SHORT COMMUNICATION

The effect of feed presentation on the performance, litter and egg quality parameters of Shika brown layers

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Abstract

A total of 240 point of lay birds were used to investigate the effect of feed presentation on the performance, litter and egg quality parameters of Shika Brown layers from point of lay. The birds were fed diet with similar nutrient content but presented in five different forms. Diet 1 was presented in the form of crumbs; diet 2 was presented in small pellets, diet 3 was presented in bigger sized pellets while diet 4 was presented as mash. Diet 5 which served as the control was a home made layer diet of 16.5% crude protein and 2600kcal/kg metabolisable energy. Each of these diets constituted a treatment (making 5 treatments) and each treatment was replicated 4 times with 12 birds per replicate in a complete randomized design experiment. The birds were raised under the deep litter system, fed and given water ad libitum. Equal quantity of five kilogramme of wood shavings was spread in each pen measuring 1.2 by 2.5 meters. Records taken includes initial and final weight of the birds, feed intake which was measured weekly, egg production which was recorded daily and mortality which was recorded as they occurred. Samples of the litter were taken from each replicate group and scored on a scale of 1-5 with 1 representing the driest and 5 representing the wettest before being analysed for moisture content. Samples of three eggs from each replicate were taken for three consecutive days at the end of every month. They were weighed and broken out into a flat white plate for the measurement of albumen height and width, yolk height and width. Yolk colour was read using the Roche Yolk Colour Fan (R). The shells were washed and sun dried for three days before the weight and shell thickness were measured. Results obtained indicated that feed presentation has a significant effect on the performance, litter quality, economic analysis and egg quality parameters of the birds.

Keywords: *Layers, feed presentation, egg quality, performance, Shika Brown.*

Introduction

Feed constitute over 70% of total cost of producing poultry meat and eggs (Abeke *et al.*, 2003). It is therefore very important that maximum benefit be derived from every unit of feed offered to birds. The way diets are presented to poultry birds has influence on feed intake and utilization (Omeje 1999). The same diet offered in different forms may be digested and utilized differently by the same class and age of birds (Najime,2003). The use of feed forms such as crumbs and pellets is not very common like mash feed in Nigeria. This is because the additional cost of processing these feeds into pellets and crumbs usually increase the cost of the feed. There is a general belief by farmers that birds fed feeds in form of pellets perform better than those fed mash feeds. This belief is based on the fact that there is less feed wastage and

that the feed is safer due to lower bacterial load because of the heat applied during the process of feed pelleting. Another advantage of pelleted feed is that it is well mixed and compressed unit of every ingredient present in the feed such that a bite is a complete ingestion of the representative sample of the ingredients in the feed. Mash feed on the other hand is cheaper but birds tend to select ingredient particles of the feed which might affect digestion and utilization of the feed (Eduvie 2002). However, birds usually spend more time in consuming mash feed which reduces the time for vices such as feather pecking and cannibalism (Abeke 2008). In terms of water intake, it is generally believed that since pelleted feeds under go high heat treatment and are therefore drier than mash feed, birds consuming pellets tend to drink more water and may have higher tendency towards wet litter. The effect of feed presentation on egg quality parameters is not clear and needs investigation. This experiment was therefore designed to investigate the effect of feed presentation on the performance, litter quality and egg quality parameters of Shika Brown layers.

Materials and Methods

This study was carried out at the poultry research unit of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika, Zaria, Nigeria. Shika is geographically located on latitude 11° 12'N and longitude 7° 33'E at an altitude of 640M above sea level (Akpa *et al.*, 2002). Shika is located about 20km along the Zaria Sokoto road in Kaduna State, North Western Nigeria. It has three distinct climatic seasons. These are the cold dry season (November February), the hot dry season (March- May) and the wet season (June October). The total annual rainfall ranges between 617 and 1365mm with a 50-year average of 1041mm Most of the rains fall between July and September (Bawa *et al.*, 2003).

The strain of birds used for the experiment is Shika Brown commercial layers. The initial weights of the birds were taken before the commencement of the experiment. Feed and water were given ad-libitum throughout the period of the experiment. Five kilogrammes of wood shavings was spread on each pen measuring 1.2m x 2.5m to a depth of about 12cm. The house that was used for this experiment is a typical half walled, open sided house. The design of the experiment was a complete randomized design. There were five isocaloric and isonitrogenous ground nut cake, soya cake and maize based layer diets each containing 16.50% crude protein and 2500kcal/kg metabolizable energy. (Table 1). Diets 1, 2, 3 and 4 were processed by a commercial feed company while diet 5 was home-made. Diet 1 was presented in the form of crumbs, diets 2 and 3 were presented as 5mm and 2mm pellets respectively while diet 4 was presented as mash. Diet 5 which served as the control was a home-made layer mash. Each of these diets constituted a treatment (making 5 treatments) and each treatment was replicated 4 times with 12 birds per replicate.

At the commencement of the experiment, the point of lay birds were weighed and randomly allotted to the various treatments in such a way that their initial weights were similar. Feed and water were provided ad-libitum throughout the period of the experiment which lasted 12 weeks. The birds were fed in the morning at 8.00am and in the afternoon at 2.30pm respectively. Eggs produced were collected twice daily at 12 noon and at 4.00pm respectively. Feed intake and weight of birds were measured

weekly while mortality was recorded as it occurred. The litter wetness was scored on a scale of 1-5 with 1 representing the driest while 5 represented the wettest. This was done by taking samples of the litter from the four corners of each pen and the centre. These were thoroughly mixed together and scores were given according to the feel of wetness and stickiness of the litter. After the score has been determined, samples of the litter were then labelled and taken to the laboratory for determination of moisture content. Moisture content was determined by placing a weighed sample of the litter inside a crucible of known weight and placed in an oven at a temperature of 70°C for 24 hours. The crucible and its content was allowed to cool in a desiccator and re-weighed. This heating and cooling procedure was continued until a constant weight was attained. The difference between the initial weight of sample and crucible and the final weight of the crucible and its content accounted for the moisture content of the litter. This was expressed as a percentage of the initial weight of the crucible and sample.

The egg quality parameters were

Table 1: Composition of Commercial and Homemade mash fed to the birds.

Ingredients	Diet 1 (Crumb)	Diet2 (5mm sized Pellets)	Diet 3 (2mm sized pellets)	Diet 4 (Mash)	Diet5 (Homemade mash)
Maize	47.80	47.80	47.80	47.80	46.00
GNC.	13.20	13.20	13.20	13.20	13.20
Soya. Cake	10.00	10.00	10.00	10.00	10.00
Maize offal	17.00	17.00	17.00	17.00	19.80
Limestone	7.50	7.50	7.50	7.50	7.50
Bonemeal	2.75	2.75	2.75	2.75	2.75
Salt	0.30	0.30	0.30	0.30	0.30
*Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
CP (%)	16.50	16.50	16.50	16.50	16.50
ME(kcal/kg)	2550	2550	2550	2550	2512
CF (%)	4.60	4.60	4.60	4.60	4.49
EE (%)	4.00	4.00	4.00	4.00	3.45
Calcium %	3.70	3.70	3.70	3.70	2.75
Av.Phos. %	0.41	0.41	0.41	0.41	0.73
Lysine (%)	0.85	0.85	0.85	0.85	0.84
Methion %	0.43	0.43	0.43	0.43	0.43
Meth.+cyst (%	0.64	0.64	0.64	0.64	0.63
Cost/kg feed (N)	78.40	78.40	78.40	75.40	64.22

*Biomix Layer premix supplied the following per kg diet. Vit A, 100000iu; vit D3, 20000iu; vit E, 100iu; vit K; 20mg; Thiamine B1, 15 mg; Riboflavin B2, 40mg; Pyridoxine B6, 15mg; Niacin, 150mg; vit B12, 0.0mg; Pantothenic acid, 50mg; Folic acid, 5mg; Biotin, 0.2mg; Choline chloride, 12mg; Anti oxidant , 1.25g; Manganese, 0.8g; Zinc, 0.5g; Iron, 0.2g; Copper, 0.05g; Iodine, 0.12g; Selenium, 2mg; Cobalt, 2mg.

determined for three consecutive days at the end of every twenty-eight day period. For this, three freshly laid eggs representing the average weight of eggs from each replicate were randomly selected and weighed using a 1kg electronic scale . The length and width of each egg was measured using a pair of vernier calliper. With the aid of a sharp knife, each egg was then carefully broken out on a flat white plate placed on a flat surface. The albumin and yolk heights and widths respectively were also measured using a pair of vernier callipers. Shell weight was measured after washing and sun drying the egg shells for three days using a sensitive electronic table scale. Also the shell thickness was measured with micrometer screw guage after washing and sun drying them for three days. The Roche Yolk Colour Fan (RYCF) was used to determine the yolk colour. Haugh unit was determined from the relationship between the height of the albumin and the egg weight using the TSS Haugh Unit Value look Up-Table.

All data collected were subjected to the analysis of variance using the general linear model (SAS,1990) while differences between treatment means were separated using the Duncans's multiple range test (Steel and Torrie 1980).

Results and Discussion

The composition of the home-made mash

Table 2: Effect of feed presentation on the performance and litter quality of ShikaBrown layers.

Parameters	Crumbs Diet1	5mm pellets Diet 2	2mm pellets Diet 3	Mash Diet 4	Home-made mash Diet 5	SEM
Initial.Wt (g/bird)	1850.21	1850.45	1850.32	1850.01	1850.11	7.55
Final.Wt. (g/bird)	2013.41^{a}	2004.48^{b}	2007.48^{b}	2016.03^{a}	2009.16^{ab}	5.24
Wt gain (g/bird)	163.20^{a}	153.03^{c}	157.16^{c}	166.02^{a}	159.05^{b}	4.66
Feed Intake g/b/day	136.05^{b}	135.70^{b}	137.44^{ab}	140.24^{a}	145.48^{a}	3.72
Henday %	89.30^{a}	85.34^{ab}	87.15^{ab}	91.70a	77.45c	2.85
Henhouse%	86.48^{a}	82.66^{ab}	83.45^{ab}	89.80^{a}	74.92^{b}	2.57
FCE egg/kgfeed	6.82^{a}	6.54^{ab}	6.73^{a}	6.80^{a}	5.78^{b}	0.14
Mortality %	2.08^{a}	2.08^{a}	4.16^{b}	2.08^{a}	6.25^{c}	0.55
Litter moisture score	2.80^{a}	3.00^{c}	3.00^{c}	2.50^{b}	2.00^{a}	0.02
Litter moisture content %	20.51^{b}	24.66^{c}	24.98^{c}	19.51^{b}	15.22^{a}	1.58

Means within the same row with different superscript are significantly (P<0.05) different. SEM: Standard error of the means.

The results obtained for the performance and litter quality of the layers (Table2) indicates that the weight gain (g/bird) were significantly (P<0.05) better for treatment 1 (crumbs) and treatment 4 (mash) than for other treatments. The reason for this is not clear. However, this could be attributed to forms of presentation of the feed. It could be that the birds had better preference for the particle sizes of the crumbs and the mash or that both feeds offered the birds greater flexibility of choice. Abeke *et al.,* (2003) and Najime (2003) reported that forms of feed presentation and particle size of diet

can affect its utilization by birds. This according to the authors is because the smaller the particle size the higher the surface area for enzyme action. According to Abeke *et al* (2003) and Etuk (2001) birds tend to perform well when their nutrient requirements are met and when such feeds are presented in forms suitable for easy prehension. The authors also argued that whatever form the feed is presented, if the nutrient requirements of the birds is not met, performance will be negatively affected. Therefore both forms and nutrient content as well as the ingredients composition of the feed are important factors influencing intake and utilization of feed by birds. Feed intake (g/bird) was significantly ($P<0.05$) higher for birds fed the home-made diet than for the other birds except for those birds fed the 2mm pellets and commercial mash respectively. According to Apata (2003) there are several factors that affect feed intake in poultry. These include form of feed presentation, nutrient content, energy level, fibre level, presence of antinutrients, health status of the birds and palatability of the feed. The birds ate more of the home-made mash but this feed consumption was not significantly ($P>0.05$) higher than that of birds that ate the 2mm pellets and those that ate the commercial mash. However the birds ate more of the diets that were presented as mash than those presented as pellets. It seems there was a preference for the mash feed possibly because it offered the birds the opportunity to select the feed particles as they desired. According to Abeke (1997) selectivity of feed particle by bird may lead to wastage which may be assumed to have been consumed. Report by Abeke (2008b) stated that one major reason why mash feed is preferred to pellet for layers is that it takes longer time for the birds to eat to their nutrient satisfaction and hence may increase feed intake.

Table 3: Economic analysis of the performance of the ShikaBrown layers fed the different feed forms.

Parameters	Crumbs Diet1	5mm pellets Diet 2	2mm pellets Diet 3	Mash Diet 4	Home-made mash Diet 5	SEM
Totalcost N/bird	1259.97^{b}	1257.50^{b}	1269.78^{b}	1289.53^{b}	1240.85^{a}	20.34
Feedcost/bird (₦)	959.97^{b}	957.50^{b}	969.78^{b}	989.53^{b}	840.85^{a}	20.22
Feedcost/10eggs (₦)	114.96^{a}	119.88^{b}	116.49^{b}	115.29^{ab}	111.11^{a}	2.10
Feedcost/dozen eggs (₦)	137.95^{a}	143.86^{b}	139.79^{b}	138.35^{ab}	133.33^{a}	2.48
Feedcost/kg Eggs (₦)	184.82^{a}	207.66^{c}	198.62^{b}	191.83^{ab}	190.88^{a}	2.50
IAFE (N20/egg) (₦)	85.04^{ab}	80.12^{b}	83.51^{b}	84.71^{ab}	88.89^{a}	2.07

Means within the same row with different superscript are significantly ($P<0.05$) different. SEM: Standard error of the means. IAFE: Income Above Feed Expenses

Percent henday and henhoused egg production were significantly ($P<0.05$) better for all except for birds on home-made mash which performed least. The least performance for these parameters was recorded for birds on home-made mash. The reason for this was not clear because the composition of the diet 5 mash met the nutrient requirement of the layers. However there may be some other factors that may have helped the birds on diets 1 to 4 to perform better in egg production than diet 5 since the ingredient composition is almost the same for all the diets. These factors may be embedded possibly in individual differences among the birds or other extraneous factors that are not clear. According to Abeke (2005) there are many products in the market today that can be included in poultry diets to enhance performance. The sophisticated processing methods for producing diets 1 to 4 (compared to simple farm machinery such as hammer mill and mixer that may not ensure one hundred percent homogeneity as in diet 5) may have possibly influenced the performance of the birds fed these diets. In terms of feed conversion efficiency (number of eggs produced per kg feed consumed), birds on diets 1, 3 and 4 performed significantly ($P<0.05$) higher than the birds on diets 5. It implies that birds on these diets were able to efficiently use feed consumed for production purposes. This could be as a result of processing method as the nutrient level of the various diets were the same though they were presented in different forms. The reason one can adduce for the best performance obtained in treatment 1 could be that the feed being in the form of crumbs had larger surface area for increased digestibility and utilization. Crumbs are pellets that have been further broken down into smaller particles for easy ingestion. They have a larger surface area for enzyme action and absorption of water than whole pellets. The overall effect of this is increased digestion and absorption of embedded nutrients in the feed (Oruseibio and Onu 2000)

Mortality was significantly ($P<0.05$) higher for treatment 3 and 5 than for birds fed diets 1, 2 and 4. The reason for the high mortality recorded for diets 3 and 5 is not clear and may be due to other factors other than feed.

Litter moisture score and litter moisture content were significantly ($P<0.05$) higher for birds that ate pellet feeds (treatment 2 and 3) than for the other treatments. Birds on treatment 2 and 3 were fed diets with bigger pellet particles. It is known that because of heat treatment (making pellets to be very dry) and compaction of pellets, birds tend to drink more water. This higher water intake was reflected in wetness of the litter for these birds. According to Omeje (1999) birds fed dry feed and pellets tend to drink more water and pass out watery faeces. The values obtained for the economic parameters (Table 3) show that total cost (N/bird), feed cost (N/bird), feed cost per 10, 12, and per kilogramme eggs produced and income above feed expenses (IAFE) were significantly ($P<0.05$) better for the home-made mash fed birds than for birds fed the 5mm and 2mm pellets. The home-made mash was the cheapest of all the diets. Feed cost constitute over 70% of the cost of poultry production (Abeke 2005; Ogundipe *et al.*, 2003; Eduvie 2002; Etuk 2001), therefore any attempt to reduce feed cost will definitely reduce cost of production. It can be seen from the result that even though birds fed diet 5 was among the lowest in terms of henday and henhoused egg production, the lowered feed cost made up for this to make it the most profitable diet in terms of returns on invested capital.

Table 4: Effect of feed presentation on the egg quality parameters of ShikaBrown layers.

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	SEM
Eggwt.(g)	57.73	58.68	60.10	58.21	62.20	4.22
Egg length (cm)	5.78	5.61	5.85	5.73	5.85	2.81
Egg width (cm)	4.23	4.39	4.39	4.36	4.38	2.55
Alb.height (cm)	0.84	0.91	0.86	0.93	0.88	0.19
Alb.width (cm)	5.42	5.34	5.29	5.22	5.44	0.54
RYCF Score	7.50^{b}	8.75^{ab}	10.25^{a}	13.25^{a}	6.25^{b}	2.43
Haugh unit	93.00	95.00	92.00	96.00	93.00	3.45
Shell thick (mm)	0.44	0.43	0.43	0.43	0.42	0.09
Shell.Wt (g)	6.85	6.88	6.89	6.87	6.92	0.98

Means within the same row with different letter superscript are significantly ($P<0.05$) different.
SEM: Standard error of the means. RYCF: Roche Yolk Colour Fan.

Results obtained for the egg quality parameters (Table 4) shows that birds fed the commercial mash had the highest RYCF score and this was significantly ($P<0.05$) better than RYCF scores for the eggs of birds fed diets 1 and 5. The reason for this is not clear as the ingredients for all the diets are the same. All other parameters measured for egg quality parameters were not significantly ($P>0.05$) different among the treatment means. Yellow maize were used to compound the diets but particle sizes of diet 4 which was in the form of mash may have encouraged better selectivity of the maize particle. This could have resulted in the high level of yolk colour observed. Abeke (1997) have reported that one way of improving egg yolk colour is to use yellow maize in layers feed. According to Ogundipe *et al.*, (2003) the minimum acceptable egg yolk colour preferred by consumers is 4. It shows that to achieve this minimum acceptable egg yolk colour certain quantity of yellow maize is needed when white maize is used for compounding poultry ration.

Conclusion

The results obtained in this study indicate that forms in which feed are presented to layers has influence on their feed intake and utilization. It shows that apart from meeting the nutrient requirements of the birds, the feed must be presented in such a way as to encourage intake. Birds fed the home made mash (treatment 5) had the best income above feed expenses even though they did not perform too well in henday and henhoused egg production compared to other treatments. This is because of the lowered feed cost which made up for the lower performance in terms of egg production. Diet 4 which was also in the form of mash had the best percent henday and henhoused egg production but was poor in terms of economic returns because of higher feed cost when compared to that of diet 5. However litter moisture content was higher for birds fed pelleted feeds which may be due to increased water consumption occasioned by the dryness of the pellets. This shows that even though birds can consume feeds in different forms, their performance and litter quality will be influenced by the form in which the feed

was presented. However for better profit margin it is recommended that poultry farmers should compound their feed on-farm.

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