Effect of feeding different commercial chick vitamin-mineral premixes at varying inclusion levels on performance of pullets chicks

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Abstract

A 56-day feeding trial using 1836 day-old dominant brown strain pullet chicks was conducted to assess the effect of feeding different commercial chick vitamin-mineral premixes type at varying levels of dietary inclusion on growth performance, haematological and serum biochemical indices. The birds were divided into 12 groups of 153 birds each and each group was assigned to one of the experimental diets in a 3×4 factorial arrangement. Each treatment group was further subdivided into 3 replicates of 51 birds each. The birds were fed twelve iso-nitrogenous and iso-caloric diets containing three commercial vitamin-mineral premixes types designated as XVM, YVM and ZVM, respectively. Each vitamin type was included at 0.15, 0.25, 0.35 and 0.45%, respectively. Feed and water were provided ad libitum. A wide variation in the micronutrients and antioxidants levels exists among the premix type. Feed intake was not significantly ($P>0.05$) influenced by the dietary treatments. However, final weight, weight gain, feed conversion ratio and cost per gain were significantly ($P<0.05$) influenced by the premix type and their levels of dietary inclusion. Except for total protein and Haemoglobin, the results showed no significant differences ($P>0.05$) on the values of all the blood parameters measured. The study suggest the need to be careful in choosing premixes type for chick rearing as some of them may be deficient in some essential vitamins and minerals. It was concluded that the use of YVM premix type at 2.5 kg per tonne (0.25% inclusion level) was cheaper and more efficient in supporting the growth performance of pullet chicks.

Key words: Chicks, commercial, growth, performance, pullets, vitamin-mineral premixes

Introduction

Vitamins and minerals are very important in avian nutrition. Thiamin (Vitamin B₁) functions in the regulation of carbohydrate metabolism in chicken (McLandless et al., 1976) while Vitamin B₆ (pyridoxae-5-phosphate) is a co-factor in amino-acid transamination and therefore plays vital roles in protein metabolism (Saroka and Combs; 1986). Vitamins B₁₂ and folate are indispensable in protein metabolism.

The continued increases in demand and supply of vitamin – trace mineral premixes have led to the appearance in the Nigerian livestock feed market of different types of premixes manufactured by different

companies. There are marked differences in their vitamins and mineral profiles (especially in their concentrations of vitamins A, E, B₂ and B₁₂). However, each of the vitamin – trace mineral premix manufacturer claims superiority of their products while the livestock farmer or feed manufacturer is easily carried away by the price quotations of the different Vitamin – trace mineral premixes. The wide variation in the vitamins and mineral profiles among the various manufacturing companies and lack of standard quality control organization for manufactured feeds and vitamin – trace mineral premixes in Nigeria to certify the claims of the manufacturing

companies over their product should be of interest to the poultry farmer and researcher. It is against this background that a comparative biological evaluation of different vitamin trace mineral premixes at varying levels of inclusion was carried out. The study was with the view to recommending a particular source of vitamin – Trace mineral premix and the optimum level of inclusion that would elicit optimum growth of pullet chicks.

Materials and methods

Experimental site

The experiment was conducted at the Poultry Division, National Veterinary Research Institute, Vom, Plateau State, Vom is a rocky country side located South-East of Jos, Plateau State capital. It is 1285m above sea level with an annual rainfall of 1328mm. The temperature ranges between 10 – 28°C with a mean value of 23°C. The relative humidity ranges between 14 – 47% in the dry season but could be higher during the raining season.

Type and sources of the tested Vitamin – trace mineral premixes

The test vitamin-Mineral premixes were all produced within Nigeria and were coded as XVM, ZVM and YVM. The major considerations that informed the choice of the above premixes among other vitamin – mineral premixes available in the Nigerian livestock feed market are:

- **ZVM, XVM and YVM** are the major vitamin – mineral products with big market outlets in the Nigerian livestock feed industry. They are always available and can easily be sourced for all the year round.
- The companies that are involved in the production of **ZVM, XVM and YVM** premixes are well recognized internationally.

- The unit price per 2.5kg bag of the premixes are relatively moderate compare to the price of other premix products in the markets.
- All the tested vitamin mineral premixes had recommended inclusion rate of 2.5kg per tonne of feed. This made the design of the experiment and basis for comparison easier.

Experimental diets and nutrient profile of the tested chick mineral premixes

Twelve iso-nitrogenous (21%CP) and Iso-caloric experimental diets were formulated such that XVM, YVM and ZVM were included each at 0.15, 0.25, 0.35 and 0.45% of the diets respectively (Table 1). The diets were balanced to meet the protein and energy requirements of pullet chicks. The nutrients composition of the tested vitamin – mineral premixes as reported by the manufacturers is shown in Table 2.

Management of experimental birds and design

A total of 1836 day-old pullet chicks of Dominant brown strains with an average initial weight of 36.15g obtained from Zartech Farm Limited, Ibadan were used in the study which lasted for 8 weeks. The birds were divided into 12 groups of 153 birds each and each group was assigned to one of the experimental diets in a 3 X 4 factorial design. Each treatment group was further subdivided into 3 replicates of 51 birds each. Birds in each replicate were kept in a compartment measuring 2m X 3.2m that was previously constructed purposely for the research. Feed and water were given *ad libitum*. All recommended health and management practices were strictly observed. All the necessary vaccinations (intraocular Lasota and Gumboro vaccines) were administered at the appropriate time. The birds were

Table 1: Composition of experimental diets fed to pullet chicks (0-8 weeks)

Ingredient	XVM			YVM			ZVM		
	0.15	0.25	0.35	0.45	0.15	0.25	0.35	0.45	0.55
Maize	56.90	56.76	56.65	56.53	56.90	56.76	56.65	56.53	56.63
Soyabean cake	30.90	30.94	30.95	30.97	30.90	30.94	30.95	30.97	30.97
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Wheat offal	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Limestone	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Glycine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vitamin premix®	0.15	0.25	0.35	0.45	0.15	0.25	0.35	0.45	0.45
Mycovoxin binder	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100	100	100	100	100
Calculated nutrients level and cost per kg diet (₦)	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
Crude protein %	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
Metabolizable energy (Kcal/kg)	3659.18	3655.5	3652.0	3648.57	3659.18	3655.57	3652.09	3648.57	3648.57
Ether extract (%)	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Crude fibre (%)	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
Calcium (%)	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.86
Phosphorus (%)	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Ca:P ratio	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Lysine (%)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Methionine + Cysteine (%)	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Cost/Kg of diet (₦)	53.92	54.54	55.15	55.76	53.56	53.94	54.31	54.68	54.86

Table 2: Nutrients composition of the tested chick Vitamin-mineral premixes as reported by the manufacturers

	XVM	YVM	ZVM
Vitamin A	10,000,000.001.U	15,000,000.001.U	4,000,000.001.U
Vitamin D ₃	3,000,000.001.U	3000,000.001.U	800,000.001.U
Vitamin E	30,000.001.U	30,000.001.U	9,200.00mg
Vitamin K	2.30gms	3,000.00mg	800.00mg
Thiamin (B ₁)	1.70gms	3,000.00mg	720.00mg
Riboflavin (B ₂)	5.00gms	6,000.00mg	2,000.00mg
Pyridoxine (B ₆)	3.10gm	5,000.00mg	1,200.00mg
Vitamin B ₁₂	16.00mg	40.00mg	6.00mg
Biotin	60.00mg	200.00mg	24.00mg
Niacin	31.00gm	40,000.00gm	11,000.00gm
Pantothenic acid	8.00gm	15,000.00gm	3,000.00gm
Folic acid	0.80gm	2,000.00gm	300.00gm
Choline chloride	200.00gm	3000,000.00gm	120,000.00gm
Iron	25.00gm	60,000.00gm	8,000.00gm
Manganese	85.00gm	80,000.00gm	16,000.00gm
Copper	6.00gm	25,000.00gm	1,200.00gm
Zinc	50.00gm	80,000.00gm	12,000.00gm
Cobalt	220.00mg	150.00mg	80.00mg
Iodine	1.10gm	500.00gm	400.00gm
Selenium	120.00mg	310.00mg	80.00mg
Antioxidants	-	70,000.00mg	500.00mg
BHT	60.00gm	-	-
Ethoxyquin	65.00gm	-	-

weighed at the beginning of the trial and weekly thereafter. Feed offered and the left-over feeds were weighed at seven days interval to determine the feed intake of the birds. Mortality records were kept as they occurred. From the primary data collected for feed intake and weight gain, other data were generated for feed conversion ratio and feed cost per unit gain in weight. The percent mortality was calculated from the mortality record kept.

Blood collection and analysis

At the end of the feeding trial, 5ml of blood samples were collected from each of 3 birds of a replicate via the wing veins and put into ethylene Di-amine Tetra Acetic Acid (EDTA) treated Bijou bottles (1mg/ml) for haematological assay. Blood samples were analysed within three hours of their collection for Packed Cell Volume (PCV), haemoglobin concentration (HBC), red blood, white blood and differential leucocytes counts according to the methods described by Lamb (1991). The total protein (TP) and Albumin were also assayed at the Chemical Pathology Laboratory, Federal College of Veterinary and Medical Laboratory Technology, Vom.

Proximate analysis

Proximate analyses of feed samples were determined using the method of A.O.A.C. (1990) at Biochemistry and Applied Molecular Biology Department, National Veterinary Research Institute, Vom.

Statistical analysis

Data generated in the study were subjected to analysis of variance (ANOVA) and differences between treatment means were compared using the Duncan's multiple Range Test according to SAS (1995).

Results and Discussion

The micronutrients profile of the three tested vitamin – trace mineral premixes type used for the chick study is presented in

Table 2. A wide variation in the levels of vitamins and mineral elements exist among the premix type. The YVM premix type excelled in the level of most of micronutrients in XVM except for vitamin D₃, Vit. E, manganese, cobalt and iodine. The ZVM premix contained lower quantities of almost all the vitamins and minerals relative to the values reported for XVM and YVM premixes. The wide variation in the micronutrients and antioxidants profiles of the three premixes showed need for standardization. This also calls for the need to be careful in choosing premixes for chick rearing as many of them may be deficient in some essential vitamins and minerals. It is better to start chicks on premix that will support growth and sound health based on their vitamin and mineral profile (as this may affect their subsequent performance) than opting for less expensive vitamin premix that is lacking in essential micronutrients.

The results of the experimental birds fed the dietary treatments is presented in Table 3. Results observed in the study were a true reflection of the vitamins and mineral profiles of the tested premixes (Table 2). Generally, except for birds on 0.45% ZVM diets, birds on XVM or YVM premix had significantly ($P<0.05$) better final live weight than those on ZVM premix. The result shows the relative superiority of XVM and YVM premix over the ZVM premix for chicks in terms of the micronutrient profile. Birds fed XVM and YVM premixes had similar final live weight ($P>0.05$) and it was also obvious that the level of inclusion of XVM or YVM premix had no significant ($P>0.05$) effect on the final live weight of the birds. Birds on 0.25% YVM premix diet had relatively higher final live weight (750.90g/bird/day) compared to other dietary treatments.

Feed intake was not significantly ($P>0.05$)

Table 3: Effects of varying levels of different vitamin-premix sources on performance of Pullet chicks (0 – 8 weeks)

PARAMETERS	0.15	0.25	XYM		0.45	0.15	0.25	0.35	YVM		0.15	0.25	0.35	ZVM		SEM
			0.35	0.45					0.45	0.55				0.35	0.45	
Initial weight, g/bird	35.96	36.12	36.07	36.25	36.50	36.14	36.05	36.14	36.37	36.42	36.26	36.30	0.104			
Final live weight, g/bird	707.61 ^{ab}	724.76 ^b	705.56 ^a	734.48 ^b	702.13 ^a	750.90 ^a	733.61 ^a	729.99 ^a	600.07 ^a	675.30 ^a	693.05 ^b	738.36 ^a	7.257			
Feed intake, g/bird/day	48.93	46.76	48.54	48.30	47.44	46.38	48.16	46.23	47.18	47.39	48.25	49.13	0.435			
Daily weight gain, g/bird/day	10.72 ^c	11.73 ^b	11.31 ^{bc}	11.72 ^{bc}	11.23 ^{bc}	13.05 ^a	12.03 ^b	11.59 ^{bc}	9.80 ^d	10.87 ^{bc}	11.02 ^c	11.99 ^b	0.146			
Feed conversion ratio	4.60 ^c	3.98 ^b	4.30 ^{bc}	4.12 ^b	4.11 ^b	3.56 ^a	4.01 ^b	3.99 ^b	4.82 ^d	4.35 ^b	4.39 ^b	4.10 ^b	0.060			
Cost per gain, N	248.03 ^{cd}	217.25 ^b	236.96 ^c	229.92 ^c	226.38 ^c	192.03 ^a	217.79 ^b	218.35 ^c	258.45 ^d	235.25 ^c	238.85 ^c	224.74 ^b	3.156			
Mortality, %	3.90 ^{ab}	1.96 ^c	3.27 ^{bc}	3.25 ^{bc}	3.25 ^{bc}	3.92 ^a	3.27 ^b	1.96 ^c	7.77 ^a	6.53 ^{ab}	3.92 ^{ab}	6.53 ^{ab}	0.607			

^{abc} - means in the same row with different superscripts differ significantly (P<0.05)
SEM - Standard Error of Mean

influenced by the dietary treatments. Feed consumption was similar even at the highest level of premix inclusion (0.45%). This is consistent with the earlier report of decreased sensitivity of the birds to vitamin premix at the finishing phase of broilers (Oduguwa *et al.*, 1996). Endogenous secretion of some vitamins (especially thiamin) with subsequent reduction of their dietary requirement in feed of the birds was the major argument put forward by these authors for the stabilization of feed intake as the bird ages. Bolu and Balogun (2003) reported that as the level of vitamin deficiency increased, corresponding increases in dietary intake were recorded. In the present study, the relatively low micro-nutrients contents of the ZVM premix compared to XVM and YVM premixes did not result in significant ($P>0.05$) increase or decrease in feed intake.

The values obtained for daily weight gain followed the same trend as that of the final live weight. Birds on 0.25% YVM premix diet had significantly ($P<0.05$) higher weight gain (13.05g/day) and better feed conversion ratio value (3.56) compare to their counterparts on other dietary treatments. Birds on 0.25% ZVM diet on the other hand had significantly ($P<0.05$) lowered weight gain (10.87g/bird/day) and poorer feed conversion ratio value (4.35) compare to those on 0.25% YVM premix and or 0.25% XVM diets (with weight gain of 11.75g/bird/day and feed conversion ratio value of 3.98, respectively). The micronutrients composition of the three premix type used in the study (Table 2), showed that the concentration of Thiamin (Vit. B₁), Vitamin B₆, Vitamin B₁₂ and folic acid are relatively more in the YVM premix than in the other tested premixes. These vitamins are indispensable in energy and protein metabolism which may accounts for

the relatively higher weight gains observed for birds on YVM premix diets than those on XVM or ZVM premix diets. Similarly, mineral elements like Ca, P, Mn, Fe, selenium etc. that supports growth in chicks are more concentrated in the YVM than that of XVM and ZVM. It was obvious from this study that as the level of YVM premix increased beyond the manufacturers recommended inclusion level (2.5kg or 0.25kg per 100kg of diet), there were no corresponding vitamin activities to aid the utilization of feed and support consistent weight gain. The same was observed for the XVM based diets. This could be an indication that there may be no relative advantage in terms of unit gain in weight by increasing the level of inclusion of the premixes beyond the manufacturers' recommended optimum level of inclusion (2.5kg per tonne) for YVM and XVM premixes, respectively. Expectedly, birds fed 0.15% ZVM, 0.15% XVM or 0.15% YVM premix based diets had significantly ($P>0.05$) depressed performances compared to their counterparts on 0.25, 0.35 and 0.45% based diets, respectively.

The rate of gain and efficiency of feed utilization for birds on the ZVM diets was a true reflection of the micronutrients profiles of the ZVM premix (Table 2). It is clear from the performance result that micronutrients supplies of the ZVM premix were below the minimum requirements for the birds. The observed trend of increase in weight gain and efficiency of feed utilization as the level of inclusion increases from 0.15 to 0.45% also confirms the insufficiency of the micronutrients in ZVM premix. During the experiment, some of the birds on ZVM premix based diets had stunted growth while very few showed symptoms of perosis and curled toe paralysis, confirming that the minerals and vitamins contained in the ZVM premix was

Table 1.4: Effect of varying levels of different vitamin-premix sources on haematological parameters of pullets chicks (0-8 weeks)

Parameters	XVM								ZVM				SEM
	0.00	0.15	0.25	0.35	0.45	0.15	0.25	0.35	0.45	0.15	0.25	0.35	
Packed Cell Volume (PCV)	32.33	31.50	31.00	33.17	30.33	29.33	28.50	30.17	30.83	30.00	30.50	29.67	0.793
Haemoglobin (Hb), g/l	15.05 ^a	18.85 ^{ab}	18.55 ^b	19.22 ^a	17.74 ^{ab}	15.52 ^d	15.93 ^c	18.05 ^{ab}	19.13 ^{ab}	17.82 ^{ab}	17.33 ^{ab}	16.83 ^{abc}	0.413
Total Protein (TP)	4.76 ^{ab}	4.42 ^b	5.92 ^c	5.10 ^{ab}	5.12 ^{ab}	4.46 ^b	4.82 ^{ab}	4.24 ^b	4.97 ^{ab}	5.18 ^{ab}	5.21	4.69 ^b	0.179
Albumin	2.70	3.04	2.93	2.66	2.68	2.72	2.88	2.81	2.78	2.62	2.75	2.61	0.078
Red Blood Cell (RBC)	1.593	1.16	1.63	1.68	1.43	1.68	1.62	1.67	1.48	2.01	1.55	1.70	0.093
White Blood Cell (WBC)	2633.30 ^a	1900.00 ^b	1625.0	1465.7	1458.3	1800.0	1491.7	1733.3	1708.30	1683.3	1691.7	1775.0	108.1
Neutrophil	41.33	22.67	27.00	38.67	36.67	36.67	36.67	34.67	32.33	32.17	37.50	43.33	08
Lymphocyte	46.00 ^b	73.33 ^a	69.00 ^{ab}	66.33 ^{ab}	53.67 ^{ab}	61.67 ^{ab}	61.00 ^{ab}	64.33 ^{ab}	71.67 ^a	68.00 ^{ab}	55.67 ^{ab}	63.67 ^{ab}	3.586
Eosinophil	3.67 ^a	2.67 ^{ab}	1.00a ^b	0.67 ^{ab}	2.00 ^{ab}	0.67 ^{ab}	1.33a ^b	1.00 ^{ab}	0.00 ^b	0.67 ^{ab}	0.33 ^b	1.00 ^{ab}	3.721
Basophil	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.469

Means in the same row with different superscripts differ significantly (P<0.05)

SEM = standard Error of Mean

not adequate.

Although, there was no much variation in the cost of producing 1kg of each diet (Table 1) based on the prevailing market prices of feed ingredients at the time of the experiment, significant ($P>0.05$) difference in the cost per unit gain across the dietary treatment was observed. The cost to produce a unit gain followed the same trend with the feed conversion ratio. The cost per kg gain was significantly ($P>0.05$) lower for birds fed 0.25% YVM premix based diet compare to other dietary treatments. This is followed by the value obtained from birds on 0.25% XVM (N192.03 Vs N217.25). At the same 0.25% level of inclusion, the cost per unit gain for birds on ZVM was N235.23. The economy of production in this study favoured YVM premix at 2.5kg/tonne or 0.25 per 100kg of feed for chicks.

Mortality observed at the course of the study was low and it occurred within the first week of the experiment. No specific trend was however observed among the treatment means. Post mortem examination of the birds at the central Diagnostic laboratory at NVRI, Vom revealed symptoms of stress and mechanical injury devoid of nutritional undertone. This is normal during brooding. The hematological and serum biochemical indices of the experimental birds as affected by the dietary treatments are shown in Table 4. Except for Total protein and Haemoglobin, the results showed no significant differences ($P>0.05$) on the values of all the blood parameters measured. The total protein and haemoglobin values at 0.25% dietary levels of inclusion (i.e. the manufacturers recommended usage rates) were statistically the same ($P>0.05$). The similarity in blood parameter values observed in this study could probably be a

reflection of the adequately balanced protein and caloric density of the diets (Babangida and Ubasi 2006). The red blood cell count (RBC), White blood cell (WBC) count, packed cell value (PCV), Total protein (TP) and haemoglobin (Hb) concentration values were within the normal range established by Jain (1986) for chicken. This would be an indication that the birds were healthy throughout the experimental period.

Conclusion

Evidence from this study favoured YVM as premix of choice for starting pullet chicks that would be subsequently used to produce quality eggs for vaccine preparation. In conclusion, the use of YVM at 2.5kg per tonne (0.25% inclusion level) was cheaper and more efficient in supporting the growth performance of pullet chicks.

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Received: 04/07/13

Accepted: 28/02/14