PHYSICO-CHEMICAL PROPERTIES OF MEAT AND BLOOD PROFILE OF BROILER CHICKENS FED FIVE COMMERCIAL VITAMIN-MINERAL PREMIXES IN IBADAN, NIGERIA

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ABSTRACT

Relative efficacy of five proprietary vitamin-mineral premixes on meat physico-chemical properties and blood profile of broiler chicken was undertaken in a trial lasting six weeks. A total of 288 one-day Abor acre broiler chicks were randomly allotted to six dietary treatments of 48 chicks per treatment. Each treatment was replicated thrice. Six isocaloric and isonitrogenous diets were formulated. Diet 1 (T1) was the control without any premix. Other diets were supplemented appropriately with 0.25% Daramvita (T2), Bio-Organics (T3), Hi-Nutrients (T4), Optimix (T5), and DSM Nutripoults (T6). The experimental diets were offered to the respective birds with water given ad libitum and the design of the experiment was a completely randomized design. Meat crude protein (%) 28.45, 30.91, 30.83, 29.91, 29.25, and 31.95; ash (%) 8.45, 10.33, 9.67, 10.28, 9.95 and 10.78 obtained for meat of broilers on T1, T2, T3, T4, T5 and T6, respectively differed significantly ($p<0.05$). Shear force of broiler primal cuts were statistically similar ($p>0.05$) while cooking losses, chilling losses and water holding capacity of thigh varied significantly ($p<0.05$). Haematology values at the finishers stage were similar ($p>0.05$). However, packed cell volume, haemoglobin, red blood cells and white blood cells varied significantly ($p<0.05$) at the starter phase. Serum cholesterol, albumin and alkaline phosphatase were significantly different ($p<0.05$) at the starter phase while serum total protein, albumin, globulin and high density lipoprotein varied significantly ($p<0.05$) at the finishers phase. The different proprietary vitamin-mineral premixes supplementation had varying effects on meat physico-chemical and blood profile of broiler which invariably connotes unequal efficacy and potency of commercial vitamin-mineral premixes in Ibadan, Nigeria.

Keywords: Meat primal cut, Proprietary vitamin-mineral premixes, Serum biochemical indices, Broiler haematology, Meat chemical composition

Introduction

Meat is one of the major products of poultry industry. Meat quality factors have been greatly linked to diets consumed by the animal from which the meat is obtained (Perez-Vendrell*et al.*, 2002). The property of meat as food depends on the muscle and associated tissues which to a large extent are governed by physico-chemical composition and nutritive values of muscle. Reports (BASF, 1996; Perez-Vendrell *et al.*, 2002; Dsouza and Mullan, 2007) linked the nutritive value of meat to vitamin intake. Optimum vitamin nutrition leads to optimum deposition of vitamin in meat which improves meat quality and increase the shelf life .

Vitamin-mineral premixes are the usual medium through which poultry diets are fortified with these essential nutrients that are either imported or manufactured locally.Nevertheless, nutritional products are being marketed throughout the country without any established regulation. For humans, animals and environment safety to be guaranteed (Wenk, 2000) the claimed effects of a product on the farm animals' performance, disease prevention antioxidant effect, pigmentation etc (that are the normal functions of nutritional additives) must be clearly demonstrated by experiments and the absence of undesired side effects clearly established.

However, there is lack of unbiased research station or poultry authority in the country to test the relative efficacy of marketed commercial premixes and provide information to the practising nutritionists and farmers. This is aside from the dearth of sufficient documented evidence of the effects of the proprietary vitamin-mineral premixes on meat physico-chemical properties. Few reports (Oduguwa and Ogunmodede, 1995; Oduguwa *et al*., 1996; Oduguwa *et al*., 2000) on the efficacy of proprietary micronutrient premixes for broiler chicken stopped at performance, carcass characteristics and blood profile. Besides, these studies were carried out more than a decade ago. The present endeavour was aimed at evaluating the physico-chemical properties of meat and the blood profile of broiler chicks fed five different commercial vitamin-mineral premixes in Ibadan, Nigeria.

Materials and Methods

The experiment was carried out at the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria. A total of 288, 1-day old Arbor acre broiler chicks were randomly allotted six dietary treatments of 48 chicks per treatment and each treatment was replicated thrice in a completely randomized design. The birds were raised on partitioned deep litter house at the stocking rate of $0.1m^2$/bird.

Six isocaloric and isonitrogenous diets were formulated at both the starter and finisher phases. The gross composition of diets fed to the birds is shown in Table 1. Five proprietary vitamin-mineral premixes were purchased from a toll feed milling factory in Ibadan, Nigeria. Each diet was supplemented with 0.25% vitamin-mineral premixes; T1 – Control (without any vitamin-mineral premix), T2 – Control diet + 0.25% Daramvita, T3 – Control diet + 0.25% Bio-Organics, T4 – Control diet + 0.25% Hi-Nutrient, T5 – Control diet + 0.25% Optimix, T6 – Control diet + 0.25% Nutripoults. The composition of the tested vitamin-mineral premixes as clearly written on their respective labels is shown in Table 2.

Birds were weighed prior to their allotment to various dietary treatments. Routine medication and vaccination were administered on the birds (Oluyemi and Roberts, 2000). The birds were given feeds and water *ad libitum*. The design of the experiment was a completely randomized design.

At 21 and 42-days of the feeding trial, blood samples were collected through the jugular vein from two birds per replicate for starters and finishers for the determination of haematology and serum biochemical indices respectively. Packed cell volume (PCV) and haemoglobin (Hb) were determined using Micro-Haematocrit method and Cyan Meth- Haemoglobin method respectively as described by Mitruka and Rawnsley (1977). Total protein was determined using Biuret method as described by Reinhold (1953). Albumin was analyzed by Bromocresol Green method (Doumas *et al*., 1971). Red blood cell (RBC) and white blood cell (WBC) were determined as described by Schalm *et al*. (1975). Cholesterol (Flegg *et al*., 1973), triglycerides (Jacobs *et al*., 1973), alkaline phosphatase (Mc Comb *et al*., 1983), high density and very low density lipoprotein (HDL and VLDL) (Friedwald, 1972), aspartate amino transferase (AST) and alanine amino transferase (ALT) (Reitman *et al*., 1957) were determined.

At week 6, three birds with the weight close to the mean of each replicate were purposively selected, tagged and slaughtered after being deprived of feed for 16 hours. They were defeathered and carefully dissected into primal cuts. Shear force was determined on the prima cuts (Omojola and Adesehinwa, 2007). Cooking and chilling losses were according to the procedure of Mahendraker *et al*. (1988). Water holding capacity was carried out according to the procedure of Suzuki *et al.* (1991) and the proximate composition undertaken in duplicate (Horwitz, 1990).

Data obtained were analysed using analysis of variance (SAS, 1999) ($p<0.05$)

Table 1: Gross composition of the experimental starter and finisher diets

Ingredients	Starter	Finisher
Maize	51.00	50.00
Soybean meal	36.00	32.00
Palm oil	2.00	2.00
wheat offal	7.99	12.99
Avatec	0.06	0.06
DCP	1.50	1.50
Oyster shell	1.00	1.00
Salt	0.25	0.25
DL Methionine	0.15	0.15
L- Lysine	0.05	0.05
Vitamin-mineral premix		
Total	100.00	100.00
Calculated nutrient values:		
Crude protein (%)	22.30	21.29
Metabolizable Energy (MEkcal/kg)	3036.38	2987.00
Calcium (%)	1.16	1.16
Phosphorus (%)	0.74	0.77

DCP: Dicalcium phosphate

Table 2: Composition/2.5kg of broiler vitamin-mineral premixes as shown on their labels

	Hinutrient	Daramvita	Bio-Organic	DSM Nutripoult	Optimix
Vitamin A (iu)	12.000.000	10.000.000	8.500.000	10.000.000	10.000.000
Vitamin D_3 (iu)	2.500.000	2.000.000	2.000.000	2.000.000	2.400.000
Vitamin E	30.000iu	10.000iu	10.000mg	40.000mg	10.000mg
Vitamin K	2.000mg	2.000iu	1.500iu	2.000mg	2.000mg
Vitamin B_1(mg)	2.250	1.500	1.600	1.500	1.500
Vitamin B_2 (mg)	6.000	4.000	1.500	4.000	1.500
Vitamin B_6 (mg)	4.500	1.500	20.000	40.000	1.500
Vitamin B_{12} (meg)	15	10. 000	20. 000	10. 000	15. 000
Niacin (mg)	40.000	15.000	20.000	40.000	15.000
Panthothenic (mg)	15.00	5.000	5.000	10.000	5.000
Folic (mg)	1.500	300	500	1.000	500
Biotin (mcg)	50	20. 000	75. 000	100. 000	20. 000
Cholinechloride (mg)	30.000	200	175.00	300.000	200.000
Manganese (mg)	80.000	80.000	40.000	80.000	80.000
Zinc (mg)	50.000	50. 000	30.000	60.000	60.000
Iron (mg)	20.000	20. 000	20.000	40.000	40.000

Table 2 Contd.

	Hinutrient	Daramvita	Bio-Organic	DSM Nutripoult	Optimix
Copper (mg)	5.000	5. 000	3.000	80.000	5.000
Iodine (mg)	1.000	1.2	1.000	800	1.200
Selenium (mg)	200	200	200	200	200
Cobalt (mg)	500	200. 000	200	300	200
Antioxidant (mg)	125.000	125. 000	1.250	100.000	125.000

Results and Discussion

The physical property of broiler primal cuts from chicks fed diets supplemented with five different commercial vitamin-mineral premixes is shown in Table 3. Data obtained for shear force Kg/cm^3 of all primal cuts were statistically similar ($p>0.05$).

Cooking losses (%) obtained for the thigh of experimental birds were 38.33, 33.33, 37.50, 37.50, 42.50 and 41.67 for T1, T2, T3, T4, T5 and T6 respectively and varied significantly ($p<0.05$). Thigh from birds on T4 and T5 had significantly higher values compared to those on T2 which indicated variation in the potency and efficacy of the dietary supplement given to birds. Cooking losses of all other primal cuts (Drumsticks and Breasts) were not significantly different ($p>0.05$).

Chilling losses (%) obtained for thigh were 1.43, 1.18, 5.10, 6.39, 0.70 and 1.14 for broiler meat from treatments 1, 2, 3, 4, 5 and 6 respectively. The values were significantly higher ($p<0.05$) for thigh from treatments 3 and 4 compared to statistically similar ($p>0.05$) values for those on other treatments. The chilling losses for drumstick, breast and wings were not significantly different ($p>0.05$). Moisture loss was evident during chilling but the ability of meat to reduce the moisture losses through evaporation is of paramount importance. BASF (1994) reported that chilled carcass weight improved with vitamin supplementation contrary to results obtained from this study. It was expected that meat from birds on control diets (without premix) would have the highest chilling losses.

The water holding capacity (WHC) (%) of thigh ranged from 43.00 to 66.67 with significantly higher value ($p<0.05$) of 66.67 for thigh of birds from T2 while those from control had lower value of 43.00. The WHC values of drumstick varied differently from that of thigh. Obtained values ranged from 48.00 for drumsticks of meat from T6 to 67.33 for those on T5 and were statistically different ($p<0.05$). The WHC of meat from birds on T5 was similar ($p>0.05$) to 56.00, 56.33, 56.00 and 56.27 for drumsticks of meat from T1, T2, T3 and T4 respectively. The WHC values obtained for breast and wings varied only numerically and were not affected by the type of test vitamin-mineral premixes used. The ability of meat to retain its water, especially, when external force is applied, is very essential for such meat to retain its nutritional value. Meat with lower WHC value has the tendency of having high drip losses. This observation conformed with the report of Perez-Vendrell *et al.* (2000) for breast of chickens fed enriched-vitamin diets which recorded numerically higher values compared with birds on control diets; which explained why primal cuts (excepting drumsticks) from birds on control diets recorded lower WHC.

Table 3: Physical properties of broiler primal cuts from chicks fed diets supplemented with five different commercial vitamin-mineral premixes

Parameters	T1	T2	T3	T4	T5	T6	SEM
Shear force Kg/cm^3							
Thigh	3.28	3.33	3.79	3.14	3.25	3.25	0.24
Drumstick	2.76	3.83	3.53	4.73	3.77	3.81	0.85
Breast	3.34	3.95	4.08	3.60	3.74	3.45	0.77
Cooking losses (%)							
Thigh	8.33^{ab}	33.33^{b}	37.50^{ab}	37.50^{ab}	42.50^{a}	41.67^{a}	1.67
Drumstick	35.83	37.50	37.50	36.67	32.83	38.33	1.37
Breast	37.50	36.67	35.83	39.17	38.33	36.67	1.27
Chilling losses (%)							
Thigh	1.43^{b}	1.18^{b}	5.10^{a}	6.39^{a}	0.70^{b}	1.14^{b}	0.87
Drumstick	2.30	0.87	0.89	1.94	1.76	2.28	0.72
Breast	1.55	1.33	3.38	1.67	1.83	1.72	0.75
Water holding capacity (%)							
Thigh	43.00^{b}	66.67a	50.00^{ab}	48.00^{ab}	52.33^{ab}	60.67^{ab}	6.13
Drumstick	56.00^{ab}	56.33^{ab}	56.00^{ab}	52.67^{ab}	67.33^{a}	48.00^{b}	5.14
Breast	37.00	34.00	42.00	49.00	42.33	47.67	6.43

a, b, c, d, e means along the same row with dissimilar superscripts differs significantly ($p<0.05$)
SEM- Standard error of the mean ; T1 – Control (without any vitamin-mineral premix), T2 – Control diet + 0.25% Daramvita, T3 – Control diet + 0.25% Bio-Organics, T4 – Control diet + 0.25% Hi-Nutrient, T5 – Control diet + 0.25% Optimix, T6 – Control diet + 0.25% DSM Nutripoults

Proximate composition (g/100g) of broiler meat fed five different proprietary premixes is shown in Table 4. Fat content obtained for broiler meat (10.39, 11.96, 12.41, 11.80, 10.70 and 10.15 for meat from T1, T2, T3, T4, T5 and T6 respectively) were not significantly different (>0.05). Zlender *et al.* (1995) obtained a fat range of 10.6-15.6 for thigh muscle of broilers which conformed to findings in this study. Crude protein of meat of birds on T2, T3 and T4 were 30.91, 30.83 and 29.91 respectively which were similar ($p>0.05$) but higher ($p<0.05$) than 28.45 for the control (T1). Meat of birds on T6 had significantly higher crude protein of 31.95. Values of crude protein here were higher than those earlier documented in literature (Snezana *et al.*, 2010; Souza *et al.*, 2011) which identified nutrition as one of the most crucial external factors in broiler production that could affect the composition of broiler meat. This could be interpreted that the rate of nutrient utilization were different due to variation in vitamin-mineral premixes profile.

The ash of meat from birds on control (without premix) was significantly lower ($p<0.05$) compared to the mineral content of those on other treatments that were supplemented with the different test premixes. Perez-Vendrell *et al.* (2000), Souza *et al.* (2011) and Dsouza and Mullan (2007) earlier correlated dietary vitamin-mineral with the vitamin and the mineral content of the meat which obviously was the situation in this study particularly for the control that had dietary vitamin-mineral excluded. Moisture (%) content of meat samples from birds on treatments 1, 2, 3, 4, 5 and 6 were 75.37, 81.79, 76.18, 81.50, 79.03 and 77.26 respectively and were statistically similar (p>0.05). The lower range of 75.26-75.62 obtained by Souza *et al.* (2011) was from meat samples of birds raised using extensive system. Bogosaljevic-Boskovic*et al.* (2006) had earlier indicated that different rearing systems could lead to varying meat quality.

Table 4: Proximate composition (g/100g) of broiler meat fed five commercial vitamin-mineral premixes

	Treatments						
Parameters	T1	T2	T3	T4	T5	T6	SEM
Ether extracts	10.39	11.96	12.41	11.80	10.70	10.15	0.70
Crude protein	28.45^{d}	30.91^{ab}	30.83^{ab}	29.91^{bc}	29.25^{cd}	31.95^{a}	0.35
Ash	8.45^{b}	10.33^{a}	9.67^{a}	10.28^{a}	9.95^{a}	10.78^{a}	0.35
Moisture	75.37	81.79	76.18	81.50	79.03	77.26	1.89

a, b, c, d, e means along the same row with dissimilar superscripts differs significantly (p<0.05)SEM-Standard error of the mean ; T1 – Control (without any vitamin-mineral premix), T2 – Control diet + 0.25% Daramvita, T3 – Control diet + 0.25% Bio-Organics, T4 – Control diet + 0.25% Hi-Nutrient, T5 – Control diet + 0.25% Optimix, T6 – Control diet + 0.25% DSM Nutripoults

Table 5 shows the haematological indices of experimental birds. Packed cell volume (PCV) values differed significantly (p<0.05) which indicated that the test vitamin-mineral premix had varying effect on birds at the starter phase. At the finishers' phase no difference was observed (p>0.05). As was reported (Gwyther *et al.*, 1992; Majid *et al.*, 2012) that removal of premixes from broiler diets would necessarily not imply such diets were devoid of vitamins or minerals. In practice, in the fortification of broiler diets with premixes, nutritionists hardly take the vitamin–minerals from natural feedstuffs into account which are more digestible and are therefore more available at the finisher phase. It may therefore be concluded that dietary vitamins-minerals available to birds at this finisher phase from diets was sufficient to meet their requirements for blood cells formation. Haemoglobin of experimental birds at the starter phase varied significantly (8.95, 9.28, 9.61, 9.61, and 9.33 for birds on diets T1, T2, T3, T4, T5 and T6 respectively). Birds on diet 3 had significantly higher values in both parameters (PCV and Hb) suggesting the premix was relatively of better quality. Birds on T2, T4, T5 and T6 had similar values (p>0.05) which indicated premixes had similar effects on the haemoglobin of the birds and this explained the profound efficacy of premixes on the birds. However, values obtained for birds on T1 was significantly lower (p<0.05) due to the absence of vitamin-mineral premix.

The RBC values at the starter phase varied significantly (p<0.05) with birds on only T4 having significantly higher (p<0.05) value of 2.05×10^{6} /mm^{3} while birds on diet1 had the lowest (p<0.05). The values obtained for RBC indicated the oxygen carrying capacity potentials of birds on T4. The standard value of white blood cell in literature ranges between 13.83-17.32x10^{3}/mm (Jain, 1986) though, birds on T1 had significantly lower value (p<0.05) but was within the standard range. Data obtained for monocytes at the starter phase varied significantly (p<0.05). The values were 1.17, 2.17, 2.00, 0.50, 2.50, and 1.83 for birds on diets T1, T2, T3, T4, T5 and T6 respectively which also indicated varying efficacy of the different premixes in boosting the immune potentials of the test birds. No significant variations were however observed in heterophils, lymphocytes and eosinophils contents at the starter phase. Basophil was not discovered at the peripheral blood. At the finisher phase, there were no significant variations(p>0.05) in all parameters measured which suggested that birds must have adjusted to the different premixes at this phase.

Table 5: Haematology of broilers fed diet supplemented with five commercial premixes at the starter phase

Parameters	T1	T2	T3	T4	T5	T6	SEM
PCV	21.67^{b}	27.83^{ab}	29.50^{a}	28.83^{ab}	28.83^{ab}	28.00^{ab}	0.77
Hb (g/dL)	8.95b	9.28^{a}	9.83^{a}	9.61	9.61^{a}	9.33^{a}	0.26
RBC (x 10^6/mm^3)	0.76^{b}	1.78^{ab}	1.93^{ab}	2.05^{a}	1.99^{ab}	1.98^{ab}	0.26
WBC (x 10^3/mm^3)	13.83	15.92^{ab}	15.75^{ab}	17.03^{ab}	17.32^{a}	14.97^{b}	0.09
Lymphocytes (x10^3/mm^3)	45.50	52.67	53.50	60.50	51.67	54.33	5.41
Heterophils (x10^3/mm^3)	51.00	42.50	42.50	37.00	43.33	40.83	4.91
Monocytes (x10^3/mm^3)	1.17^{b}	2.17^{ab}	2.00^{ab}	0.50	2.50^{a}	1.83^{ab}	0.39
Eosinophils (x10^3/mm^3)	3.17	2.67	2.17	2.17	2.67	2.00	0.65
Basophils (x10^3/mm^3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

a,b,c means along the same row with dissimilar superscripts are significantly different ($p<0.05$)
SEM standard error of mean. PCV packed cell volume, RBC red blood cells, WBC white blood cells. T1 control (without any vitamin-mineral premix), T2 control diet + 0.25% Daramvita T3 control diet + 0.25% Bio-organics, T4 control diet + 0.25% Hi-Nutrient, T5 control diet + 0.25% Optimix, T6 control diet + 0.25% Nutripoults

Table 6: Haematology of broilers fed diet using five different commercial premixes at the finishers' phase

	Treatments →						
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**SEM**
Packed cell volume	26.83	26.17	27.50	26.33	27.17	26.67	0.87
Haemoglobin (g/dL)	8.95	8.72	9.17	8.78	9.06	8.89	0.29
Red blood cell (10^6/mm^3)	2.35	2.21	2.56	2.37	2.43	2.39	0.16
White blood cell (x10^3/mm^3)	62.33	62.83	63.67	65.00	58.67	63.00	3.23
Lymphocytes (x10^3/mm^3)	31.33	30.67	30.83	28.67	34.67	33.33	3.19
Heterophils(x10^3/mm^3)	3.33	3.17	3.00	3.00	3.83	3.00	0.37
Monocytes(x10^3/mm^3)	3.00	3.33	2.50	3.50	3.33	2.33	0.77
Oesinophils							
Basophils(x 10^3/mm^3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

a,b,c means along the same row with dissimilar superscripts are significantly different
SEM standard error of mean T1 control (without any vitamin-minearal premix)
T2 = control diet + 0.25% Daramvita, T3 = control diet + 0.25% Bio-organics,
T4 = control diet + 0.25% Hi-Nutrient, T5 = control diet + 0.25% Optimix,
T6 = control diet + 0.25% Nutripoults.

The serum biochemical indices obtained for birds fed five different commercial vitamin mineral premixes at both the starter and finisher phases are shown in Tables 7 and 8 respectively. Albumin (g/dL)(1.25, 1.46, 1.36, 1.27, 1.51 and1.29) cholesterol (mg/dL) (117.48, 124.58, 139.49, 154.53, 143.30 and 165.13) and alkaline phosphatase (iu/L) (163.01, 167.10, 157.53, 155.02, 153.92 and 143.27 obtained for birds on T1, T2, T3, T4, T5 and T6 respectively) varied significantly ($p<0.05$) with the type of vitamin mineral premixes used at the starter phase while other serum indices were similar (p>0.05). Also, at the finisher phase, values of the total protein (g/dL) 5.45, 5.86, 6.13, 6.94,6.74 and 6.80; albumin (g/dL)1.06, 1.19, 1.41, 1.25, 1.51 and 1.36; globulin (g/dl)4.26, 4.67, 4.73, 5.29, 5.23 and 5.44 and the high density lipoprotein (mg/dL)81.11, 88.16, 90.40, 86.25, 85.35 and 154.63 obtained for birds on T1, T2, T3, T4, T5 and T6 respectively differed significantly (p<0.05).This showed that the premixes used had varying effects on the indicated serum indices which invariably implied differing potency of the test premixes.

Table 7: Selected serum biochemical Indices of broilers fed diet using five different commercial premixes at the starter phase

	Treatments →						
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**SEM**
Packed cell volume	26.83	26.17	27.50	26.33	27.17	26.67	0.87
Haemoglobin (g/dL)	8.95	8.72	9.17	8.78	9.06	8.89	0.29
Red blood cell (10^6/mm^3)	2.35	2.21	2.56	2.37	2.43	2.39	0.16
White blood cell (x10^3/mm^3)	62.33	62.83	63.67	65.00	58.67	63.00	3.23
Lymphocytes (x10^3/mm^3)	31.33	30.67	30.83	28.67	34.67	33.33	3.19
Heterophils (x10^3/mm^3)	3.33	3.17	3.00	3.00	3.83	3.00	0.37
Monocytes (x10^3/mm^3)	3.00	3.33	2.50	3.50	3.33	2.33	0.77
Oesinophils							
Basophils (x 10^3/mm^3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

a,b,c means along the same row with dissimilar superscripts are significantly different
SEM standard error of mean, T1 control (without any vitamin-mineral premix)
T2 = control diet + 0.25% Daramvita, T3 = control diet + 0.25% Bio-organics,
T4 = control diet + 0.25% Hi-Nutrient, T5 = control diet + 0.25% Optimix,
T6 = control diet + 0.25% Nutripoults.

The serum biochemical indices obtained for birds fed five different commercial vitamin mineral premixes at both the starter and finisher phases are shown in Tables 7 and 8 respectively. Albumin (g/dL)(1.25, 1.46, 1.36, 1.27, 1.51 and1.29) cholesterol (mg/dL) (117.48, 124.58, 139.49, 154.53, 143.30 and 165.13) and alkaline phosphatase (iu/L) (163.01, 167.10, 157.53, 155.02, 153.92 and 143.27 obtained for birds on T1, T2, T3, T4, T5 and T6 respectively) varied significantly (p<0.05) with the type of vitamin mineral premixes used at the starter phase while other serum indices were similar (p>0.05). Also, at the finisher phase, values of the total protein (g/dL) 5.45, 5.86, 6.13, 6.94,6.74 and 6.80; albumin (g/dL)1.06, 1.19, 1.41, 1.25, 1.51 and 1.36; globulin (g/dl)4.26, 4.67, 4.73, 5.29, 5.23 and 5.44 and the high density lipoprotein (mg/dL)81.11, 88.16, 90.40, 86.25, 85.35 and 154.63 obtained for birds on T1, T2, T3, T4, T5 and T6 respectively differed significantly (p<0.05).This showed that the premixes used had varying effects on the indicated serum indices which invariably implied differing potency of the test premixes.

Table 7: Selected serum biochemical Indices of broilers fed diet using five different commercial premixes at the starter phase

Parameters	T1	T2	T3	T4	T5	T6	SEM
Total protein (g/dL)	4.50	4.62	5.36	4.95	4.93	4.96	0.32
Albumin (g/dL)	1.25[b]	1.46[ab]	1.36[ab]	1.27[b]	1.51[a]	1.29[ab]	0.07
Globulin (g/dL)	3.24	3.68	4.00	3.70	3.42	3.62	0.31
Cholesterol (mg/dL)	117.48[b]	124.58[ab]	139.49[ab]	154.53[ab]	143.30[ab]	165.13[a]	13.39
HDL (mg/dL)	76.27	76.25	91.31	88.52	88.86	88.63	7.68
Triglycerides (g/dL)	128.23	83.36	71.25	104.79	71.46	94.68	20.39
VLDL (mg/dL)	25.65	16.67	14.25	20.96	14.29	18.94	4.08
AST (iu/L)	16.04	14.52	10.80	14.50	13.95	13.84	2.75
ALT (iu/L)	20.45	7.44	6.96	7.45	7.91	7.54	5.20
ALP (iu/L)	163.01[ab]	167.10[a]	157.53[ab]	155.02[b]	153.92[b]	143.27[c]	3.69
Urea (mg/dL)	7.33	9.00	10.00	9.67	11.00	7.00	1.85
Creatinine (mg/dL)	0.78	0.75	0.73	0.76	0.77	0.81	0.03

a,b,c, *means along the same row with dissimilar superscripts are significantly different (p<0.05)*
SEM *standard error of the mean*
HDL *high density lipoprotein, VLDL- very low density lipoprotein, AST- aspartate amino transferase, ALT- alanine amino transferase, ALP- alkaline phosphatase*
T1 *Control (without any vitamin-mineral premix)*
T2 *Control diet + 0.25% Daramvita,* *T3- Control diet + 0.25% Bio-organics,*
T4 *Control diet + 0.25% Hi Nutrient,* *T5- Control diet + 0.25% Optimix,*
T6 *Control diet + 0.25% Nutripoults.*

Table 8: Selected Biochemical Indices of broilers fed diet using five commercial premixes at the finisher phase

Parameters	T1	T2	T3	T4	T5	T6	SEM
Total protein (g/dL)	5.45[b]	5.86[ab]	6.13[ab]	6.94[a]	6.74[a]	6.80[a]	0.30
Albumin (g/dL)	1.06[b]	1.19[ab]	1.41[ab]	1.25[ab]	1.51[a]	1.36[ab]	0.11
Globulin (g/dL)	4.26[b]	4.67[ab]	4.73[ab]	5.29[a]	5.23[a]	5.44[a]	0.30
Cholesterol (mg/dL)	80.75	94.40	91.47	75.69	93.15	106.91	10.06
HDL (mg/dL)	81.11[b]	88.16[b]	90.40[b]	86.25[b]	85.35[b]	154.63[a]	7.00
Triglycerides (g/dL)	138.00	131.67	150.53	134.65	149.00	149.45	10.19
VLDL (mg/dL)	27.60	26.33	30.11	26.93	29.80	29.89	2.04
AST (iu/L)	39.87	39.90	42.98	36.23	38.23	44.93	5.62
ALT (iu/L)	8.74	8.80	8.60	8.58	8.51	8.60	0.36
ALP (iu/L)	164.00	163.15	164.98	163.96	164.93	164.11	0.64
Urea (mg/dL)	11.67	10.50	12.00	9.93	11.65	12.83	1.67
Creatinine (mg/dL)	0.75	0.69	0.78	0.72	0.77	0.78	0.04

a,b,c, *means along the same row with dissimilar superscripts are significantly different (p<0.05)*
SEM *standard error of the mean*
HDL *high density lipoprotein, VLDL- very low density lipoprotein, AST- aspartate amino transferase, ALT- alanine amino transferase, ALP- alkaline phosphatase*
T1 *Control (without any vitamin-mineral premix)*
T2 *Control diet + 0.25% Daramvita,* *T3- Control diet + 0.25% Bio-organics,*
T4 *Control diet + 0.25% Hinutrient,* *T5- Control diet + 0.25% Optimix,*
T6 *Control diet + 0.25% Nutripoults.*

Conclusion and Recommendation

Empirical evidence from broiler meat physico-chemical and blood profile indices indicated varying effects of the different proprietary premixes used. This could only be because the different vitamin-mineral premixes had varying potency. Therefore, cautions need be exercised by animal nutritionists in the choice of premixes in formulating broiler rations in Ibadan, Nigeria.

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