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RESEARCH ARTICLE

Comparative Response of Japanese quails *(Coturnix coturnix japonica)* Fed Palm Kernel Meal and Brewer's Dried Grain based diets

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ABSTRACT

This study was carried out to evaluate the growth performance, carcass characteristics and organs weight of Japanese quails (*Coturnix coturnix japonica*) fed palm kernel meal (PKM) and brewers dried grain (BDG) based diets. Five diets were formulated with diet 1 (control) containing 0%PKM and 0%BDG. PKM and BDG were included at two levels each in diets 2, 3, 4 and 5 respectively (15%PKM, 30%PKM, 15%BDG and 30%BDG). A total of 300 unsexed Japanese quail chicks of two-weeks old were allotted to five dietary treatment groups of 60 quail chicks each with three replicates of 20 birds per pen in a completely randomized design. The diets were formulated to be iso-nitrogenous (25%CP). The birds were raised in cages for four weeks. Water and feed were offered *ad libitum.* The result of the experiment showed that average daily weight gain of quails fed control diet was comparable ($P>0.05$) to quails fed diets containing 15%BDG and those fed 15%PKM. Quails fed diet containing 30%BDG and 30%PKM consumed significantly ($P<0.05$) higher feed compared to those fed the control and other diets. The efficiency of feed utilization revealed a downward trend as dietary levels of BDG and PKM increased. There were significant differences ($P<0.05$) in the carcass parameters measured except for dressing percentage, breast, thigh and wings which were not influenced by the treatments. Also, there were no significant ($P>0.05$) differences in the organs weight such as liver, heart and intestinal weight but gizzard and intestinal length differ ($P<0.05$) significantly. On the basis of the result obtained, utilization of BDG and PKM up to 15% in quail's diet did not pose any negative effect on the performance of Japanese Quails and reduced the cost of production especially at the grower phase.

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INTRODUCTION

In recent times, a new genus of poultry, Japanese quail (*Coturnix coturnix japonica*) was introduced into Nigeria by the National Veterinary Research Institute (NVRI) Vom to expand the poultry subsector and help supplement the domestic chicken production through meat and eggs (Edache *et al.*, 2007; Anie *et al.*, 2009). The quails have unique characteristics and advantages 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 between 200-300 eggs in 360 days and are very resistant to common epidemics of poultry (NRC, 1991). The quail are hardy birds that can adapt easily to different environments (Haruna *et al.*, 1997). 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 (Haruna *et al.*, 1997; Olubamiwa *et al.*, 1999). Despite all these benefits, there are no improved feeding regimes as well as ways of enhancing the productive potential of the quails. Improving the nutritional strategies will enhance greater productivity of quails fed non-conventional feedstuffs (such as rice offal, palm kernel meal, brewer's dried grain, wheat offal) and possibly provide an avenue for utilization of available feed ingredients. Brewer's dried grain (BDG) is the residue obtained from the production of beer from barley or other grains in a mixture. It is an agro-industrial by-product of the brewing industry and is abundant in many parts of Nigeria. Brewer's dried grains were reported by

McDonald *et al*. (1998) to contain about 700-760g water/kg when wet and about 100g water /kg when dry. Same researchers reported its energy value as 2710kcal/kg ME and a crude protein content of 25.3%. They also described BDG as an excellent source of B-vitamins and trace minerals and a potential substrate for the production of microbial protein during fermentation. Similarly, Palm kernel meal (PKM), is a by-product from the palm-oil industry. It is an interesting feed ingredient for animal production due to its availability and low cost. The production is not seasonal as the oil palm tree produces fruits year round. However, the peak of production falls between the months of March and May when seasonal protein meal sources are scarce and expensive (Aduku *et al.*, 1998). World production of palm kernel meal in 1996 was estimated to be 2.66 million tonnes (FAO, 1998). However, the use of BDG and PKM as feed ingredient is mainly utilized by ruminants because of their fibrous nature, low palatability and low availability of amino acids and energy (McDonald *et al.*, 1998). Considering that BDG and PKM have very high crude fibre (CF) contents and the negative effect such high dietary CF could have on performance characteristics, carcass characteristics and organs weight of Japanese quails, this study was therefore undertaken to evaluate the growth performance, carcass characteristics and organs weight of Japanese quails (*Coturnix coturnix japonica*) fed palm kernel meal (PKM) and brewers dried grain (BDG) based diets.

MATERIALS AND METHODS

The study was conducted at the Poultry unit of Animal Science Department, Ahmadu Bello University, Zaria. The BDG and PKM used in this study were obtained from a reputable feed-mill in Kaduna State while the quail chicks were purchased from National Veterinary Research Institute (NVRI) Vom, Jos. Five diets were formulated with diet 1 (control) containing 0%PKM and 0%BDG. PKM and BDG were included at two levels each in diets 2, 3, 4 and 5 respectively (15%PKM, 30%PKM, 15%BDG and 30%BDG).

Experimental design

A total of three hundred (300) unsexed Japanese quail chicks of two-weeks old were allotted to five dietary treatment groups of 60 quail chicks each with three replicates of 20 birds per pen in a completely randomized design. The diets were formulated to be iso-nitrogenous (25%CP). The birds were raised in cages for four weeks. All management procedures were followed. Feed and water were provided *ad-libitum* and the experiment lasted for 28 days. The quails were allowed an adjustment period of two weeks before the initial weight and performance data were taken. They were then weighed weekly. Data collected were used to compute daily feed intake, daily weight gain and feed conversion ratio. At the end of the feeding trial (28 days), four quails selected from each replicate based on the group average weight were slaughtered by severing the jugular vein, before slaughtering, they were starved overnight to clear the guts and live weights were recorded. Evisceration of the carcasses was carried out and the internal organs were excised, weighed separately and expressed as percentage of live weight. The carcasses were then cut into primal parts and each part expressed as a percentage of the dressed carcass.

Chemical analysis

Proximate composition of the PKM and BDG used for the study was analysed using the method of AOAC (2000).

Statistical analysis

Experimental data were subjected to analysis of variance (ANOVA) using SAS (2008) software. Means were separated with Duncan multiple range test at 5% level of significance.

RESULTS AND DISCUSSION

Table 1 shows the chemical composition of the BDG and PKM. The result shows that the crude protein, crude fibre, ether extract and NFE content of the ingredients were significantly ($P<0.05$) different from each other. However, Dry matter and ash content were not significantly ($P>0.05$) different. The lower NFE recorded in BDG may be attributable to solubilisation and leaching of soluble starch and other nutrient content of this ingredient as a result of the water treatment during fermentation process (Mbajunwa, 1995). However, the levels of crude protein, crude fibre and ether extract were within the range reported by Oluokun and Olalokun (1995). The crude protein, crude fibre and ether extract content of PKM were within the range reported by Sundu *et al.* (2005) and Sue (2001).

Table 1: Chemical composition of BDG and PKM

Composition (%)	BDG	PKM	SEM
Dry matter	93.17	93.04	0.21
Crude protein	23.67[a]	17.45[b]	2.51
Crude Fibre	39.20[a]	25.10[b]	3.56
Ether extract	8.91[a]	4.01[b]	0.98
Ash	3.86	4.98	0.66
N F E	24.36[b]	48.46[a]	5.89

[ab] Means with different superscripts within the same row are significantly($P<0.05$) different; SEM= Standard error of the means

Table 2 and 3 shows the gross composition of the experimental diet as well as the performance of the Japanese quails following the 28-day trial. The result shows that the inclusion of BDG and PKM in quails diet had significant ($P<0.05$) effect on feed consumption of the birds in all treatment groups and weight gain was reduced with increasing inclusion levels. Compared to control diet, feed utilisation was depressed significantly ($P<0.05$) in all treatment groups except in the PKM and BDG at 15% inclusion levels. Similarly, feed conversion ratio indicated that the most efficient utilisation of feed resources was in treatments 2 and 4 respectively. Poorer weight gain observed in treatments 3 and 5 could be as a result of the high fibre content of the diets. This was similar to the reports of Arrif Omer *et al.* (1998) and McDonald *et al.* (1995) who observed that lower weights of birds fed PKM diets could be attributed to the high content of fibre that might have resulted from the diets which increased with

Table 2: Percentage composition of Starter/Grower diets containing graded levels of BDG and PKM based diets (2-6weeks).

Treatments Ingredients (%)	1 0%BDG+0%PKM	2 15%PKM	3 30%PKM	4 15%BDG	5 30%BDG
Yellow Maize	52.75	37.75	30.25	40.30	30.25
Full fat soyabean	15.00	15.00	15.00	15.00	15.00
Groundnut cake	27.79	27.79	20.29	25.24	20.29
Brewers dried grain	0.00	0.00	0.00	15.00	30.00
Palm kernel meal	0.00	15.00	30.00	0.00	0.00
Limestone	0.51	0.51	0.51	0.51	0.51
Bonemeal	3.00	3.00	3.00	3.00	3.00
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15	0.15
Salt	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100
Calculated Analyses					
ME(Kcal/kg)	2868	2898	2856	2893	2800
Crude protein (%)	25.00	25.00	25.00	25.00	25.00
Crude fibre (%)	4.81	4.48	4.64	4.60	4.94
Total P. (%)	0.85	0.82	0.85	0.83	0.81
Lysine (%)	1.11	1.15	1.11	1.17	1.10
Methionine (%)	0.55	0.54	0.55	0.54	0.53
Arginine (%)	1.30	1.81	1.92	1.32	1.45
Valine (%)	0.90	0.93	0.94	0.90	0.91
Lysine:Arg. Ratio	1:1	1:1	1:2	1:1	1:1
Ether extract (%)	5.30	5.35	5.30	5.25	5.40
Calcium (%)	1.47	1.40	1.47	1.48	1.35
Cost/kg of Diet (₦)	82.34	76.48	68.76	76.45	69.96

*****Biomix premix provided per kg of diet: vit. A, 10,000i.u; vit, D3, 2000i.u; vit. E, 23mg; vit. K, 2mg; calcium pantothenate, 7.5mg; vit. B12, 0.051mg; folic acid, 0.75mg; sodium chloride, 300mg; vit. B1, 1.8mg; vit. B2, 5mg; manganese, 40mg; iron, 20mg; zinc, 30mg; copper, 3mg; iodine,1mg; cobalt, 0.2mg; selenium, 0.3mg.

Table 3: Effects of feeding graded levels of PKM and BDG based diets on the growth performance of quail birds (2-6weeks).

Parameters	0%	15%PKM	30%PKM	15%BDG	30%BDG	SEM
Initial weight(g/b)	38.07	37.90	38.06	38.14	37.86	0.45
Final weight(g/b)	133.49^{a}	130.63^{a}	114.81^{b}	131.63^{a}	115.74^{b}	2.76
Daily weight gain (g/b/d)	3.41^{a}	3.31^{a}	2.74^{b}	3.34^{a}	2.78^{b}	0.09
Daily feed intake (g/b/d)	20.70^{b}	20.81^{b}	22.30^{a}	20.94^{b}	21.66^{a}	0.52
F C R	6.07^{a}	6.28^{a}	8.45^{b}	6.27^{a}	8.15^{b}	0.41

^{abc} Means with different superscripts within the same row are significantly($P<0.05$) different. SEM= Standard error of the means

Table 4: Effects of feeding graded levels of PKM and BDG based diets on the carcass characteristics of quail birds (2-6weeks).

*Parameters (%)	0%	15%PKM	30%PKM	15%BDG	30%BDG	SEM
Live weight (g)	134.42^{a}	126.72^{b}	122.03^{b}	125.74^{b}	123.37^{b}	4.19
Carcass weight (g)	87.70^{a}	83.19^{b}	79.65^{b}	83.51^{ab}	80.45^{b}	2.85
Dressing	65.24	65.65	65.27	66.41	65.21	1.35
Breast	28.87	27.38	27.24	27.44	27.63	1.14
Thigh	8.84	8.43	8.46	8.52	8.18	0.46
Back	23.42^{a}	22.31^{ab}	20.17^{b}	21.93^{ab}	20.34^{b}	1.61
Wings	7.71	7.41	7.66	7.24	7.67	0.30

^{ab} Means with different superscripts within the same row are significantly($P<0.05$) different. SEM= Standard error of the means. *Expressed as % of live weight

Table 5: Effects of feeding graded levels of PKM and BDG based diets on the organs weight of quail birds (2-6weeks).

*Parameters (%)	0%	15%PKM	30%PKM	15%BDG	30%BDG	SEM
Liver	2.29	2.32	2.18	2.35	2.23	0.18
Gizzard	3.59^{b}	3.72^{b}	4.52^{a}	3.83^{ab}	4.13^{a}	0.18
Heart	1.19	1.05	1.04	1.12	1.11	0.05
Intestinal weight	5.67	5.44	5.84	5.51	5.86	0.44
Intestinal length (cm)	56.19^{b}	58.46^{ab}	59.67^{ab}	57.07^{b}	62.70^{a}	2.48

^{ab} Means with different superscripts within the same row are significantly($P<0.05$) different. SEM= Standard error of the means. *Expressed as % of Carcass weight

increased percentage inclusion of PKM. Yaakugh *et al.* (1994) also observed a linear decrease in average daily weight gain of birds as the level of maize replacement by BDG increased in the diet. Delic *et al.* (1997) had earlier reported satisfactory result in live weight gain of pigs when 10% BDG was included in growing pigs' diet. Also, Ariff Omer *et al.* (1998) and Orunmuyi *et al.* (2006) showed that PKM can be used in the diets of finisher broilers and grower rabbits up to 15% and 30% inclusion level respectively without being detrimental to their performance. However, 15%BDG and 15%PKM inclusion levels are the best in the starter/grower phase

feeding in terms of daily weight gain, daily feed intake and feed conversion ratio. From the results of the average daily intake and weight gain, PKM and BDG may be used in poultry ration only about 15% inclusion. This result further validates the assertion of Ariff Omer *et al.* (1998) that PKM can be included in broiler finisher diet up to 15% of total ration.

The results of the carcass characteristics and organs weight are presented in Tables 4 and 5. The result indicated that the cut parts and internal organs did not differ significantly ($P<0.05$) from the control diet. The internal organs showed no significant differences among the treatments. This is a preliminary indication that there was no hypertrophy of any of the visceral organs. Relative organ weight, lack of abnormalities or gross pathologic lesions in the liver and other internal organs have been indicative of the absence of toxicity arising from feedstuff (Amaefule *et al.,* 2005). The linear increase in the weights of the intestine across the treatments may be due to their involvement in the digestion process.

Conclusion

On the basis of the result obtained, utilization of BDG and PKM up to 15% in quail's diet did not pose any negative effect on the performance of Japanese quails and reduced the cost of production especially at the grower/ starter phase.

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