



Effect of Dietary Grit Inclusion on the Performance of Broiler Chicken

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Abstract: A 42 day feeding trial was conducted using 240 broiler chicks to reveal the effect of different dietary inclusion levels of grit (0,3 and 4%) in the diet containing whole millet grain as main energy source in a completely randomize design. Each of the four dietary treatments was further replicated two times. The treatment contained ground millet 0, whole millet 0, whole millet 3, and whole millet 4 grit kg/100kg designated diet 1,2,3and 4 respectively. There were two controls in the experiment, a negative control which contained ground millet (T1) and a positive control with a whole grain (T2) without additive grit. Result showed that, dietary grit inclusion had effect on some of the performance parameters of the birds, as it improved feed conversion ratio, dressing percentage and carcass weight. Significant difference ($p < 0.05$) was observed in most of the performance parameters between birds fed with and without additive grit. The study recommended 3% level of inclusion in diet containing whole millet grains for effective utilization by the birds.

Keywords: Grit, Grain, Inclusion, Whole Millet and Broiler

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INTRODUCTION

One of the unique aspects of the avian digestive system is the presence of gizzard, where a combination of muscular contraction, grinding action and enzyme help to reduce feed material into absorbable portion (Adeniji, 2010). Grit, a kind of angular and hard crushed rock preferentially derived from granite, is used by the birds in place of "teeth" and hence enhances mechanical digestion by the gizzard (Ali *et al.*, 2006). For this reason, it is important in poultry nutrition when high fiber diets are used or when whole grains are fed

Birds commonly ingest and maintain grits in their muscular gizzard to help grind up food (Gionfriddo *et al.*, 1999). The incorporation of whole grain into poultry feeds has become a more common practice especially in European countries as a way of reducing feed cost due to handling and processing. This practice has resulted in some beneficial effects associated with increased gizzard activity, such as improvement in feed conversion ratio (Plavaik *et al.*, 2002), increased starch digestibility (Hetland *et al.*, 2002) and greater apparent metabolizable energy (Svihus *et al.*, 2004).

Whole pearl millet can be readily broken down by young broilers and thus be incorporated into their diets (Hidalgo *et al.*, 2004). The inclusion of pearl millet in poultry diets has gained interest due to the favorable nutritional characteristics of this grain. The metabolizable energy is comparable to that of corn (Davis, *et al.*, 2003). Furthermore, pearl

millet has higher crude protein (12 to 14%) and lysine (0.38 to 0.41%) concentration than either corn or sorghum (Adeola *et al*, 1994), Ojewola and Oyin (2006) reported that millet has higher crude fiber (7.92%) and ash (3.83%) than maize or sorghum. Pearl millet also has higher oil content than other common cereal grains (Hill *et al*, 1990), and it is a better source of linolenic acid (Rooney, 1978). Based on the performance of broilers fed pearl millet, it appears that pearl millet is equivalent or superior to corn as a grain source for poultry rations (Collins *et al*, 1994).

Pearl millet is a good alternative source of energy for broilers up to seven weeks. Broilers can be fed pearl millet-soybean based diets since it can replace maize in a maize-soybean based diet. The proposed replacement rates range from 10% to 100%, though most authors suggest replacing 50% of maize or more (Davis *et al*, 2003; Raju *et al*, 2003; Choudhary *et al*, 2005; Udeybir *et al*, 2007; Udeybir *et al*, 2009).

Justification of the Study

Poultry production forms an important commercial enterprise involving thousands of birds. However, there is the need to further improve the efficiency of poultry in terms of feed preparation and utilization to maximize profit margin (Eduvie, 2002).

To aid the action of the gizzard, the average local chicken picks up a few stones while scavenging for food. It is thought that, these stones aid the digestion of materials which the local chicken picks up (Fritz, 1937; Salverson, 1996). Birds reared under intensive management have no access to such stones. There is possibility that, incorporation of grit (stones) into the diet of intensively reared birds may increase the amount of nutrients extractable from these diets (Adeniji, 2009). Besides, the use of whole grains saves the farmer additional cost of grinding the grains into powder or amorphous state. The increase in the price of maize has adversely affected the cost of production of poultry and pigs in Nigeria as these animals depend almost entirely on concentrate feeds. Therefore there is the need for exploitation of other energy sources as alternative to maize if the growth of the poultry enterprise in the country is to be sustained (Udeidibie *et al*, 2004).

Most of the sub- Sahara communities grow millet as source of grains because of its tolerance to low rainfall and high ambient temperature, which does not favour the growing of maize and much of sorghum.

Sokoto state is one of the highest millet producing states. It is grown by almost every farmer during the short rainy season resulting in higher tonnage that is surplus for human consumption and hence available for poultry feeding. Hence, it is pertinent that poultry farmers use millet as source of energy in a more economical form that cut cost and increase the profit margin of the enterprise.

PROBLEM STATEMENT

Modern birds are fed predominantly on low fiber diet without access to grit and as a result, their gizzards are small and the proventriculi may be dilated. This results in food passing very quickly arriving in the duodenum still in a particulate form. Recent research indicates that fine grinding does not improve the nutritional value of grain and may even be detrimental to performance (Tim, 1999).

AIMS AND OBJECTIVES OF THE STUDY

The aim of the study is to assess the effect of dietary inclusion of grits as additive in whole millet based diets on the performance of broilers.

Objectives

1. To determine the impact of different additive levels of grit inclusion on general performance of broilers at the starter and finisher phase.

2. To evaluate the carcass characteristics of broilers fed different additive grit levels of 0, 3 and 4kg in whole millet based diets at starter and finisher phases

MATERIALS AND METHODS

Study Area

The study was conducted at the poultry production and research unit of the Department of Animal Health and Production Technology, Umaru Ali Shinkafi Polytechnic Sokoto. Data was collected within 6 weeks. Four weeks for starter phase and two weeks for finisher phase.

Sokoto State is located between latitudes 12⁰ and 13⁰N and between longitudes 4⁰ and 6⁰E in the northern part of Nigeria and at an altitude of 250m above sea level (Mamman et al., 2000). The state falls within the Sudan savannah vegetation zone to the south and Sahel savannah to the north with alternating wet and dry seasons. The hot dry spell extends from March to May and some time to June in the extreme Northern part. A short cool, dry period (Harmattan) occurs and lasts between late October and late February (Malami et al., 2001). Mean annual temperature is 34.9⁰C with the highest in April ranging from 38 to 41⁰C and lowest in January ranging from 13 to 16⁰C (Reuben, 1981).

Experimental Design

A total of 240, 8 day old broilers were used. The birds were randomly allocated to four dietary treatments of different levels (ground, 0, 3 and 4kg) of Grit (2-3mm), with each treatment having two replicates of 30 birds in a completely randomized design (CRD). There were two controls in the experiment, a negative control which will contain ground millet and a positive control containing whole millet without additive inclusion of grits. The other two experimental diets will contain 3 and 4kg/100kg additively included in the diet containing whole millet grains.

Management of the Birds

Necessary medications were provided according to the recommendation of Oluyemi and Roberts (2000). The birds were housed on a deep litter with open side walls. The housed pens were cleaned, washed and disinfected prior to the arrival of the birds. They were also been fed with diet that meets their nutrients requirement at starter and finisher levels. The gross and calculated nutrients composition of the experimental diets are shown in tables 1, 2 and 3.

Table 1: Gross Composition of the Starter diet

Ingredients%	Trt 1 Ground millet (Control 1)	Trt 3 Whole millet	Trt 4 Whole millet	Trt 2 Whole millet (Control 2)
Millet	60.25	60.25	60.25	60.25
GNC	27.00	27.00	27.00	27.00
Wheat Offal	6.50	6.50	6.50	6.50
Bone meal	2.00	2.00	2.00	2.00
Blood meal	2.30	2.30	2.30	2.30
Salt	0.30	0.30	0.30	0.30

Premix	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Limestone	1.00	1.00	1.00	1.00
Total	100	100	100	100
Grit	0	3	4	0

Table 2: Gross Composition of the Finisher diet

Ingredients%	Trt 1 Ground millet (Control 1)	Trt 3 Whole millet	Trt 4 Whole millet	Trt 2 Whole millet (Control 2)
Millet	61.00	61.00	61.00	61.00
GNC	22.25	22.25	22.25	22.25
Wheat Offal	13.00	13.00	13.00	13.00
Bone meal	2.80	2.80	2.80	2.80
Blood meal	-	-	-	-
Salt	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Limestone	1.00	1.00	1.00	1.00
Total	100	100	100	100
Grit	0	3	4	0

Table 3: Nutrient Composition of the Diets

Nutrient	Starter	Finisher
Crude Protein%	22.95	19.67
Calcium%	1.11	1.42
Phosphorus	0.44	0.64
Crude fibre%	6.75	7.10
M.E kcal/kg	3000.1	2966
Ether extract%	4.30	4.2

Data Collection

Records of feed intake were taken on daily basis, while weight gain was monitored weekly. Data for feed intake and weight gain were used to compute feed conversion ratio of the birds for each treatment. Mortality was recorded as it occurs throughout the period of the experiment. At the end of the finisher phase, four best performed birds per treatment were slaughtered and dressed for carcass evaluation and to assess the impact of grit inclusion on the growth and development or otherwise of internal organs such as the proventriculus and gizzard.

Data Analysis

Data collected from the trial were subjected to ANOVA using statistical package for social science (SPSS, 2012).

RESULTS

Table 4: Performance Characteristics of Experimental Birds.

Parameters	Diet				SE
	1	2	3	4	
Initial weight g/b	76.70 ^a	76.70 ^a	78.33 ^{ab}	78.33 ^{ab}	0.21
Final body weight g/b	1760.00 ^a	1710.00 ^c	1720.00 ^b	1700.00 ^d	5.90
Weight gain g/b	1689.00 ^a	1633.30 ^c	1641.67 ^b	1621.67 ^d	6.62
Feed intake g/b/d	83.00 ^a	78.06 ^b	76.09 ^c	75.50 ^d	0.76
Feed conversion ratio	2.06 ^a	2.01 ^c	1.95 ^a	1.96 ^b	0.01
Mortality%	6.70 ^a	13.30 ^c	11.70 ^b	6.70 ^a	0.76

abcd: means within the same row with different superscript are significantly different (p<0.05).

Performance Characteristics

Final body weight differed significantly (p<0.05) between those fed ground millet and (1760g/b) compared to broilers fed whole millet (1710g/b) and broilers fed with 3 and 4% grit (1720g/b and 1700g/b, respectively). Feed intake, feed conversion ratio and mortality also differ significantly (p<0.05) between the treatment. The values ranged between 75.50 to 83g/b, 1.95 and 2.06kg, and 6.70 and 13.30% respectively for feed intake, feed conversion ratio and mortality.

Table 5: Effect of Dietary Grit Inclusion on Carcass Characteristics of Experimental Birds.

Parameters	Diet				SE
	1	2	3	4	
Live weight g/b	2200.00 ^a	2083.00 ^c	1988.00 ^d	2113.00 ^b	19.55
Carcass weight (g)	1400.00 ^a	1353.00 ^c	1318.00 ^d	1393.00 ^b	8.52
Dressing percentage (%)	63.64 ^d	64.95 ^c	66.30 ^a	65.93 ^b	0.27
Proventriculus & gizzard(g)	62.75 ^c	63.50 ^a	63.50 ^b	62.00 ^d	0.66

abcd: means within the same row with different superscript are significantly different (p<0.05)

Carcass Characteristics

Live weight showed significant difference (p<0.05) the control groups and the birds fed additive grit. The values ranges from 1988g/b to 2200g/b. carcass weight also shows significant difference (p<0.05) between the treatment. Birds fed ground millet recorded the highest value (1400g) while bird fed with 3% grit has the lowest value (1318g). Birds fed 3%

grit had the best dressing percentage (66.30%) while birds fed ground millet recorded the least dressing percentage (63.64%). Proventriculus and gizzard weight also showed significant difference ($p < 0.05$) between the treatment groups. The values range between 62.00g to 68.50g.

Discussion

The differences observed for final body weight, weight gain and feed conversion ratio between birds on treatment 2 and 3, is in line with the findings of Idachaba et al. (2003) who reported improved feed utilization with incorporation of grit in the diet of broiler chicken. But the values recorded for treatment four (4%) does not support the findings of Idachaba et al. (2003). The result is also in line with the findings of Adeniji (2010) who reported better feed to gain ratio ($p < 0.05$) for chicks fed 5% grit compared to those fed diet without grit.

The mortality rate recorded was above the normal recommended or accepted level of 5% (Oluyemi and Roberts, 2000). This could be as a result of sudden death syndrome which affects the heavier birds in the flock. Mahmood (2012) reported that, poultry nutritionist suggest that, the higher growth rate in modern broiler chicks could be the main reason for the problem.

The significant difference ($p < 0.05$) recorded for mortality is not in line with the findings of Ali et al. (2006) who reported that, mortality showed no significant difference ($p > 0.05$) between birds fed acid insoluble granite grit (AIGG) and control diet without grit.

Live weight, dressed weight and dressing percentages showed significant difference between the treatments. This result contradicts the findings of Ali et al. (2006) who reported that, feeding granite grit had little or no effect on carcass weight and dressing percentage. The significant difference ($p < 0.05$) recorded on weight of gizzard and proventriculus, is not in line with the findings of Silva Junior et al. (2003) who reported that, insoluble granite grit in broiler diet increase gizzard and proventriculus weight.

CONCLUSIONS

It could be concluded that,

- Dietary grit inclusion improved the performance of broiler chickens without detrimental effects.
- Significance difference ($p < 0.05$) was observed in most of the performance parameters between those fed with or without additive grit and those fed whole millet and ground millet.

RECOMMENDATIONS

- The study recommended 3% level of inclusion as it recorded better performance values in terms of feed conversion ratio, final body weight and carcass weight when compared with other group with 4% level of inclusion.
- The study also recommended grinding whole millet coarsely, instead of feeding whole grains to avoid selection of feed ingredients and feed wastage by the broiler chickens.

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