

PERFORMANCE OF BROILER CHICKEN FED GRADED LEVELS OF BENTONITE

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ABSTRACT

The study was conducted to evaluate the performance of broiler chicken fed graded levels of Bentonite. 300 chicks (10 days old) were allotted to five treatments (0%, 0.5%, 1%, 1.5% and 2% Bentonite) and replicated thrice with 20 birds/replicate in a completely randomized lay out. During the eight weeks experimental period, the birds were offered feed and water *ad libitum* and routine vaccinations/medications were administered appropriately. 0.5% Bentonite inclusion in Broiler chicken diets improves final weight gain, daily weight gain, total weight gain, FCR and reduced mortality by 6.32%, 6.72%, 6.75%, 6.72% and 50.19% respectively. 0.5% bentonite inclusion in broiler chicken diet improves dressing weight, carcass weight and dressing percentage by 11.71%, 12.90% and 5.07% respectively. Inclusion of at least 0.5% Bentonite in diet improves performance of broiler chickens.

INTRODUCTION

Aluminosilicates are generally inert and nontoxic to animals, and they have multifunctional properties (Ali *et al.*, 2016). Bentonite is an absorbent aluminum phyllosilicate with strong colloidal properties that absorb water rapidly, which results in swelling and manifold increase in volume, giving rise to a thixotropic gelatinous substance (Pasha, *et al.*, 2008). Bentonite is actually a mixture of minerals from montmorillonite group with high ion exchange capacity which binds with deferent cations (Wals *et al.*, 1998).

Some studies show that the use of silicate minerals in broiler chickens diets would improve their weight gain (Prvulovic *et al.*, 2008). Bentonite is tri-layered aluminium silicate having sodium or calcium as its exchangeable cations. Sodium form is the best and mineral hydration results in a 5 times increase in weight of the mineral (Niamat, 2014). During this change, aluminum silicate layers became separated and water was attracted to their ionic surfaces creating a 12 to 15 times increase in volume (Niamat, 2014).

MATERIALS AND METHODS

Experimental site and Location

The experiments was conducted at the Department of Animal Science Teaching and Research Farm, Ahmadu Bello University, Zaria. Zaria is located in Northern Guinea Savannah Zone of Nigeria, Latitude 11° 14' 44'' N and Longitude 7° 38' 65'' E at an altitude of 610 mm above sea level between the months of December to February.

Experimental treatments and diets

Three hundred (300) broiler chicks were brooded for 10 days before being used for the study. The study design was a Completely Randomized Design with 5 treatments and 3 replicates of 20 birds each. Broiler starter and finisher diets were formulated to meet the nutrient requirement of broilers and used in feeding the experimental birds throughout the 56 days period of the study. Bentonite was included in the diets at graded levels as follows: 0% Bentonite (control), 0.5% bentonite, 1% bentonite, 1.5% bentonite and 2% bentonite. The basal diets for the starter and finisher phases are shown in Tables 1 and 2.

Table 1: Ingredients Composition and Calculated Analysis of Starter Diets

Ingredient	Bentonite Inclusion Level (%)				
	0	0.5	1.0	1.5	2.0
Maize	54.95	53.80	52.85	51.05	51.10
Soya bean meal	36.00	36.25	36.40	36.50	36.70
Crude Vegetable Oil	1.00	1.40	1.70	1.90	2.15
Wheat Bran	3.00	3.00	3.00	3.00	3.00
Lime stone	1.50	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Dicalcium Phosphate	0.50	0.50	0.50	0.50	0.50
Common Salt	0.25	0.25	0.25	0.25	0.25
Sodium Bicarbonate	0.05	0.05	0.05	0.05	0.05
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Bentonite	-	0.50	1.00	1.50	2.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	22.38	22.39	22.37	22.33	22.33
Metabolisable energy (kcal/kg)	3,040	3,040	3,035	3,027	3,020
Ether extract (%)	4.79	5.13	5.37	5.53	5.73
Crude fibre (%)	3.40	3.36	3.33	3.30	3.27
Calcium (%)	1.43	1.43	1.43	1.43	1.43
Available Phosphorus (%)	0.68	0.69	0.69	0.69	0.69
Lysine (%)	1.51	1.52	1.52	1.52	1.52
Methionine + Cystine (%)	0.95	0.95	0.95	0.95	0.95

*Composition of premix supplies the following per 1kg diet: Vit. A = 10000IU; Vit. D₃ = 2000IU; Vit. E = 20IU; Vit. K = 2.500mg; Thiamin = 1.75mg; Riboflavin = 5.0mg; Pyridoxine = 2.75mg; Niacin = 2.75mg; Panthotenic acid = 7.5mg; Folic acid = 7.5mg; Biotin = 0.05mg; Vit. B₁₂ = 0.015mg; Choline chloride = 0.40g; Antioxidant = 0.125g; Mn = 0.08g; Zn = 0.05g; Fe = 0.02g; Cu = 0.005g; I = 0.0012g; Se = 0.2mg; Co = 0.02mg.

Table 2: Ingredients Composition and Calculated Analysis of Finisher Diets

Ingredient	Bentonite Inclusion Level (%)				
	0	0.5	1.0	1.5	2.0
Maize	56.50	55.80	54.80	53.00	52.20
Soya bean meal	31.00	31.10	31.20	31.35	31.50
Wheat Bran	5.00	5.00	5.00	5.00	5.00
Crude Vegetable Oil	2.50	2.60	3.00	3.15	3.30
Lime stone	1.50	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Dicalcium Phosphate	0.50	0.50	0.50	0.50	0.50
Common Salt	0.25	0.25	0.25	0.25	0.25
Sodium Bicarbonate	0.05	0.05	0.05	0.05	0.05
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25	0.25
Bentonite	-	0.50	1.00	1.50	2.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	20.45	20.42	20.38	20.37	20.36
Metabolisable energy (kcal/kg)	3,141	3,130	3,131	3,120	3,109
Ether extract (%)	6.38	6.45	6.79	6.90	7.00
Crude fibre (%)	3.39	3.37	3.33	3.30	3.27
Calcium (%)	1.42	1.42	1.42	1.42	1.42
Available Phosphorus (%)	0.65	0.65	0.65	0.65	0.65
Lysine (%)	1.32	1.32	1.32	1.33	1.33
Methionine + Cystine (%)	0.89	0.89	0.88	0.88	0.88

*Composition of premix supplies the following per 1kg diet: Vit. A = 8000IU; Vit. D₃ = 1600IU; Vit. E = 5.0IU; Vit. K = 2.0mg; Thiamin = 1.50mg; Riboflavin = 4.0mg; Pyridoxine = 1.50mg; Niacin = 15.0mg; Panthotenic Acid = 5.0mg; Folic acid = 0.50mg; Biotin = 0.02mg; Vit. B₁₂ = 0.01mg; Choline chloride = 0.20g; Antioxidant = 0.125g; Mn = 0.08g; Zn = 0.05g; Fe = 0.02g; Cu = 0.005g; I = 0.0012g; Se = 0.20mg; Co = 0.20mg.

DATA COLLECTION AND ANALYSES

Growth Parameters

Feed intake, weight gain and feed conversion ratio were determined weekly. Mortality was recorded as it occurred and body weight was recorded.

Carcass evaluation

At the termination of the experiment (day 56), two birds from each pen having representative weights for the group (6 birds per Treatment) were selected. The selected birds were bled, dressed and eviscerated. Prime cuts were separated and weighed individually and were expressed as percentages of carcass weight.

Statistical analysis

All the data collected from the experiment were subjected to analysis of variance (ANOVA) using the general linear model of SAS software package and the mean separation was done using Duncan Multiple Range Test in the SAS (2001) package.

RESULTS AND DISCUSSION

Performance of Broiler Chickens Fed Graded Levels of Bentonite

Table 3 shows the performance of broiler chickens fed graded levels of bentonite. There were significant ($P < 0.05$) differences between treatment groups in final weight, daily feed intake, daily weight gain, total weight gain and feed conversion ratio (FCR), but no significant ($P > 0.05$) differences were recorded in mortality.

The higher final weight, daily weight gain and total weight gain observed in the treatment group with bentonite in diet might be due to the ability of bentonite to slow down feed passage rate for better utilization of feed nutrients and performance (Damiri *et al.*, 2010). These results agrees with the findings of Yousra *et al.* (2016), who reported that the groups fed bentonite in diet displayed the highest performances, especially in body weight with about 13% higher compared to the control group. The better feed conversion ratio observed in treatment groups with bentonite in diet compared to the control agrees with the findings of Khanedar *et al.* (2013), who reported feed conversion ratio was improved by adding 1.0% bentonite to the diet of broiler chickens. The non-significant difference observed between treatment groups in mortality agrees with the result of Nasir, *et al.*, (2001), who reported non-significant difference in mortality between birds fed various combinations of bentonite with the control.

Table 3: Performance of Broiler Chicken Fed Graded Levels of Bentonite

Parameter	Bentonite Inclusions (%)					SEM
	0	0.5	1.0	1.5	2.0	
Initial Weight (g)	150.00	150.00	150.00	150.00	150.00	0.00
Final Weight (g)	2423.33 ^c	2576.67 ^a	2546.67 ^a	2566.67 ^a	2516.57 ^b	16.06
Daily Feed Intake (g)	96.75 ^a	96.34 ^a	95.00 ^{ab}	95.66 ^{ab}	94.25 ^b	0.94
Daily Weight Gain (g)	40.60 ^c	43.33 ^a	42.80 ^{ab}	43.16 ^a	42.26 ^b	0.29
Total Weight Gain (g)	2273.33 ^c	2426.67 ^a	2396.67 ^{ab}	2416.67 ^a	2366.67 ^b	16.06
FCR	2.38 ^b	2.22 ^a	2.21 ^a	2.21 ^a	2.23 ^a	0.01
Mortality (%)	2.67	1.33	1.33	0.00	0.00	1.03

^{abc} = Means on the same row with different superscripts are significantly ($P < 0.05$) different.

FCR = Feed conversion ratio and SEM = Standard error of mean

Carcass Characteristics of Broiler Chickens Fed Graded Levels of Bentonite

Table 4 shows the carcass characteristics of broiler chickens fed graded levels of Bentonite. The dressed weight, carcass weight and dressing percentages were significantly ($P < 0.05$) higher in treatment groups with bentonite inclusion in the diet compared to the control (0% bentonite).

The higher dressed weight, carcass weight and dressing percentages in birds fed bentonite diets compared to the birds without bentonite in diet (control) may be attributed to the significantly higher body weight gain among the broiler chickens fed bentonite diets. This result agreed with the report of Yousra *et al.* (2016) who reported that the inclusion of raw calcium bentonite at 2 and 5% significantly ($P < 0.05$) increased the eviscerated carcass and dressed weights of broiler chickens compared to the control treatment.

Table 4: Carcass Characteristics of Broiler Chicken Fed Graded Levels of Bentonite

Parameter	Bentonite Inclusions (%)					SEM
	0	0.5	1.0	1.5	2.0	
Live Weight (g)	2423.33 ^c	2576.67 ^a	2546.67 ^a	2566.67 ^{ab}	2516.67 ^b	16.06
Dressed Weight (g)	1830.33 ^c	2044.75 ^a	2021.50 ^{ab}	2041.40 ^a	2002.20 ^b	12.33
Carcass Weight (g)	1662.50 ^b	1877.00 ^a	1877.20 ^a	1876.80 ^a	1877.20 ^a	4.15
Dressing Percentage (%)	75.53 ^b	79.36 ^a	79.38 ^a	79.53 ^a	79.56 ^a	0.20
Prime Cut Expressed as Percentage of Carcass Weight (%)						
Breast	32.30 ^a	31.79 ^b	31.79 ^b	31.78 ^b	31.79 ^b	0.23
Wings	10.82 ^b	10.96 ^{ab}	10.97 ^a	10.96 ^{ab}	10.96 ^{ab}	0.07
Back	17.89 ^b	18.05 ^a	18.03 ^a	18.04 ^a	18.05 ^a	0.06
Thighs	16.66 ^b	16.76 ^a	16.78 ^a	16.76 ^a	16.75 ^a	0.04
Drum Sticks	15.45 ^b	15.67 ^a	15.65 ^{ab}	15.67 ^a	15.66 ^a	0.10

^{abc} = Means on the same row with different superscripts are significantly (P<0.05) different.

SEM = Standard error of mean

CONCLUSIONS AND RECOMMENDATION

In Conclusion, the inclusion of Bentonite in diet of broiler chickens significantly improved performance and carcass characteristics of broiler chickens. 0.5% bentonite inclusion in the diet should be used to improve performance of broiler chickens.

REFERENCES

- Ali, G., Hassan, K., Abolghasem, G. and Saeed, S. (2016). Appraisal of the impact of aluminosilicate use on the health and performance of poultry. *Turkish Journal of Veterinary and Animal Science*, 40: 255-262.
- Damiri, H., Chaji, M., Bojarpour, M., Eslami M. and Mamoei, M. (2010). The effect of sodium bentonites on economic value of broiler chickens diet. *Journal of Animal and Veterinary Advances*. 9: 2668-2670.
- Khanedar, F., Vakili, R. and Zakizadeh, S. (2013). Effect of two kinds of bentonite on performance, blood biochemical parameters, carcass characteristics and tibia ash of broiler chickens. *Iranian Journal of Applied Animal Science*. (2013) 3(3), 577-581.
- Nasir A., Javed I. and Haq N. (2001). Effect of Different Levels of Bentonite with Varying Energy Levels on the Performance of Broilers. *International Journal of Agriculture and Biology*. 1560–8530/2001/03–1–85–88. <http://www.ijab.org>.
- Niamat, M. (2014). Effect of feed supplemented with different levels of sodium bentonite on japanese quail performance. *Egyptian Poultry Science Journal*, 34 (3): 705-713.
- Pasha, T., Mahmood, A., Khattak, F., Jabbar, M. and Khan, A. (2008). The effect of feed supplemented with different sodium bentonite treatments on broiler performance. *Turkish Journal of Veterinary and Animal Science*., 32: 245-248.
- Prvulovic, D., Kogic, D., Lasic, G. and Kosarcic, S. (2008). The effect of dietary inclusion of hydrated aluminosilicate on performance and biochemical parameters of broiler chickens. *Turkish Journal of Veterinary and Animal Science*. 32: 183-189.
- Statistical Analysis System, (2001). Copyright © by SAS Institute Inc. Cary, NC, USA.
- Wals, L. S., White, T. W., Fernandes, J. M., Gentry, L. R. and Blouin, D. C. (1998). Effects of fish-meal and sodium bentonite on daily gain, wool growth, carcass characteristics and ruminal and blood characteristics of lambs fed concentrate diets. *Journal of Animal Science*, 76: 2025-2031.
- Yousra B., Djamel A., Ghalem S., Jacques M., Cecile P. and Gwenola R. (2016). Effects of Dietary Addition of Raw and Treated Calcium Bentonite on Growth, Digesta Characteristics, Blood Profiles and Meat Fatty Acids Composition of Broilers Chicks. *Asian Journal of Animal and Veterinary Advances*. Volume 11 (12): 805-814, 2016.