) in this study were in agreement with the findings of Rahman *et al.* [11] who also reported increased body weight gain as a result of premix supplementation. It also conformed to the increased weight gain reported by Deyhim *et al.* [22]. Gavrilona *et al.* [23] reported that the addition of vitamin-minerals to basal diet increased the growth of broiler chickens by 3 to 12%. The withdrawal of premix (0.00% premix level) at this age (week 2 – week 5) significantly reduced average daily live weight gain, feed conversion ratio and final weight gain (market weight) of the broilers. These results showed that broilers had high demand for minerals and vitamins during this period which was the period of growth hence, the reduction and withdrawal produced negative effect. Deyhim *et al*. [22] opined that vitamin-minerals premix may enhance the absorption of nutrients and utilization of feed. Vitamins act as cofactors in several metabolic reactions, thus increasing the efficiency of the synthesis pathways in animals. According to Saif *et al*. [24], except from vitamin c**,** almost all vitamins are dietary essentials for poultry. Sahin *et al*. [25] explained the role of vitamins as having positive effect on the growth performance of chickens by improving feed utilization and metabolism, stimulating the immune system and minimizing stresses. Ward [26] explained that the in-ability of chickens gut flora to synthesis required amount of vitamins makes them more susceptible to vitamin deficiency and undergo severe stress when there is no vitamin supplementation. Broilers that were fed with diet with 0.25% and 0.375% premix inclusion probably received the optimum amount of minerals and vitamins [27] which probably led to the improved performances observed in them. According to Ogunwole and Mosuro [28], lower FCR indicates better feed utilization which could translate to cheaper cost of production. Lower values of FCR observed in broilers that were fed with diets containing 0.25% premix and 0.375% premix may have resulted to better feed utilization which explained the improved final weight gain recorded in them. The poor performances recorded in 0.00% premix level and 0.125% premix level were indications that the premix excluded diet did not provide sufficient minerals and vitamins for the chickens and supplementation with 0.125% premix was not enough to produce optimum performance of the broilers.

CONCLUSION

The results of the present study indicated that minerals-vitamins premix supplementation of broiler starter feed fed to Anak hybrid broilers from week 2 – week 5 was necessary for improved performance of the chickens. However, 0.125% premix supplementation did not lead to optimum performance. Increased level of 0.375% premix supplementation which translated to more cost of production did not result to significant increased performance when compared to 0.25% premix level. Optimum performance was obtained in 0.25% premix supplementation. 0.25% minerals-vitamins premix level could therefore be recommended for profitable production of broilers in the prevailing tropical condition.

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