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Comparative Effect of Some Proprietary Vitamins and Trace Mineral Mixtures on the Performance and Egg Quality of Laying Hens

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Abstract: *The research study was carried out to evaluate the comparative effect of some proprietary vitamins/trace mineral mixtures on the performance and egg quality of laying hens. Two hundred and fifty- six fifty weeks old Yaffa strain laying birds were used. The birds were randomly allotted to four premixes fortified experimental diets; PPGODOMIX, PPOMIX, PPROCHE and PPWRITEX with each diet containing isocaloric and isoproteinous. Sixty four birds were randomly assigned to each of the dietary treatments. The birds were further sub- divided into four replicates with sixteen birds per replicate. The four dietary treatments elicited no significant (P>0.05) influence on the overall performance of birds. Percentage hen day egg production was equally not significantly (P>0.05) affected by any of the dietary treatments examined. The average daily feed intake was significantly (P<0.05) affected by PPOMIX. The average final weights of the experimental birds were significantly (P<0.05) affected by PPGODOMIX. The external and internal egg quality traits were not significantly (P>0.05) influenced by PPOMIX. Birds fed PPOMIX obtained a significantly (P<0.05) higher value of egg weight, albumen weight and blood spot which were statistically similar to other experimental premixes examined. The results generated from this study revealed that premix of similar profile will give similar result which could be used to improve ration management towards enhanced feed utilization and egg internal/external quality.*

Keywords: *Growth performance, egg quality, premixes, isocaloric and isoproteinous,*

I. Introduction

Livestock can fully express their genetic endowments on the basis of good nutrition to produce optimum productivity. It is not enough to feed a layer all she can eat, (Kenneth, 1981). Hence, the efficiency with which feed is utilized by birds is of utmost importance and this is where the micronutrients are needed to be present in a relatively small quantities compared to carbohydrates, liquid and proteins (Aduke, 1992). Hence, vitamins and minerals are regarded as essential micronutrients, since the animal cannot itself synthesize these biologically but must be supplied with the feed. It has long been recognized that livestock rations must be supplemented with vitamins and minerals if the efficiency of growth and production were to be maintained (Aduke, 1992). Scott et al. (1982) submitted that vitamin D_3 is needed for normal egg production and calcification of egg shell. Some vitamins are required for transformation of energy. Vitamin-mineral premix is the combination of vitamins and minerals which is added to the formulated diet to meet up with the requirements of at least few vitamins and minerals that are deficient in the formulated diet (Singh and Panda, 1988).

Deficiency of vitamin and mineral cause various diseases such as xerophthalmia, cage layer fatigue, rickets etc. Supplementing Vit-E in well balanced diets has shown to increased humoral immunity for monogastric species (Langweiler et al., 1983 and Wuryastuti et al., 1993). In recent years, the importance of certain trace minerals in immune function has become evident. Selenium, copper, zinc and iron have been showed to alter various components of the immune system (Suttle and Jones, 1989).

It was also reported that zinc supplementation enhanced nitrogen retention and the mineral has a regulatory roles in protein synthesis in the liver as a component of both nucleic acid and RNA polymerase (Church and Pond, 1988). Minerals has been found to be an essential requirement in layer diet, calcium and phosphorous are needed for young chicks in a minimum requirement of 1% of the diet as calcium and 0.5% as phosphorus, while the layer bird requires about 3.5% of calcium approximately 4.0 g daily because this is the main constituent of egg shell (Scott et al., 1982).

Inclusion of vitamin-mineral premix in the formulated diet has become indispensable practice because feed ingredients do not contain all essential vitamins and minerals at the right amounts needed for chicken. Critical vitamins (choline, folic acid, pantothenic acid, pyridoxine, riboflavin, Vit-A, Vit-D and Vit-E) and minerals (Calcium, phosphorus, copper, iodine, iron, manganese, sodium and zinc) should be checked carefully in the diet. Minerals and vitamins contribute only 10 per cent of the total cost of feed (Singh and Panda, 1988).

Synthetic vitamins are supplied singly or as low potency premixes in combination with active ingredients like minerals, antibiotics etc. Premixes are normally not produced to supply significant dietary protein. A complete vitamin and trace mineral premixes in poultry feeds has yielded tremendous results (Oluyemi et al., 2000). Meanwhile, different brands of premix are available without adequate profile information for farmers and nutritionist which creates a setback. Anisuzzaman (1993) observed deficiency diseases of various types in broiler flocks in spite of adding vitamin-mineral premix in the experimental diet. This was probably due to poor quality of premix used for the experiment. In view of this, this study therefore determined the efficacy of some vitamins and trace minerals mixtures on the performance and egg quality of laying hens with a view to providing base line information for better feed formulation and improved performance.

II. Materials And Methods

2.1 Experimental location

The research study was carried out at the teaching and research farm of Federal University of Agriculture Abeokuta, Alabata (7^0 10^0N and 3^0 2^0 E), located in the hot humid tropics with average ambient temperature of 33^0C, a relative humidity of 80% and mean precipitation of 1100 mm per annum.

2.2 Proximate composition of treatment diets

Four experimental diets were designed for this study, the treatment contained four premixes fortified experimental diets; PPGODOMIX, PPOMIX, PPROCHE and PPWRITEX with each diet containing isocaloric and isonitrogenous/proteinous (Tables 1 and 2). The proximate composition of the treatment diets were analyzed according to AOAC (1990).

2.3 Experimental birds and data collection

Two hundred and fifty –six fifty weeks old Yaffa strain laying birds were used for this research study, sixty four birds were randomly assigned to each of the dietary treatments. The birds were further sub- divided into four replicates with sixteen birds per replicate. Water and feed were given ad libitum. All vaccination and medication procedure were adhere to. The birds were weighed at the beginning and end of the feeding trial to determine the weight changes. Records on daily feed intake were taken by weighing feed given and the left over. Feed conversion ratio was recorded as daily feed intake per daily egg weight The following data were also collected; hen day production, daily feed intake, average final weight, albumen weight, egg weight were measured using sensitive weighing scale. Albumen height was measured using p6085 spherometer, shell thickness was determined with a micro meter screw gauge while egg length and breadth were measured using vernier caliper. Egg albumen quality and egg shape index were calculated. Yolk color was determined using egg color chart.

Egg shape index= Egg breadth/Egg length

2.4 Statistical analyses

All data generated were subjected to Analyses of variance of SAS (2005). All means were separated using Duncan multiple range test.

III. Results

3.1 Weight gain and laying performance of the experimental laying hens as influenced by treatment diets

The result revealed that there were no significant ($P>0.05$) difference in all the performance characteristics examined except average final weight as shown in Table 3. The percentage hen day egg production were highest for birds fed PPG treatment diet while birds fed PPO diet recorded lowest values, PPR and PPW treatment diets followed similar trends. The average daily feed intake ranged between 88.50g-91.10g. Birds fed PPO treatment diet recorded highest feed intake value of 91.10g and was closely followed by birds fed PPW treatment diet with PPG and PPR recording least feed intake values.

The final weight of birds were significantly ($P<0.05$) affected by the dietary treatments (Table 3). Birds fed PPG obtained a significantly ($P<0.05$) higher values relative to those fed with PPR and PPW but not numerically different from birds fed with PPO treatment diet. An average weight gain of 102g was obtained for birds fed PPG treatment diet whereas birds placed on PPO, PPR and PPW treatment diets lost weight. The efficiency of feed utilization (dozen of egg collected per kilogram of feed consumed) were not affected ($P>0.05$)

by treatment diets imposed. Birds fed PPG treatment diet recorded 1.97kg/dozen of egg collected while 0.19 kg, 0.18kg and 0.19kg were recorded for bird placed on PPO, PPR and PPW treatment diets respectively.

3.2 External and internal egg quality traits performance as influenced by treatment diets

Result obtained from this study showed that treatment diets exerted no marked significance ($P>0.05$) on egg length, egg breadth and egg shape index except egg weight that was significantly ($P<0.05$) influenced by the treatment diets examined (Table 4). Birds placed on PPO treatment diet obtained a higher value of egg weight which was numerically similar to those fed PPG and PPR treatment diets while birds fed PPW treatment diet recorded least egg weight value. Treatment diets influenced ($P<0.05$) albumen weight and egg blood spot performances. Albumen weight initially increased slightly but later decline across the treatment diets examined. Birds fed PPO and PPR treatment diets had higher albumen weight values but were not numerically different from those fed PPG treatment diet while those placed on PPW treatment diet obtained the least albumen weight value. Blood spot followed similar trend.

Table 1: Composition of Experimental Diets Fed Layer chickens (%)

Ingredients	**PPG**	**PPO**	**PPR**	**PPW**
Maize	42	42	42	42
Soya	6	6	6	6
GNC	12	12	12	12
Fish meal	1.5	1.5	1.5	1.5
Wheat offal	17	17	17	17
PKC	10.3	10.3	10.3	10.3
Bone meal	2.0	2.0	2.0	2.0
Oyster shell	8.5	8.5	8.5	8.5
Premix	0.25	0.25	0.25	0.25
Salt	0.23	0.23	0.23	0.23
Lysine	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1
% CP	17.1	17.1	17.1	17.1
M.E. Kcal/kg	2473.6	2473.6	2473.6	2473.6
Total	**100**	**100**	**100**	**100**

Table 2: Micro-nutrients in various premixes (Kg)

Premix	**PPG**	**PPO**	**PPR**	**PPW**	**NRC**
Vitmin A (IU)	3400	10000	10000	8000	1500
Vitmin D (IU)	600	2000	2500	2000	200
Vitamin E (mg)	4	24	20	5	10
Vitamin K_3 (mg)	0.4	2	2 (IU)	1.5	0.5
Vitamin B_1 (mg)	0.6	3	3	-	1.8
Vitamin B_2 (mg)	1.8	8	7	2	3.6
Vitamin B_6 (mg)	1.2	4	5	1	3.0
Vitamin B_{12} (mg)	0.006	0.025	0.025	0.003	0.009
Niacin (mg)	6	30	30	5	27
Pantothenic acid (mg)	1.8	10	10	3	10
Folic acid	0.24	0.8	0.8	-	0.55
Biotin	-	0.05	0.85	0.01	0.15
Manganese (mg)	16	80	80	70	60
Iron (mg)	-	24	40	30	80
Zinc (mg)	12	48	60	50	40
Copper (mg)	1.2	4.8	8	5	8.0
Cobalt (mg)	0.08	0.25	0.25	-	-
Iodine (mg)	8	1.2	1.00	1	0.15
Selenium (mg)	0.08	0.3	0.15	0.1	0.15
Chlorine (mg)	70	200	200	75	1300
Anti-oxidant (mg)	-	120	100	-	-

Table 3: Mean of weight gain and laying performance of the experimental layer chickens as influenced by treatment diets

Parameters	**PPG**	**PPO**	**PPR**	**PPW**	**SEM**
% Hen day production	56.97	53.57	56.60	56.46	1.56
Average daily feed intake (g)	88.50	91.10	88.50	90.22	0.60
Dozen egg/Kg feed	1.97	2.09	1.91	2.25	0.11
Average initial weight (g)	1593	1588	1600	1600	4.25
Average final weight (g)	1692^{a}	1579^{ab}	1503^{b}	1563	38.37

Average weight gain (g)	102	-9.0	-97.5	-37.5	-30.5

abc means within the same row with different superscripts are significantly different (P<0.05)

Table 4: Mean of external and internal egg quality traits as influenced by treatment diets

Parameters	**PPG**	**PPO**	**PPR**	**PPW**	**SEM**
External egg qualities					
Egg weight	56.98[ab]	59.32[a]	58.86[ab]	56.18[a]	0.48
Egg length	4.83	4.89	4.85	4.95	0.06
Egg breadth	3.18	3.28	3.26	3.23	0.04
ESI	0.66	0.68	0.67	0.67	0.01
Internal Egg qualities					
Yolk weight	13.74	14.55	14.36	14.11	0.15
Shell weight	5.01	5.03	5.05	4.82	0.83
Albumen weight	38.47[ab]	39.79[a]	39.50[a]	37.26[b]	0.38
Yolk color	3.43	3.95	3.23	3.90	0.19
Shell thickness	0.76	0.71	0.72	0.72	0.03
Haugh unit	67.52	70.23	71.49	73.38	1.12
% Yolk	24.09	24.60	24.45	25.19	0.20
% Shell	8.43	8.51	8.56	8.64	0.09
% Albumen	67.47	66.88	67.09	66.14	0.22
AIHT	5.00	5.48	5.42	5.56	0.11
Blood spot	2.35[ab]	3.22	1.67	2.32[ab]	0.50

abc means within the same row with different superscripts are significantly different (P<0.05)

IV. Discussion

The percentage hen day egg production was not influenced by the treatment diets imposed on the birds. Average daily weight gain was not affected by treatment diets examined on the birds, although, birds fed PPO obtained a numerically higher feed intake than those fed PPG and PPR treatment diets, this could be due to higher B vitamins profile of PPO treatment diet (Oduguwa et al., 1996). Birds placed on various treatment diets consumed less feed than expected and this could be due to increasing environmental temperature which possibly led to decline in feed intake (Williamson and Payne, 1989).

The average final weight of birds was markedly influenced by dietary treatments thus affecting feed utilization, supplementation of PPG dietary treatment obtained an average weight gain of 102g while those of PPO, PPR and PPW dietary treatment lost 9.0g, 97.5g and 37.5g respectively. The increased average final weight of birds fed PPG could be as a result of better feed utilization and good digestibility. However, the significant increase noticed in final weight of the birds might also be due to the fact that PPG and PPO diets increased appetite. The lost weight could be as a result of reduced feed intake and impaired nutrients utilization. This agrees with earlier work of Fafiolu (2003). The high value of egg weight as recorded for birds fed PPO, PPG and PPR treatment diets informs an enhanced appetite for increased feed consumption which invariably influenced better egg weight recorded (Oduguwa, 1996). Albumen weight and blood spot decreased significantly for birds fed PPG and PPR treatment diets but increased for birds fed PPO and PPW and this could be the result of high thiamine, niacin, pyridoxione and riboflavin profile of these two premixes because of their key role in improved protein intake (Abdul salam and Kratzer, 1979). The values of yolk weight, shell weight, albumen height and yolk colour were not significantly (P>0.05) influenced by the dietary treatment. It shows that the broken out qualities of the eggs from different dietary treatments were largely similar. However, the haugh unit values were not significant (P>0.05) among the dietary treatments. This shows that eggs produced by the laying birds on the different treatments were largely similar in quality.

In conclusion, the results generated from this study showed that any of the premixes could be used to improve ration management towards enhanced feed utilization and egg internal/external quality. However, inclusion of vitamins and premixes to improve the performance and egg quality of laying hen should be done with utmost care and farmers should consider the interaction effect of these micro nutrients before using them.

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