FEED UTILIZATION BY BROILER CHICKENS FED THREE COMMERCIAL MICRONUTRIENT PREMIXES AT TWO PHYSIOLOGICAL STAGES OF GROWTH

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ABSTRACT

Three commercial premix types were fed in duplicates to six groups of 45 broilers each at the starter phase (0-5 weeks). At the finisher phase (5-9 weeks) each treatment group of the starter was further divided into three groups. Nine premix combinations were used at the finisher phase. Performance of the birds was monitored. At the starter phase, birds fed premix Z diet had a mean body weight (629.90gm) that was higher ($P < 0.05$) than those fed premix A diet (518.87 gm) which was also higher than those fed premix U diet (414.59gm). The mean daily weight gains followed the same trend with 16.81gm, 14.04gm, or 10.58 gm for birds fed diets that contained premixes Z A or U respectively. Birds fed diet that contained premix Z consumed 48.80 gm daily which was more than those for birds fed premix U in their diet (37.85gm). The feed to gain ratio was not significantly affected ($P > 0.05$) by the premix type fed at this phase. Poor growth rate caused by premix fed at the starter phase was not completely overcome due to the premix type fed at the finisher phase. Dry matter digestibility and the nitrogen retention at the finisher phase varied ($P < 0.05$) with the type of premix fed. No difference ($P > 0.05$) was observed among the premix types for the metabolic trials at the starter phase.

Keywords: Feed utilization, Broiler, commercial micronutrient, premixes, stage of growth

INTRODUCTION

A good number of nutritional diseases are caused by marginal deficiencies of various vitamins which lead to often observed disorders such as degenerative changes in the tissues and bone malformations. Thiamine (Vit

B1) functions in the regulation of carbohydrate metabolism (McLandless and shanker, 1968 and McLandless *et al*; 1976). Vitamin B6 (Pyridoxal-5-phosphate) is a co-factor in amino-acid transaminases and therefore plays vital roles in protein metabolism (Saroka and Combs, 1986) While vitamin B12 and folate are indispensable in protein metabolism.

The mineral elements function either as constituents or activators of enzymes in the blood and body fluids. They aid in absorption secretion and excretion and are important in the maintenance of osmotic relations and acid base equilibrium (Ofowbe, 1987). The discovery and inclusion of a complete vitamin and trace mineral premix in feeds for poultry has been a major break through. The growth of poultry industry in Nigeria was parallel to the improved supply and utilization of micronutrients. However, increase in the demand and supply of these products led to appearance in the market of many brands of premixes with marked differences in their vitamin and trace mineral profiles. Oduguwa and Ogunmodede (1995a, 1995b), reported the differing potentials of three locally available vitamin and tracemineral premixes for rearing meat type chicken.

However, availability of the premixes tend to be unstable as a result of economic situation in Nigeria (Ogunmodede, 1991). This informed the consideration of employing a combination of premixes for rearing broilers. The present study seeks to explore the complementary effect of premixes used solely or in replacements at the starter and finisher phases.

MATERIALS AND METHODS

A batch of 270 day old broiler chicks were divided into six groups of 45 birds each, weighed and randomly assigned in duplicates to three dietary treatments at the starter phase

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(0-5 weeks). Three isocaloric and isoproteinous diets were fortified, at the manufacturers' recommended levels, with three commercial premixes purchased locally and labelled as premix A, U or Z. At the finisher phase (6-9 weeks), the birds in the two replicates for each treatment were randomly subdivided into three treatment groups of two replicates each. One treatment group continued on the premix it received at the starter phase and the other two groups were assigned to the remaining premixes that were not given at the starter phase for that particular treatment group. The nine premix

TABLE 1: PREMIX TYPES FED AT THE STARTER AND FINISHER PHASES

Starter Premix	Finisher Premix
A	A
U	Z
A	Y
U	Z
A	Z
U	Z

Feed and water were provided *ad libitum*. The rate of growth and the feed intake of the birds were recorded. Diets were analysed for their proximate constituents using the methods of Association of Official Analytical Chemists (AOAC, 1984). Two metabolic trials were carried out at the fifth and ninth weeks. The retention of nitrogen and the apparent digestibilities of dry matter and nitrogen were determined.

The analysis of faecal samples for nitrogen digestibility was based on the extraction of uric acid from poultry dropping by the use of uranyl acetate, thus correcting for the non-proteinous nitrogen extraction. Data obtained were subjected to analysis of variance and significant differences among treatments separated using Duncan's multiple range test (Gomez and Gomez, 1984).

TABLE 2: COMPOSITION OF EXPERIMENTAL DIETS (g/kg diet)

Ingredients	Premix A	Starter Rations Premix U	Premix Z	Premix U	Finisher Rations Premix A	Premix Z
Yellow Corn	560.0	560.0	560.0	558.0	558.0	558.0
Groundnut meal	214.0	214.0	214.0	186.9	186.9	186.9
Spent grain	68.0	68.0	68.0	120.1	120.1	120.1
Menhaden						
Fish meal	40.0	40.0	40.0	35.0	35.0	35.0
Blood meal	45.0	45.0	45.0	30.0	30.0	30.0
Palm oil	20.0	20.0	20.0	15.0	15.0	15.0
Bone meal	35.0	35.0	35.0	35.0	35.0	35.0
Oyster shell	10.0	14.0	12.5	10.0	14.0	12.5
Salt	3.0	3.0	3.0	5.0	5.0	5.0
*Vitamin/Mineral premix	5.0	1.0	2.5	5.0	1.0	2.5
Total	1000	1000	1000	1000	1000	1000
Determined Analysis						
Crude protein (g/kg diet)	221.8		231.2	228.6	199.6	203.5
Crude fibre (g/kg diet)	47.7		49.4	48.7	51.2	50.0
Ether extract (g/kg diet)	54.3		57.6	59.7	54.7	51.6
Ash (g/kg diet)	75.2		66.8	90.3	69.2	71.8
Calculated Energy Values						
Energy (ME)	3024.5		3024.5	3024.5	2997.97	2997.97
KCal/Kg						

combinations of two replicates each were used at the finisher phase (Table 1). The composition of the experimental diets at the starter and finisher phases are shown in Table 2

RESULTS AND DISCUSSION

Table 3 shows the performance characteristics at the starter and finisher phases. Birds that received premix Z at the starter phase were heavier than those given

TABLE 3: PERFORMANCE CHARACTERISTICS OF EXPERIMENTAL BIRDS AT THE STARTER AND FINISHER PHASES

PARAMETER PHASE (0.5 weeks Starter Phase)	Premix Type Fed						Sex									
	Premix A		Premix U		Premix Z											
Initial weight (g)	41.35		44.50		40.90		0.8									
Final weight (g)	518.87 ^a		414.59 ^a		629.39 ^a		11.91									
Mean daily feed intake (g)	46.72 ^a		37.85 ^b		48.80 ^a		0.77									
Mean daily weight gain (g)	14.04 ^b		10.55 ^c		16.81 ^a		0.03									
Feed/Gain ratio	3.33		3.54		3.05		0.20									
6-9 Weeks (finisher Phase)																
Final weight (g)	1233.11 ^{cd}		1260.42 ^{cd}		1366.99 ^{bc}		1202.70 ^{cd}	1146.72 ^d	1263.79 ^{ab}	1375.00 ^{ab}	1431.21 ^{ab}	1512.50 ^a	28.25			
Mean daily feed intake (g)	107.07		99.01		108.14		97.85		103.41		98.68		100.83	101.53	3.02	
Mean daily weight gain (g)	28.01 ^{ab}		26.21 ^{ab}		29.79 ^{ab}		25.30 ^b		23.31 ^b		25.04 ^{ab}		25.70 ^{ab}	25.93 ^{ab}	30.11 ^a	1.78
Feed/Gain ratio	4.35 ^a		3.92 ^{ab}		3.85 ^{ab}		3.95 ^{ab}		4.51 ^a		3.91 ^{ab}		4.03 ^a	3.97 ^a	3.46 ^b	0.21
Values with different superscripts on the same horizontal row are significantly different (P<0.05).																

TABLE 5: METABOLIC TRIALS AT THE STARTER AND FINISHER PHASES

PARAMETERS										
Premix Type Fed										
PHASE		Premix A		Premix U		Premix Z		Sex		
0-5 weeks (Starter)		Premix A		Premix U		Premix Z		Sex		
Dry Matter Digestibility		70.12		73.12		69.48		2.10		
Nitrogen Retention		50.27		49.43		42.96		8.25		
Nitrogen Digestibility		84.44		84.33		79.86		2.21		
6-9 weeks (Finisher)										
Dry Matter Digestibility		67.16 ^b		63.92 ^b		70.21 ^{ab}		69.63 ^{ab}		76.11 ^{ab} 4.47
Nitrogen Retention		47.53 ^b		48.93 ^b		59.12 ^{ab}		60.54 ^{ab}		71.87 ^a 4.70
Nitrogen Digestibility		85.01		84.26		88.15		87.65		90.28 87.72 85.98 90.09 2.24
Values with different supper scripts on the same horizontal row are significantly different (P < 0.05).										

premix A or U. This is a confirmation of an earlier study (Oduguwa and Ogunmodede, 1995a) and an indication that the feed consumed was properly utilized for growth on account of the balanced trace mineral profile of this premix. Premix A on the other hand had an unbalanced profile characterised by excessive additions of some vitamins and minerals and complete absence of others. (Table 4). This explains why birds fed premix A ate as much as those on premix Z but weighed lower at the end of the fifth week.

It was obvious that the profile of premix U could not stimulate a high feed consumption rate at this stage to allow the birds to produce to their full capacity since it contained lower quantities of almost all the vitamins and trace minerals relative to the values recommended by NRC (1984) coupled with the absence of micro nutrients like thiamine, biotin and folic acid.

finisher phase when the same premix profile was given at both phases. Endogenous secretion of some vitamins (especially thiamine) with the subsequent reduction of their dietary requirement in the feeds of the birds was a major reason put forward. In this study, the stabilization of feed intake was suspected to be further effected by the complementary effects of combination of the premix profiles.

Birds started with premix Z and finished with the same premix or with either A or U had relatively good final body weights. Those started with premix A and finished with any of the three premixes had final body weights that were not significantly different. Feeding premix U or A at both the starter and finisher phases gave final body weights that were lower than feeding premix Z at the two physiological stages (Table 3). The mean feed to gain ratio was not significantly affected by the premix

TABLE 4: PERCENTAGE OF *NATIONAL RESEARCH COUNCIL REQUIREMENT OF BROILER CHICKEN SUPPLIED BY THE PREMIXES

	Starter %	** Premix A Finisher %	Premix U%	Premix Z%
Vitamin A	1200	1000	533	833
Vitamin D3	1250	1250	750	1250
Vitamin E	140	110	30	400
Vitamin B2	333	278	65	167
Vitamin B3	163	148	29	130
Vitamin B6	933.33	667	10	117
Choline Chloride	37	31	-	23
Manganese	200	200	17	167
Iron	88	88	6.25	63
Copper	125	125	2.50	25
Iodine	628	628	42.6	443
Selenium	133	133	6.67	67
Vitamin K3	.	.	600	500
Calcium Pantothenate	.	.	30	100
Vitamin B12	.	.	89	113
Zinc	.	.	11.25	112.5
Cobalt	.	.	-	-
Vitamin B1	.	.	-	111
Biotin	.	.	-	33
Folic Acid	.	.	-	182

*NRC 1984

** Manufacturers of premix A had designated premixes for starters and finisher broiler while manufacturers of premix U and Z provided only one premix for the starters and finishers.

The wide variation in the micronutrient profiles of the three premixes shows the need for standardisation. There was a stabilization of the feed consumption rate at the finisher phase. This observation is consistent with the earlier observation (Oduguwa and Ogunmodede, 1995a) of decreased sensitivity of the birds to the type of premix fed at the

type at the starter phase. However, birds fed premix Z at both phases had better values than the group that received premix A or U at both phases.

Table 5 shows the nitrogen retention and the digestibilities of Nitrogen and dry matter. The premix type at the starter phase did not significantly affect the dry matter digestibility

by the birds. The dry matter digestibility at the ninth week of trial for birds fed premix U at both the starter and finisher phases was higher than those for group of birds fed premix A at the starter phase and finished with either premix A or U. The high dry matter digestibility of birds fed premix U at both phases was not reflected in their live weights. A high digestibility value does not mean proper metabolism of the digested materials.

Actually, vitamins and minerals play more roles in the fate of absorbed material than in the process of digestion. The nitrogen retention values followed the same pattern as the dry matter digestibility values at the starter and finisher phases. The nitrogen digestibility in both phases were not significantly affected by the premix types.

In conclusion, when changes are to be made in the types of premix fed at the starter and finisher phases, care should be taken to start the birds with a proven premix because the poor premix profile produced detrimental effects on the young birds. The poor performance was not made up for, even when a good premix was fed at the finisher phase.

REFERENCES

- A.O.A.C. (1984). Official Methods of Analysis (14th ed.) Association of Official Analytical Chemists, Arlington, Virginia, U.S.A.
- AKESSON, C., FEHLING, M., JAGERSTAD and U. STERHRAN, (1982). Effect of experimental folate deficiency on lipid metabolism in liver and brain. *Br. J. Nutr.* 47 505-519.
- ASHILDKROGHDAHL and BRITA DALSGARD (1981). Estimation of Nitrogen digestibility in poultry: Content and distribution of major urinary nitrogen compounds in excreta. *Poult. Sci.* 60 (II), 2480-2485.
- GOMEZ, A.K. and A.A GOMEZ. (1984). *Statistical Procedures for Agricultural research.* Copyright by John Wiley and Sons Inc., Pg. 304.
- LUDWIGSHAFEN, N.A., BONN. G.B., ELMSHARM, D.D., OLDEND. W.K.A., K.K., GRENZACH, H.L. (1984). Vitamins in Animal Nutrition Publ. Arbeits gematschaft for werkstoffe in dar Turrernahrunge V. (AWT) Adenauerallae 170 Bonn.
- MCLANDLESS, D.W.; SCHENKER, S.S. (1968). Encephalopathy of thiamine deficiency studies of intracerebral mechanism *J Clin Invest* 47: 2268-2280.
- MCLANDLESS, D.W.; A.D. CYRLEY, AND CASSIDY, C.E. (1976). Thiamine deficiency and the pentose phosphate cycle in rats intracerebral mechanisms *J. Nutr.* 106: 114-1151.
- N.R.C (1984). National Research Council. Nutrient requirements of domestic animals No. 1 Nutrient requirements of poultry Nat. Acad. of Sciences. Washington D.C.
- ODUGUWA, O.O. (1991). Protein utilization by broiler chicks fed on three commercial premixes at the starter and finisher phases Ph.D Thesis. Department of Animal Science, Univ. of Ibadan Pg. 77
- ODUGUWA, O.O. and OGUNMODEDE, B.K. (1995a). Growth and Protein utilization by broiler chicks fed three commercial micronutrient mixtures. *International Journal of Animal Sciences* Vol. 10 (In Press)
- ODUGUWA, O.O. and OGUNMODEDE, B.K. (1995a) Efficiency and Carcass characteristics of broiler chicks fed three commercial micronutrient mixtures: *International Journal of Animal Sciences* Vol. 10 (In press)
- OFOVBE, V.N. (1987). Metabolism of some divalent minerals by broilers fed palm kernel products and varying calcium to phosphate rations. Ph.D Thesis, Dept. of Anim. Sci., Univ. of Ibadan.
- OGUNMODEDE, B.K. (1991). Vitamin • nutrition by poultry in warm climates. Paper presented at a conference organised by Roche Nig. Ltd., 6th March, 1991
- SAROKA, J.N. and JR, COMBS. G.F. (1986). The lack of effect of a pyridoxine deficiency on the utilization of the hydroxy Analogue of methionine by the chick. *Poult sci.* 65: 764-768.