GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF JAPANESE QUAILS (*Coturnix coturnix japonica*) FED WHEAT BRAN SUPPLEMENTED WITH ENZYME

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ABSTRACT

A 28 days study was conducted to evaluate the effect of wheat bran supplementation with maxigrain® enzyme on the performance characteristics and nutrient digestibility of Japanese quail (*Coturnix coturnix japonica*). A total of 120 unsexed two-week-old quail chicks were weighed (43.9±0.02g) and randomly assigned into four treatments of three replicates each and ten birds/replicate. Diets formulated with 0, 10, 20 and 30% wheat bran as replacement for maize were designated as treatment 1, 2, 3 and 4 respectively. Maxigrain® was included at 10g/100kg into treatments 2, 3 and 4 while treatment 1 served as control. Diets were served on an *ad-libitum* basis and data on feed intake and weight gain were collected/replicate for performance parameters. At the last three days of the feeding trial, excreta were collected daily for nutrient digestibility determination. Data were subjected to ANOVA and means were separated using Duncan's Multiple Range Test. Quails fed T4 had a significantly higher ($P< 0.05$) Final Body Weight (153.4 g/bird) and Daily Weight Gain (3.9 g/bird) and a significantly lower ($P< 0.05$) feed conversion ratio (4.89) over other treatments. T1 recorded a significantly lower ($P< 0.05$) digestibilities (%) of Crude Protein-CP (20.6) Crude Fiber-CF (48.78), Dry Matter (93.97) and Nitrogen Free Extract-NFE (61.43) while Quails fed T2, T3 and T4 were similar in CP and NFE. The % CF favoured birds fed T3 (55.18) and T4 (55.76). The study concluded that 30% wheat bran with Maxigrain® as replacement for maize could improve performance and nutrient digestibility of growing Japanese quail.

Keywords: Enzyme supplementation, Agro-Industrial by-products, Performance parameters, Nutrient digestibility evaluation, Weight gain

INTRODUCTION

Japanese quail have unique characteristics over other species of poultry which include early attainment of sexual maturity, short generation interval making it possible to have many generations in a year (Anon, 1991), high rate of egg production and are very resistant to common epidemics of poultry (NRC, 1991). Their meat and eggs are renowned for their high-quality protein, high biological value and low caloric content, making it a choice product for hypertensive patient (Olubamiwa *et al*., 1999). Over the years, the increase in the price of corn, due in part to the competition for them between man and livestock, has caused a rise in the price of poultry feeds and consequently poultry products (Milad *et al*., 2011). There is thus the need to search for alternative energy sources that are cheaper and readily available. Agro-Industrial by- Products (AIBs) are cheap and abundant in Nigeria and they represent ready feedstuffs for feed formulation in animal production (Ademola *et al*., 2012). The use of non-conventional feedstuffs such as cassava peel mash, corn bran and many others to partially or completely replace maize in poultry diet have been studied (Attia *et al*., 2001; Attia *et al*., 2003a). These AIBS however cannot be included in poultry feeds at high levels because they contain increased fiber levels which reduce nutrient utilization and depresses growth when ingested by non-ruminants (Makinde *et al*., 2014), hence, the need for exogenous enzymes. Acamovic (2001) reported that enzymes increase the digestibility of feed ingredients and reduce the incidence of wet droppings which may result from the presence of fibrous polysaccharides in diets. Wheat bran is one of such agro industrial by-product available in large quantities all year round in the wheat growing areas of Nigeria. The bran contains husk, bran polishing and small quantity of broken grains. Maxigrain® is a multi-enzyme compound of cellulase, xylanase, phytase and protease. Cellulase and xylanase breakdown cellulose and hemicellulose molecules (Beg *et al*., 2001) while phytase and protease degrades indigestible, organic phosphorus and proteins (Mullaney *et al*., 2000; Kohei, 2012) respectively. This study was therefore carried out to investigate the effect of Maxigrain® enzyme on

the utilization of wheat bran and its subsequent effect on performance characteristics and nutrient digestibility of growing Japanese quail.

MATERIALS AND METHODS

a) Experimental Site, Birds and their Management

The experiment was carried out at the Poultry Unit of Federal College of Agriculture, Moor Plantation, Apata, Ibadan. A total of one hundred and fifty (150) unsexed day old Japanese quails were purchased from a reputable hatchery. Before the arrival of the birds, the brooder house was cleaned and disinfected and was heated up to provide warmth. The birds were brooded and acclimatized for two (2) weeks after which one hundred and twenty (120) were weighed and randomly assigned into four (4) dietary treatments of three (3) replicates each and ten (10) birds per replicate. They were placed in metabolic cages designed for excreta collection. The experiment lasted for 28 days

b) Experimental Diets

Four diets were formulated to meet the nutrient requirement for growing Japanese quail according to NRC (1994). The diets were designated as followed:

Diet 1(Control, without wheat bran and enzyme supplementation)
Diet 2 (10% wheat bran supplemented with 10g/100kg Maxigrain®)
Diet 3 (20% wheat bran supplemented with 10g/100kg Maxigrain®)
Diet 4 (30% wheat bran supplemented with 10g/100kg Maxigrain®)

Table 1: Gross Composition of the experimental diet of Japanese quail (*Coturnix coturnix japonica*) at growing phase

Ingredients	T1 (control)	T2(10% wheat bran)	T3(20% wheat bran)	T4(30% wheat bran)
Maize	58.63	52.77	46.90	41.04
Wheat Bran	-------	5.86	11.73	17.59
Soyabean meal	34.52	33.52	33.12	32.00
Fish Meal (72%)	4.52	4.52	4.52	4.52
DCP	0.30	0.92	0.92	0.60
Limestone	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20
Methioinine	0.20	0.20	0.20	0.20
Premix	0.20	0.20	0.20	0.20
Salt	0.20	0.20	0.20	0.20
Soya Oil	0.23	0.61	1.01	2.45
Total	100	100	100	100
Calculated Analysis				
Metabolisable Energy (Kcal/kg)	2864.40	2851.60	2853.20	2851.20
Crude Protein (%)	23.60	23.60	23.80	23.70
Fat (%)	4.00	4.00	4.10	4.10

Crude Fibre (%)	4.00	4.40	4.80	5.10
Calcium (%)	0.65	0.80	0.80	0.70

DATA COLLECTION

a) Performance characteristics

Data on daily feed intake and weekly weight gain were collected and recorded throughout the duration of the experiment to calculate the feed conversion ratio (FCR).

$$Average\ Feed\ Intake\ (\frac{g}{bird}) = \frac{Total\ feed\ supplied - Total\ left\ over\ feed}{Number\ of\ birds\ per\ replicate}$$

$$Weight\ gain\ \left(\frac{g}{bird}\right) = \frac{Final\ weight - Initial\ Weight}{Number\ of\ Birds\ per\ replicate}$$

$$Feed\ Conversion\ Ratio = \frac{Total\ feed\ Intake}{Total\ weight\ gain}$$

b) Digestibility trial

At the beginning of the last 3 days of the trial, the birds were fasted to empty their gut content and to mark the beginning of excreta collection. Total excreta samples were collected from birds in each replicate twice daily, morning and evening for three (3) days. The samples were thereafter pooled together and taken to the laboratory to determine the proximate composition. Diet samples were also analyzed for proximate composition. The official methods of analysis described by the Association of Official Analytical Chemist (AOAC, 2005) was used to determine the proximate composition of excreta and feed samples. Apparent digestibility coefficient of nutrients was calculated as followed:

$$Digestibilty\ (\%) = \frac{Nutrients\ in\ Feed - Nutrients\ in\ Excreta}{Nutrients\ in\ Feed} \times 100$$

c) Statistical Analysis

Data collected were subjected to Analysis of Variance (ANOVA) using SAS Statistical package (SAS, 2003). Experimental design used was Completely Randomized Design and means were separated using Duncan's multiple range test.

RESULTS AND DISCUSSION

Table 2 presented the effect of varying levels of wheat bran supplemented with Maxigrain® on the performance characteristics of growing Japanese quails. There were no significance differences ($P > 0.05$) across the treatments for all the performance parameters with the exception of body weight, weight gain and feed conversion ratio. Japanese quails fed 30% T3 recorded a significantly higher ($P < 0.05$) final body weight (153.4g/bird), total weight gain (109.3g/bird) and daily weight gain (3.9g/bird) as compared with the other treatment groups. The similarities obtained in the values of total and daily feed intake of the control and treatment groups may be attributed to the reduced intestinal viscosity and decreased retention time of digesta in the gut of the enzyme treated groups allowing the same level of consumption as in the control group (Kamelia *et al*., 2012). The result obtained for weight gain is in support with the findings of Makinde *et al* (2014) when finishers broilers diets were supplemented with rice offal at 10% and 20% in the presence of enzyme. This improvement of body weight of Quails fed T4 could be linked to enzyme supplementation that probably led to the degradation of fiber content of wheat bran coupled with the improvement in nutrient extraction in the small intestine by the Quails through accelerated digestion and reduced microbial activity (Bedford and Apajalahti, 2001). The reduced feed conversion ratio of quail birds fed T3 implies that birds efficiently convert their feed intake to improve their body weight gain. The result is similar to the report by Attia *et al* (2003a).

Table 2: Effect of graded level of wheat bran supplemented with maxigrain® on the performance characteristics of growing Japanese quail

Parameters	T1 (0% wheat bran)	T2 (10% wheat bran)	T3 (20% wheat bran)	T4 (30% wheat bran)	SEM±
Initial Body Weight (g/bird)	43.9	43.7	43.9	44.1	0.02
Final body Weight (g/bird)	147.10^{ab}	145.67^{ab}	144.47^{ab}	153.40^{a}	3.79
Total weight gain (g/bird)	103.20^{ab}	101.97^{ab}	100.57^{ab}	109.30^{a}	4.62
Daily weight gain (g/bird)	3.69^{ab}	3.64^{ab}	3.59^{ab}	3.90^{a}	0.18
Total feed intake (g/bird)	585.03	568.2	582.5	534.03	2.33
Avg. daily feed intake (g/bird)	20.89	20.29	20.80	19.07	0.08
Feed Conversion ratio	5.66^{a}	5.57^{a}	5.79^{a}	4.89^{ab}	0.23

^{ab} means along the same row with different superscripts are significantly different (P<0.05)
T2, T3 and T4 diets were supplemented with 10g/100kg Maxigrain®

Table 3 showed the effect of varying levels of wheat bran supplemented with Enzyme on the % nutrient digestibility of growing Japanese quails. There were significance differences (P< 0.05) across the treatments for all the parameters with the exception of ether extract and ash digestibility. The Crude protein digestibility of the control group (20.60%) was significantly lower (P < 0.05) as compared with the treatment groups (43.68, 45.68 and 45.06%). Crude fiber digestibility was significantly higher (P < 0.05) in T3 and T4 (55.18 and 55.76% respectively) as compared with the control and T2 (48.77 and 47.67% respectively). The dry matter digestibility for T3 and T4 increased significantly (95.03 and 95.65% respectively) than T1 and T2 (93.97 and 94.67% respectively). The improvement in % crude protein, crude fiber and nitrogen free extract digestibilities due to enzyme supplementation supports the findings of Adeola and Olukosi (2008) who reported that exogenous enzyme supplementation improves digestibility of nutrients. High dietary fiber can only be well digested and utilized in poultry when exogenous enzymes are added such that the enzymes break down the anti-nutritional factors that are present, many of which are not susceptible to digestion by the animal endogenous enzymes. The increased dry matter of the treatment groups over the control can be attributed to the fact that the xylanase enzyme in Maxigrain® helps to reduce the excreta moisture in the process of breaking down the non-starch polysaccharides in the gastro intestinal tracts of the birds (Graham, 1996).

Table 3: Effect of graded level of wheat bran supplemented with maxigrain® on the nutrient digestibilities of growing Japanese quail

Nutrient Digestibilities (%)	T1(0% wheat bran)	T2 (10% wheat bran)	T3 (20% wheat bran)	T4 (30% wheat bran)	SEM±
Crude Protein	20.60^{b}	43.68^{a}	45.68^{a}	45.06^{a}	4.68
Crude fiber	48.78^{b}	47.77^{b}	55.18^{a}	55.76^{a}	2.3
Ether Extract	28.3	38.46	27.06	36.03	7.05
Ash	51.92	53.60	55.00	54.14	6.89
Dry Matter	93.97^{b}	94.67^{ab}	95.03^{a}	95.65^{a}	0.43
Nitrogen Free extract	61.43^{b}	67.16^{a}	69.13^{a}	70.47^{a}	1.93

^{ab} means along the same row with different superscripts are significantly different (P<0.05)
T2, T3 and T4 diets were supplemented with 10g/100kg Maxigrain®

CONCLUSION AND RECOMMENDATION

The study concludes that it is economically advantageous to replace maize with up to 30% wheat bran when enzymes are added to Japanese quail diet at growing phase in order to reduce cost incurred on production and make poultry business worthwhile. It can be recommended that wheat bran be included in Japanese quail diets at levels above 30% when supplemented with exogenous enzymes.

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