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Influence of Granite-grit on Nutrient Digestibility and Haematological Parameters of Broiler Chickens Fed Rice Offal Based Diets

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Abstract: A total of 270 broiler chickens were used for the study. The birds were fed common diet containing 23% Crude protein and 2864 kcal kg^{-1} Metabolizable energy at the starter phase while 20% Crude protein and 2923 kcal kg^{-1} Metabolizable energy was fed at the finisher phase. Starter and finisher diets contained 10 and 15% inclusion levels of rice offal respectively. Granite grit was added to the basal diet at 0.0, 2.0, 4.0, 6.0, 8.0 and 10.0 g per bird per month thus making a total of six treatments. Each treatment was replicated three times with 15 birds per replicate in a completely randomized design. Packed cell volume and haemoglobin level were not significantly ($p>0.05$) affected by dietary grit levels while total protein increased across the graded levels of granite grit. Crude protein, crude fibre and nitrogen free extract significantly ($p<0.05$) improved with increasing grit levels. These parameters improved up to the highest level of grit addition (10.0 g) granite-grit. It was concluded that 10.0 g granite grit per bird per month is beneficial to broiler chickens as it allows for efficient nutrient utilization. Further study to determine the optimum level of granite grit in broiler diet is encouraged since result obtained showed the optimum level was not attained.

Key words: Feed, gizzard, granite-grit, total protein

INTRODUCTION

Derived primarily from granite, grit plays the functional role of the "teeth" in birds and can either be soluble (limestone, oyster shell) or non-soluble (silica, mica, sand) of which the latter is retained in the gizzard. Soluble sources also provide calcium (Adeniji and Oyeleke, 2008).

Adeniji (2009) reported that the local chicken pick up stones while scavenging for feed thus, aiding the abrasive activity of the gizzard. Similarly, Moore (1998) asserted that feeding grit to poultry birds will help to facilitate the breakdown of feed materials in the gizzard thereby influencing digestibility. It was also reported by Idachaba *et al.* (2013) that feed utilization improved with incorporation of grit in the diet of broiler chickens. Fibrous feedstuffs are known to allow constant passage of ingesta through the gut, thereby reducing nutrient digestibility and adsorption (Adeniji and Oyeleke, 2008). Consequently, useful portions of the feedstuff maybe lost in faeces as a result of such rapid rates of digestion. Since most non-traditional feedstuffs used in poultry rations are fibrous in nature, practical ways of improving feed digestibility and utilization is necessary. Based on this premise, the study was conducted to evaluate the influence of granite-grit on the nutrient digestibility and haematological parameters of broiler chickens.

MATERIALS AND METHODS

Experimental site: The research was conducted at the poultry unit of the National Animal Production Research Institute, Shika Zaria. Shika is situated between latitude 11°12' 42'' N and 7°33'14''E at an altitude of 640 m above sea level (Kabir *et al.*, 2006).

Experimental birds: The broiler chickens used for the experiment were purchased from Zani hatchery located in Ibadan, southwestern Nigeria. They were reared on deep litter, in an open sided wire mesh screened poultry house. Supplementary heat sources were supplied by using kerosene stoves, charcoal stoves and hurricane lanterns during brooding. In addition, the open sides of the house were covered with polyethylene sheets to conserve heat for the first three weeks of age. Feed and water were provided *ad-libitum*. Vaccination and other management practices were carried out appropriately. At one week of age, the birds were allotted to six dietary treatments in three of 15 birds each giving a total of 45 birds per treatment in a completely randomized design.

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Experimental feed: A common broiler starter ration of 23% crude protein and 2864 kcal kg^{-1} Metabolizable energy was fed across all treatments while finisher diet contained 20% crude protein and 2923 kcal kg^{-1} Metabolizable energy. The diet contained 10 and 15% inclusion levels of rice offal at starter and finisher phases respectively (Table 1). The grit was not part of the formulated diet as it was extraneously added to the diet. Birds on the control diet were not supplied granite grit while treatment 2-6 had graded levels of granite grit at 2.0, 4.0, 6.0, 8.0 and 10.0 g per bird per month. The grit was added once, at the beginning of each month in the feeder.

Digestibility study: Two chickens were randomly selected from each replicate. They were transferred to battery cages for faecal collection. Five days of acclimatization was observed followed by a day of fasting before the commencement of the trial which lasted for seven days. Feed of known quantity was fed to the birds on daily basis while water was provided *ad libitum*. Faecal samples were collected on daily basis and preserved in a deep freezer till the trial was over. The samples were taken to the biochemistry laboratory of National Animal Production Research Institute Shika Zaria. They were oven dried at a temperature of 60°C for 72 h after which they were weighed, ground and analyzed according to methods described by AOAC 1990. Nutrient retention was determined for crude protein, ether extract and crude fibre. Nitrogen free extract was also calculated from the result obtained.

Table 1: Percentage composition of experimental broiler diet

Items	Starter	Finisher
Ingredients		
Maize	45.32	46.15
Full fat soya	19.60	22.90
Groundnut cake	14.63	15.00
Rice offal	10.00	4.00
Blood meal	3.00	3.00
Fish meal	3.00	3.00
Bone meal	3.00	3.00
Limestone	0.50	1.50
Common salt	0.30	0.50
Premix	0.25	0.30
Methionine	0.20	0.25
Lysine	0.20	0.20
TOTAL	100	100
Calculated analysis		
ME Kcal kg^{-1}	2864	2923
Crude protein (%)	23.00	20.00
Crude fibre (%)	6.88	8.39
Ether extract (%)	6.90	8.52
Available p. (%)	0.61	0.60
Lysine (%)	1.10	0.85
Methionine (%)	0.50	0.40
Meth+cystine (%)	0.90	0.60
Calcium (%)	1.09	0.82
Cost/kg diet (N)	71.62	78.63

[1]Biomix chick premix provide per kg of diet vit A, 10,000 i.u, vit D3, 2000 i.u; vit. E 23 mg, vit K, 2.mg, calcium pantothenate, 7.5 mg; B12, 0.015 mg, folic acid, 0.75 mg, choline chloride, 300 mg, vit B1, 1.8 mg, vit B2, 5mg; vit B6, 3 mg, manganese, 40 mg, iron, 20 mg, zinc, 53.34 mg, copper, 3 mg; iodine, 1 mg; cobalt, 0.2 mg; selenium, 0.2 mg, zinc, 30 mg

Haematological evaluation: Two chickens were randomly selected from each replicate and 2 mL of blood sample was collected from each of them via the wing vein and put into a sample bottle containing anti-coagulant Ethylene Di-amine tetra acetic acid (EDTA). Blood samples were analyzed for Packed Cell Volume (PCV), Haemoglobin level (HB) and Total Protein (TP) at the haematological laboratory, Veterinary Teaching Hospital, Ahmadu Bello University, Zaria according to the methods described by Lamb (1991).

Data analysis: Data obtained from the experiment was subjected to analysis of variance using the general linear model procedure of (SAS, 1993). Significant treatment means were separated using Duncan's Multiple Range Test according to procedures described by (Steel and Torrie, 1980).

The data obtained was analyzed using the following model.

$$Y_{ij} = u+a_i+e_{ij}$$

Where:

Y_{ij} = Individual observation
u = Overall mean
a_i = Effect of the ith granite grit (I = 0.0, 2.0, 4.0, 6.0, 8.0 and 10.0 g per bird per month)
e_{ij} = Random error

RESULTS AND DISCUSSION

Nutrient digestibility of broiler chickens fed rice offal based diets with graded levels of granite grit: Nutrient retention of broiler chickens fed rice offal based diets with graded levels of granite grit is presented in Table 2. Results obtained showed that no significant difference ($p>0.05$) was observed in ether extract retention across the graded levels of granite grit addition. However, a significant difference was observed in crude fibre retention. Birds fed 8.0 and 10.0g granite grit showed the best result in crude fibre retention. Similarly, birds fed 2.0, 4.0 and 6.0 g granite grit levels showed comparable ($p>0.05$) results which was better than the control diet (0.0 g) grit. Birds on the control diet and those fed 2.0 g and 4.0 g granite grit levels showed comparable results in nitrogen free extract and crude protein retention. Birds fed 6.0, 8.0 and 10.0 g granite grit levels did not differ significantly ($p>0.05$) from each other in nitrogen free

Table 2: Nutrient digestibility of broiler chickens fed rice offal based diets with graded levels of granite grit

	Granite		Grit (g/b/m)				
Parameters	0.0	2.0	4.0	6.0	8.0	10.0	SEM
Dry matter	57.11^{c}	56.84^{c}	60.54^{b}	61.31^{a}	64.50^{a}	64.94^{a}	2.20
Crude protein	76.66^{b}	76.32^{b}	76.67^{b}	78.04^{a}	79.02^{a}	80.11^{a}	1.27
Crude fibre	63.90^{c}	64.20^{b}	66.20^{b}	66.91^{b}	68.40^{a}	68.90^{a}	2.00
Ether extract	79.47	80.99	79.42	81.32	80.01	78.41	2.74
Nitrogen free extract	65.33^{b}	65.56^{b}	64.40^{b}	70.91^{a}	71.82^{a}	72.90^{a}	1.80

Means with different superscript on the same row differ significantly ($p<0.05$) SEM: Standard error of means, g/b/m: gram per bird per month

Table 3: Haematological indices of broiler chickens fed rice offal based diets with graded levels of granite grit

	Granite		grit (g/b/m)				
Parameters	0.0	2.0	4.0	6.0	8.0	10.0	SEM
Packed cell volume (%)	30.69	30.66	30.68	30.70	32.00	32.33	1.52
Haemoglobin level (g dL^{-1})	9.50	9.73	9.97	9.97	9.80	9.98	0.41
Total protein (g dL^{-1})	3.73^{b}	3.87^{b}	3.93^{b}	4.20^{a}	4.33^{a}	4.40^{a}	0.15

Means with different superscript on the same row differ significantly ($p<0.05$) SEM: Standard error of mean, g/b/m: gram per bird per month

extract and crude protein retention. It was observed that birds fed 6.0, 8.0 and 10.0 g granite grit gave the best results in crude protein, crude fibre and nitrogen free extract retention.

Haematological parameters of broiler chickens fed rice offal based diets with graded levels of granite grit: Table 3 shows the haematological parameters of broiler birds fed rice offal based diets. Packed cell volume (PCV) and haemoglobin level (Hb) did not show any significant difference ($p>0.05$) across the graded levels of granite grit. Result obtained for total protein showed that it was significantly ($p<0.05$) affected by dietary grit addition. It was observed that birds on the control diet and those fed 2.0 and 4.0 g grit levels showed similar results in total protein and were significantly ($p<0.05$) lower than values obtained for birds fed 6.0, 8.0 and 10.0 g dietary grit levels. Birds fed 6.0, 8.0 and 10.0g grit showed similar ($p>0.05$) results in total protein.

DISCUSSION

Digestibility of Nutrients by Broiler Chickens fed Rice Offal Based Diets with Graded Levels of Granite Grit Result obtained showed that ether extract was not affected by dietary grit levels however crude protein, crude fibre and nitrogen free extract were significantly ($p<0.05$) affected. The higher values of crude protein, crude fibre and nitrogen free extract retention for birds fed 6.0, 8.0 and 10.0 g granite grit levels could be an indication that the presence of grit in the diet of the birds was responsible for the improved digestibility vis a vis the higher weight gain observed. This corroborates the report of Moore (1998), who asserted that grit facilitates the physical breakdown of feed materials in the gizzard, thus influencing digestibility. Result obtained for nutrient retention showed that the simple addition of granite grit at little or no extra cost will result in improved nutrient digestibility as evident in the crude protein, crude fibre and nitrogen free extract retention. This is also supported by the assertion of Rowland Jr and Hooge (1980) who observed that nutrient retention improved with the incorporation of grits in diet of poultry birds. Adeniji (2009) reported similar observation when pullet chicks were fed palm kernel cake based diets with grit inclusion.

Haematological Parameters of Broiler Chickens Fed Rice Offal Based Diets with Graded Levels of Granite Grit Haematological indices is an index and a reflection of the effect of dietary treatments on an animal in terms of the type, quality and amount of the feed ingested and are available to meet the physiological, biochemical and metabolic necessities of the animal (Ewuola *et al*., 2004). Dietary grit levels showed no significant difference ($p>0.05$) in the Packed Cell Volume (PCV) and haemoglobin level (Hb), thus indicating that granite grit had no direct influence on the packed cell volume or haemoglobin concentration in the blood. However, the values obtained for PCV were within the range of 33.55±2.90% for healthy chickens as reported by Abeke *et al.* (2008). PCV is an index of toxicity; for the value to fall within the normal range suggests absence of toxins in the diet. Similarly, values obtained for haemoglobin level were within the range for healthy chickens 11.30±1.82 g dL^{-1} as reported by Oladele and Ayo (1999).

Values of total protein obtained for birds fed 6.0, 8.0 and 10.0 g granite grit levels were 4.20, 4.33 and 4.40 g dL^{-1}, respectively. These values are within the range of 4.68-5.27 g dL^{-1}±0.48 for healthy chickens as reported by Oladele and Ayo (1999). Birds fed diets without granite grit, birds fed 2.0 and 4.0 g grit levels had values of total protein as 3.73, 3.87 and 3.93 g dL^{-1} respectively. However, these values did not fall within the range for healthy chickens. The higher values of total

protein obtained for birds fed 6.0, 8.0 and 10.0 g granite grit levels, may have resulted from improved abrasive activities of grinding and nutrient extraction imposed on the gizzard by the grit.

CONCLUSION

A research was conducted to evaluate the effect of granite grit on the nutrient digestibility and hematological parameters of broiler chickens fed rice offal based diets. Results obtained showed that granite grit significantly ($p<0.05$) improved total protein, crude protein, crude fibre and nitrogen free extract retention. These parameters improved up to the highest level of grit addition 10.0 g. The study showed that PCV were not affected by dietary grit levels because granite grit does not contain any toxic substances. However, the values obtained were within the range for healthy chickens.

RECOMMENDATIONS

Further study at higher grit levels beyond 10.0g per bird per month is encouraged as results obtained in this study showed that the optimum level was not attained.

Comparative study on the use of soluble and/or insoluble grit in broiler diet can be evaluated to determine its effect on performance and nutrient digestibility.

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