THE INFLUENCE OF GENOTYPE AND DIETARY SALT LEVELS ON THE FAECAL CHARACTERISTICS OF ISA BROWN AND HARCO BLACK LAYERS

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Abstract

This experiment was performed to unravel the effects of genotype and dietary salt levels on the faecal parameters of two breeds of laying birds. Four experimental diets designated as: T1 (control diet with 0.25% salt), T2 (0.50% salt), T3 (0.75% salt) and T4 (1.00% salts) were fed to Isa Brown and Harco Black breeds of birds. The birds were fed with these diets for a period of twenty weeks. Faecal samples were collected and analyzed for total faecal output, faecal dry matter, faecal volume, faecal density, faecal consistency and faecal moisture content during the last week of the experiment to ascertain the effect of varying dietary salt on the faecal parameters of the birds. The result showed that faecal volume and faecal density were significantly different ($P < 0.05$) between breeds and among the different dietary treatments. The Harco Black breed had a higher faecal volume (34.88±0.85ml) than the Isa Brown breed (33.25±0.49ml) while faecal density was lower in Harco Black (1.44±0.03g/ml) than in the Isa Brown breed (1.51±0.02g/ml). The highest faecal volume (35.75±1.44ml) and lowest faecal density (1.41±0.05ml) were recorded in birds fed 1.00% dietary salt. Percentage faecal moisture, faecal dry matter and faecal consistency were statistically similar between breeds but total faecal output was significantly different between Harco Black (1386.38±52.85g) and Isa Brown (1485.00±54.62g) breeds. The diet with 1.00% salt was consistently higher in total faecal output (1562.75±30.45g) and percentage faecal moisture (75.50±3.43) and lower in faecal dry matter (24.50±3.43%) and faecal consistence (1.50±0.29) than in all the other three diets. The best combination of breed and salt level that would ensure maximum management and physiological benefits to the birds in terms of faecal volume, consistency, density and output could be achieved at 0.75% salt level for both the Isa Brown and Harco Black laying chickens. It could be concluded within the limit of this study that the Isa Brown breed had a higher faecal output than the Harco black breed. Also for litter management and physiological considerations, these two breeds of laying chickens could be fed diets with maximum inclusion of 0.75% dietary salt.

Keywords: Dietary salt, faecal parameters, genotype, Harco Black, Isa Brown.

Introduction

It is a common knowledge that too much dietary salt (sodium chloride) can provoke wet litters in layers (Aro *et al.*, 2015). Other factors like the nature of the feed (Aro, 2015), the feed ingredients used in the ration formulation (Choct *et al.*, 1999), the prevalence of intestinal spirochetes (Stephens and Hampson, 1999) and the source of water fed to the birds could predispose layers to wet litter. Wet litter in poultry production presents a major management problem in the evacuation and disposal of the accumulated waste because of the attendant increase in the volume and bulk density of the faecal matter. The concomitant increase in the moisture content of the droppings as occasioned by the salt content also accelerates the rate of decomposition and the generation of green house gases like carbon IV oxide (CO_2), methane (CH_4), nitrous (NO_2) and nitric oxides (NO_3) and of course, the harmful ammonia (NH_3). The wet litter has also been known to accentuate the proliferation of maggots thus adding to messy nature of the litter.

Several measures have been taken to mitigate the effects of wet litter in poultry production. Such measures include the use of different enzyme supplementation, the use of different dietary energy sources and the use of different breeds or genotypes of the laying chickens (Choct *et al.*, 1999). This study was therefore conducted to add to the body of knowledge on the effects of breed/genotype on the faecal parameters by investigating the response of two breeds of laying birds – Isa Brown and Harco Black to varying dietary salt levels as reflected by their faecal parameters.

Materials and Methods

The experiment was carried out at the poultry unit of Teaching and Research Farm of the Federal University of Technology Akure, Akure, Ondo State, Nigeria. A total number of 160 layers made up of 80 Isa Brown and 80 Harco Black breeds were used for the experiment. The birds were assigned to four dietary treatments of 40 birds per treatment and 10 birds per replicate. Four experimental diets with different dietary salt

concentration were formulated, compounded and used for this experiment. These diets had 0.25% salt (T1/control diet), 0.50% salt (T2), 0.75% salt (T3) and 1.00% salt (T4). The gross composition of the experimental diets is shown in Table 1.

The birds were fed with these diets for the entire 20 week duration of the experiment. During the last week of the experiment, faecal samples were collected the birds from which faecal parameters like moisture, volume, density, consistency, dry matter and total faecal output were determined. Fifty grammes (50g) each the faecal matter sampled per bird was used to determine faecal volume from which the density was calculated using the Archimedes Principle of floatation.

The density was calculated using the formula:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Data obtained on these parameters were subjected to two (two breeds) by four (four dietary salt levels) factorial analysis in a completely randomized design using SAS 2008 statistical package. Mean separations where applicable were done with the Duncan's multiple range test of the same statistical package.

Results and Discussion

Table 2 shows the faecal volume and densities of the two breeds of birds (Harco Black and Isa Brown) fed varying levels of dietary salt. The faecal volume (34.88±0.85ml and 33.25±0.49ml) and density (1.44±0.03g/ml and 1.51±0.02g/ml) respectively of the two breeds of birds were significantly different ($P < 0.05$) between breeds, among the different dietary treatments and in the interactions between the breeds and the treatments. Aro *et al.* (2015) observed similar trends in faecal volume and density in their work on late production layers. Table 3 shows total faecal output, moisture, dry matter and consistency of Harco Black and Isa Brown layers fed varying levels of dietary salt. The Isa brown breed voided a significantly higher (1485.00±54.62g) total faecal matter than the Harco Black breed (1386.38±52.85g). The faecal moisture, faecal dry matter, and faecal consistency of the experimental birds were however not significantly different ($P > 0.05$) between the two breeds. The total faecal output was significantly different among the dietary treatments where the highest value (1562.75±30.45g) was recorded in the T4 with a range between 1330.75±72.61g (T2) and 1562.75±30.45g. The highest percentage moisture content (75.50±3.43) and the lowest faecal consistency (1.50±0.29) were equally recorded with the T4 diet. The interaction between treatments and breeds showed significantly differences ($P < 0.05$) among all the four parameters considered. Choct *et al.* (1999) reported on clear genetic differences among three breeds of laying chickens in terms of the wetness of the litter and ranked Isa Brown and HiSex with 68.40% faecal moisture as the strains that produced the wettest litter. The control diet (T1) under the present study recorded the lowest (70.00±1.78%) percentage faecal moisture while Isa Brown had a drier faecal matter than the Harco Black breed.

Conclusion

From the management point of view, the best combination of dietary salt level with breed that will help reduce the incidence of wet litter in layers pens is T3 versus Isa Brown breed. Also the Isa Brown breed recorded the drier and denser faecal matter while T2 will produce a more consistent faecal matter in combination with Harco Black or Isa Brown layers.

References

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Table 1: Gross composition (g/100 g) of the experimental diets

Ingredients	T1	T2	T3	T4
Yellow maize	52.50	52.50	52.50	52.50
GNC	8.00	8.00	8.00	8.00
SBM	11.00	11.00	11.00	11.00
Wheat offal	16.00	16.00	16.00	16.00
Bone meal	2.75	2.75	2.75	2.75
Limestone	7.90	7.65	7.40	7.15
Fish meal	1.00	1.00	1.00	1.00
Salt	0.25	0.50	0.75	1.00
Premix	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15
Methionine	0.25	0.25	0.25	0.25
Total	100 kg	100 kg	100 kg	100 kg

T1 = Diets with 0.25 % salt; T2 = Diets with 0.50 % salt; T3 =Diets with 0.75 % salts; T4 = Diets with 1.00 % salts; G.N.C = Groundnut cake; S.B.M. = Soya bean meal

Table 2: Faecal volume and density of two breeds of laying birds fed with varying levels of dietary salt.

Treatments	Breeds	Faecal weight (g)	Faecal volume (ml)	Faecal density (g/ml)
	Harco Black	50.00	34.88±0.85^{a}	1.44±0.03^{b}
	Isa Brown	50.00	33.25±0.49^{b}	1.51±0.02^{a}
T1	-	50.00	32.75±0.75^{c}	1.53±0.04^{a}
T2	-	50.00	33.50±0.65^{b}	1.50±0.03^{a}
T3	-	50.00	34.25±0.85^{b}	1.46±0.36^{b}
T4	-	50.00	35.75±1.44^{a}	1.41±0.05^{b}
Treatments x Breeds				
T1 x Harco Black		50.00	34.00±0.02^{b}	1.47±0.02^{bc}
T1 x Isa Brown		50.00	31.50±0.50^{c}	1.59±0.03^{a}
T2 x Harco Black		50.00	34.00±1.00^{b}	1.48±0.05^{b}
T2 x Isa Brown		50.00	33.00±1.00^{b}	1.52±0.05^{b}
T3 x Harco Black		50.00	34.00±2.00^{b}	1.48±0.09^{b}
T3 x Isa Brown		50.00	34.50±0.50^{a}	1.45±0.02^{c}
T4 x Harco Black		50.00	37.50±2.50^{a}	1.34±0.09^{d}
T4 x Isa Brown		50.00	34.00±0.00^{b}	1.47±0.02^{bc}
Breed		-	0.11sig	0.11sig
Treatment		-	0.18sig	0.17sig
Breed x Treatment		-	0.46sig	0.44sig

$^{a, b, bc, c, d}$ = Means on the same column but with different superscripts are statistically ($P<0.05$) significant. T1= treatment with 0.25 % salt; T2 = treatment with 0.50 % salt; T3 = treatment with 0.75 % salt; T4 = treatment with 1.00 % salt.

Table 3: Faecal output, moisture, dry matter and consi stency of Isa Brown and Harco Black layers fed varying levels of dietary salt.

Treatments	Breeds	F.O. (g)	F.M. (%)	F.D.M. (%)	F.C.
	Harco Black	1386.38±52.85^{b}	73.75±1.94	26.25±1.94	2.13±0.30
	Isa Brown	1485.00±54.62^{a}	72.88±1.64	27.13±1.64	2.13±0.23
T1		1365.00±81.78^{c}	70.00±1.78^{c}	30.00±1.78^{a}	2.25±0.25^{b}
T2		1330.75±72.61^{c}	70.50±2.53^{b}	29.50±2.53^{a}	2.75±0.25^{a}
T3		1484.25±76.22^{b}	71.25±1.03^{b}	28.75±1.03^{a}	2.00±0.41^{b}
T4		1562.75±30.45^{a}	75.50±3.43^{a}	24.50±3.43^{b}	1.50±0.29^{c}
Treatments x Breeds					
T1 x Harco Black		1290.50±40.50^{b}	76.50±2.50^{a}	23.50±2.50^{c}	2.00±0.02^{b}
T1 x Isa Brown		1439.50±165.5	75.50±3.50^{a}	24.50±3.50^{c}	2.50±0.50^{b}
T2 x Harco Black		1301.00±142.00^{b}	72.50±5.50^{b}	27.50±5.50^{c}	3.00±0.02^{a}
T2 x Isa Brown		1360.50±98.50^{b}	68.50±0.50^{b}	31.50±0.50^{a}	2.50±0.50^{b}
T3 x Harco Black		1379.50±57.50^{b}	72.50±1.50^{b}	27.50±1.50^{c}	2.00±1.00^{b}
T3 x Isa Brown		1589.00±98.00^{a}	70.00±1.00^{b}	30.00±1.00^{b}	2.00±0.00^{b}
T4 x Harco Black		1574.50±34.50^{a}	73.50±7.50^{b}	26.50±7.50^{c}	1.50±0.50^{c}
T4 x Isa Brown		1551.00±64.00^{a}	77.50±2.50^{a}	22.50±2.50^{c}	1.50±0.50^{c}
Breed		0.19Sig.	0.03 NS	0.02NS	0.04NS
Treatment		0.14Sig.	0.40Sig.	0.40Sig.	0.17Sig.
Breed x Treatment		0.66Sig.	0.74Sig.	0.74Sig.	0.80Sig.

$^{a, b, c,}$ = Means on the same column but with different superscripts are statistically ($P<0.05$) significant.
T1= treatment with 0.25 % salt; T2 = treatment with 0.50 % salt; T3 = treatment with 0.75 % salt; T4 = treatment with 1.00 % salt. F.C. = Faecal Consistency; F.D.M. = Faecal Dry matter; F.M. = Faecal Moisture; F.O. = Faecal Output; N.S. = Not Significant; Sig. = Significant.