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EVALUATION OF FISHMEAL PROTEIN SUPPLEMENTATION TO COMMERCIAL FEEDS FOR EGG LAY AND QUALITY IN WARM TROPICAL REGION

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SUMMARY

A total of 140 Lohman pullets layers at eighteenth week of lay were randomly selected and used to study effects of graded levels of fishmeal protein supplementation to two commercial feeds (type A & B) on egg production and quality. Layers were divided into two equal groups each of which was divided into five equal sub groups of A_1, A_2, A_3, A_4, A_5 and B_1, B_2, B_3, B_4, B_5. Each feed type was used as control diet and also to formulate four other diets by supplementation with graded levels of fishmeal such that CP level of control diets (A_1, B_1) was raised from 16.0% to 17.0, 18.0, 19.0 and 20.0% respectively. Each sub group of layers (n=14) was fed particular treatment diet, at 120g/layer daily for 57 days. Eggs were collected daily for the last 50 days and samples were used to determine quantity by number, graded by weight and shape while egg quality was determined from shell thickness and yolk index. Irrespective of types of diets, layers consumed their ration. Those fed type A diets performed less than their contemporaries fed type B diets probably because of the latter's superior feed quality including balanced protein-energy ratio. Generally, fishmeal supplementation to the commercial feeds relatively improved egg lay and quality with optimum values recorded at CP level of 18.0%. Thereafter, increase in feed CP level relatively caused slight (sub groups A) or negligible (sub groups B) decline in egg lay and quality. Thus, control layers (A_1, B_1) laid 282 and 294 eggs at average weights of 56.9 and 60.3g and feed conversion values of 5.2 and 4.7 compared with egg numbers of 338 and 368 weighing 60.6 and 61.8g and feed conversion values of 4.1 and 3.7 ($P<0.01$) recorded for A_3 and B_3 sub groups respectively. There was significant difference between sub groups in their hen-day egg production rates and yolk indices ($P<0.05$). We recommend that for reasons of economics and higher profit margins, farmers who use commercial feeds in warm tropics should supplement feeds with fishmeal to CP levels not exceeding 18.0%.

KEYWORDS:

INTRODUCTION

In most countries situated within the warm tropical zone, escalating increase in production cost arising from scarcity and high cost of resources inputs, limitation in skill and adverse effects of environmental factors pose major constraints to monogastric production (Oluyemi and Roberts 1979; CAB, 1983). Over the last decade Branckaert (1995) noted that poultry production throughout the world has increased by 23 percent in developed countries and by 76 percent in developing countries. This notwithstanding, egg production has met with relative stagnation if not with clear recession in most of the developing countries mainly because of the associated deficiency in feed production and people's income. In sub-Saharan Africa, poultry production business is consequently characterized by low profit margins (Stockland and Blaylock, 1972). Efforts being made to abridge aforementioned problems include manpower development and improvement in nutrition. Several workers in the zone (Obioha and Onyiliogwu, 1982; Ikeobi *et* *al.* 1998) advocated for low cost high-protein diets for layers raised in warm tropical environment. This will enable potential farmers to make sustainable profits in poultry business. It appears however that many farmers and feed producers in the tropics tend to produce and market low quality feeds that do not meet requirements for optimum layer performance. This is more so as most farmers prefer stocking high performer improved strains of poultry. It has been speculated that this poor feed quality and hence poor nutrition arise from attempt by farmers and feed producers to minimise production cost by inadequate feeding of birds, poor feed formulation, processing, storage and administration (CAB, 1983) If the down trend in poultry business is to be contained, the need to ascertain quality of commercial feeds relative to performance of layers therefore arises. This is more so as there is near absence of livestock product quality control enforcement agency in most developing countries situated in the tropical zone.

Chalwa *et al.* (1976) suggested that feeds produced for layers in warm tropics should contain higher protein levels and adequate energy than what are normally recommended for layers in the temperate zone. Farmers and feed producers consequences source low-cost protein supplements to monogastric diets. Fry *et al.* (1965) and Jassen (1971) highlighted that fishmeal is a conventional high quality protein source for monogastric feed. Besides, its contents of high energy, minerals, vitamins, lysine, methionine and variable nitrogen compounds are evident. Fin (2000) highlighted the benefits of fish meal in poultry rations. It is naturally balanced feed ingredient that is high in protein, energy, minerals (calcium and phosphorus) vitamins (Choline, biotine, B12, A and E) and other micronutrients such as selenium and iodine. The present study was designed to comparatively evaluate performance and egg quality of layers maintained on two types of commercial feeds and supplemented with graded levels of fishmeal protein.

MATERIALS AND METHODS

Animals

A total of 140 Lohman pullet layers raised at Veterinary Farm of University of Nigeria Nsukka (UNN) was randomly selected from a larger group as from their eighteenth week of lay and used. They were randomly divided into two equal groups, each of which was replicated into five equal sub groups of A_1, A_2, A_3, A_4, A_5 and B_1, B_2, B_3, B_4, B_5 respectively. They were kept separately in four tier cage system at a rate of two layers per cage, measuring 46.7 x 40.0cm. Layers in each sub group were fed with one type of diet constituted from either of the two commercial feeds being used for the study.

Feeds and feeding

The two commercial feeds chosen from different producers were grouped as A_1 and B_1. Cognisance was first taken of their labelled nutritional composition while they were reanalysed to ascertain their actual nutritional composition at onset of the experiment (Table I), at Animal Science laboratory, Faculty of Agriculture UNN, by proximate analysis. Since values of feed types did not vary significantly (P>0.05), they were used as control diets.

TABLE I: Some nutritional components of two commercial feeds for layers marketed at Nsukka as indicated by labelled and reanalytical values

	Feed Type A		Feed Type B	
Variables	Labelled values	Analytical values	Labelled values	Analytical values
Metabolic Energy Kcal/kg)	2300.0	2340.0	2746.0	2722.0
Crude Protein (%)	16.0	15.9	16.0	16.2
*Crude Fibre (%)	4.0	-	4.0	-
Oils and Fat (%)	4.0	3.8	3.0	3.0
*Calcium (%)	3.5	-	3.3	-
*Phosphorus (%)	0.7	-	0.3	-

*Ca, P and CF were not reanalysed

Based on the knowledge that fishmeal contains about 66.0% CP and 2800 Kcal/kg ME (NRC, 1994), experimental diets A_2 to A_5 and B_2 to B_5 were formulated from each control diet by the application of simultaneous equation as shown below.

Feed Formula:

$$16.0a + 66.0b = P(a + b)$$

Where a = Qty of the control feed having CP of 16.0

b = Qty of fishmeal having CP of 66.0

P = CP value of the constituted diet.

(CAB, 1980)

Using the above formula, to prepare diets containing variable CP levels of protein, other nutrients components in the diets were calculated as shown in Table II.

Layers in each sub group (n=14) were fed respective diets at the restricted rate of 120g/birds daily while water was provided adequately. Birds were fed for the first seven days, following which feed intake and egg production were assumed to have stabilized before data collection was started.

TABLE II: Some nutrient composition of treatment diets prepared and used in feeding layers following feed supplementation with fishmeal

Variables	Group A diets					Group B diets				
	A_1	A_2	A_3	A_4	A_5	B_1	B_2	B_3	B_4	B_5
Wt. of comm. feeds (kg)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Wt. of fishmeal suppl. (kg)	-	0.165	0.174	0.184	0.194	-	0.165	0.174	0.184	0.194
Total wt. of mixture (kg)	25.0	25.165	25.174	25.184	25.194	25.0	25.165	25.174	25.184	25.194
Crude protein (%)	16.0	17.0	18.0	19.0	20.0	16.0	17.0	18.0	19.0	20.0
Fats and oils (%)	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0
ME (kcal/kg)	2300	2303.3	2303.5	23.3.7	2303.9	2860.1	2860.2	2800.0	2760.3	2760.3

It is assumed that variations in the values of trace elements and vitamins in the respective diets were negligible.

Data Collection

Eggs were collected from individual sub groups at 8.00 and 16.00h daily for the last fifty days. They were weighed using mettlers PC 20 electrical balance, and measured for egg length (pole to pole) and width (longest mid-saggital diameter) using vernier callipers. Egg shape index (SI), defined as egg length divided by egg width was calculated. Eggs were also graded by weight and or SI value. At weekly interval, six eggs were randomly selected from each sub-group and used within fourteen days to determine interior egg quality as was described by Oguike and Onyekweodili (1998) and Ikeobi *et al.* (1998). Thus, shell thickness (ST) was measured using vernier callipers. Yolk index (Y1) was calculated as the ratio of yolk height to its weight after yolk was carefully separated from albumen on a clean white tile as background – in such a way that the yolk remained unbroken from its membrane. Yolk height was determined by inserting a clean office pin onto the highest point of the yolk so that its penetration distance was measured. Yolk width was measured with vernier callipers.

Statistical analysis

Data collected were subjected to statistical analysis using completely randomized procedure (Steel and Torrie, 1980) significant values were carefully separated using Duncan's (1965) multiple range test.

RESULTS

Layers in each sub group consumed their daily rations and apparently remained healthy throughout the study period. In both groups, graded supplementation of feed with fishmeal relatively improved performance of layers and egg quality with optimum values attained at CP level of 18.0% (Table III). Above this level there were relatively decrease in layer performance and egg quality. Generally, layers that consumed type A diets, performed less than those fed Type B diets as was evidenced by their feed conversion values shown in the table. Those layers fed control diets (A_1 and B_1) laid 282 and 294 eggs with average egg weights of 56.9 and 60.3grams (g) and feed conversion values of 5.2 and 4.7 respectively compared with egg numbers of 338 and 368, egg weights of 60.6 and 61.8g and feed conversion values of 4.1 and 3.7 ($P<0.01$) respectively recorded for layers fed fishmeal supplemented diets that contained 18.0% CP A_3 and B_3. However there was significant difference between sub groups in their hen-day production rates and yolk indeces ($P<0.05$) as shown in Table III.

TABLE III: Comparative performance and egg quality of layers fed two types of commercial feeds supplemented with graded levels of fishmeal protein for over 50 days

Variables	Group A diets					Group B diets				
	A_1	A_2	A_3	A_4	A_5	B_1	B_2	B_3	B_4	B_5
No. of eggs laid	282	306	338	328	329	294	325	368	331	312
Wt. of 30 eggs (g)	1707	1773	1818	1806	1803	1809	1830	1854	1848	1848
Total feed consumed to produce 30 eggs	8904	8167.9	7392	7736.2	7728	8568	7728	6888	7560	8064
Hen-day production rate (%)	40.3^{a}	43.7^{a}	48.3^{b}	46.9^{a}	47.0^{a}	42.0^{a}	46.4^{a}	52.6^{b}	47.3^{b}	44.6^{a}
Av. Egg wt. (g)	56.9	59.1	60.6	60.2	60.1	60.3	61.0	61.8	61.6	61.6
[1]Feed conversion	5.2^{a}	4.6^{b}	4.1^{b}	4.3^{b}	4.3^{b}	4.7^{b}	4.2^{b}	3.7^{c}	4.1^{b}	4.4^{b}
Egg quality										
Shape Index	1.3	1.3	1.16	1.4	1.3	1.3	1.4	1.3	1.3	1.3
Shell thickness (mm)	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.33
[2]Yolk Index	0.42^{a}	0.41^{a}	0.51^{b}	0.50^{b}	0.44^{a}	0.46^{a}	0.50^{b}	0.56^{b}	0.52^{b}	0.48^{a}
Egg grade by %										
>60g	22.0	22.3	25.0	21.4	21.2	23.8	28.9	24.2	22.2	20.0
50-60g	55.4	55.8	53.1	56.0	56.2	55.8	56.2	56.4	54.5	54.5
<50g	22.6	21.9	21.9	21.6	21.6	20.4	19.4	19.4	23.3	17.5

ab = $P < 0.05$; bc = $P < 0.01$; values with same superscripts in the same horizontal lines are not significantly different

1 – Feed conversion value = $\dfrac{\text{Weight (g) feed intake to lay 30 eggs}}{\text{Weight (g) of 30 eggs laid}}$

2 – Yolk index = yolk height/width

DISCUSSION

In the study made, it was noted that all layer groups consumed their daily ration, remained healthy and performed fairly well. Significantly, performance and egg quality increased to an extent with increase in CP content of diets and was optimized at 18.0%. Thereafter, performance values tended to stabilize (Group As) or decline (Group Bs) as CP in diets exceeded 18.0% (Table III). Observations made are supportive of previous recommendations that to optimize production, daily feed intake should be about 120g/layers (CAB, 1983; NRC, 1994) and that layers feed should contain at least 17.0% CP in warm tropics (Mack, 1972; Obioha and Onyilogwu, 1982; Sikla *et al.* 1995). It is evident from the performance of layers placed on control diets (A_1, B_1) that the feed intake was nutritionally deficient. Thus, depression in feed quality may have arisen from poor feed formation, mixing, transportation and or storage which tend to characterise the feed industry in warm tropics. There is no doubt that most commercial feeds are transported over long distance and are consumed several weeks after they are produced during which their quality tends to deteriorate, and they loose palatability. It is no wonder that supplementation of such feeds with fishmeal improved their quality and promotes egg quality and animal health (Fin, 2000). It provides the much needed essential amino acids and other nutrients for layer performance (Fin, 2001). Differences noted in performance and egg quality of layers that consumed feed types irrespective of their sub groups may be attributed to differences in nutritional composition of the diets the values of which tended to favour types B than types A diets. Comparatively, type A diets contained less ME while both diet types contained less phosphorus as are recommended to provide sufficient protein-energy and calcium-phosphorus ration for layers (NRC, 1994; Conn *et al.* 1988), knowing that each of the nutrients tends to limit the other. Besides, the ME level below 2, 600 kcal/kg feed and CP level of 16.0% as contained in the control diets are rather low and would limit efficient utilization of feed. No wonder that slight increase in CP level from 16.0% to 18.0% resulted in significant increase in performance and egg quality of layers, particularly for those placed on type B feed. This is in agreement with observations of David (1992) who suggested that to ensure adequate feed intake and also to meet 14.0% CP that is contained in a normal hen's egg, a higher level of CP in diet is necessary. It may be opined that there is maximum level of CP required in layer feed above which there will be decline in layer performance and egg quality. Consequently we hypothised that 18.0% CP in feed is a recommended level required for optimum performance of layers raised in humid tropics. Further increase in CP values is considered uneconomic, unnecessary and hinders performance of layers.

The choice of fishmeal in the supplementation of layers feed is informed by its availability, cheap cost and promotion of egg quality and poultry health provided it is used appropriately. This is in agreement with the views of several authors (Butt and Cunningham, 1972; Klasing, 1998 and Aken, 1998) who also enumerated its benefits to poultry. We recommend that poultry farmers in sub Saharan Africa be encouraged to source fish offals and or other by-products for supplementation to poultry feeds particularly layers' mash so as to ensure high profit margins and promote poultry production business.

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