EFFECT OF FEEDING WHOLE OR GROUND PEARL MILLET (*Pennisetum glaucum*) WITH OR WITHOUT ENZYME SUPPLEMENTATION ON THE NUTRIENTS' DIGESTIBILITY OF JAPANESE QUAILS (*Coturnix coturnix japonica*)

M. N. SABO, S. DURU AND S. B. AFOLAYAN

ABSTRACT

An experiment was conducted to evaluate effect of pearl millet inclusion level, pearl millet form and enzyme supplementation of pearl millet as replacement for maize on the nutrients' digestibility of Japanese quails using 3 quails per treatment (1 quail per replicate). The quails were fasted for 24hrs and then fed for fecal collection. The faeces collected were sun dried, bulked and samples were collected for proximate analysis. Feeding whole pearl millet increased the digestibility of crude protein, ether extract and ash by laying Japanese quails. Pearl millet inclusion increased crude protein digestibility. Enzyme supplementation in pearl millet based diets did not improve their nutrient's digestibility. The results of this study showed that grinding of pearl millet or its supplementation with enzyme did not improve nutrients' digestibility of Japanese quails.

Keywords: pearl millet; Japanese quails; nutrients; digestibility

INTRODUCTION

Feeding whole grains to poultry is now becoming a common management practice used frequently in Europe, Australia, and Canada (Bennett *et al.*, 2002). The practice has been reported to save costs (from grinding and pelleting), increase gizzard activity (Bennett *et al.*,2002; Engberg *et al.*, 2004; Biggs and Parsons, 2009; Svihus, 2010), increase pancreatic enzyme secretion (Svihus, 2010), increase efficiency of exogenous enzymes (Svihus, 2010), increase starch and amino acid digestibility (Engberg *et al.*, 2004; Biggs and Parsons, 2009; Svihus, 2010). The high fibre levels of pearl millet could be a limiting factor to its use in poultry diets. The utilization of this fibre could be improved with the use of exogenous enzymes (Singh and Perez-Maldonado, 1999). Svihus (2010) hypothesized that a more developed gizzard as a consequence of structural components may improve efficacy of exogenous enzymes. This could be due to increased retention time in the gizzard and the favourable pH there. The objective of this study was to determine the effect of pearl millet inclusion level, pearl millet form and enzyme supplementation of pearl millet as replacement for maize on the nutrients' digestibility of Japanese quails.

MATERIALS AND METHODS

The study was conducted at the Poultry Unit of the Research and Training Farm of the Department of Animal Science, Ahmadu Bello University Zaria, located within Northern Guinea Savannah Zone of Nigeria at latitude 11° 09' 06"N longitude 7° 3' 8"E with an altitude of 706m above sea level (GPS).

Factorial arrangement in a 2x2x2 completely randomized design with two levels of millet inclusion (50 and 100) as replacement for maize, two forms of millet (whole or mash) and enzyme supplementation (with or without) was used for this study. A maize based layer diet was formulated (20% CP and 2900MEkcal/kg) as the control. Pearl millet replaced maize on a weight to weight basis for the different inclusion levels and forms and each with or without enzyme supplementation (Table 1). The exogenous enzyme used in this study was Maxigrain®. Three quails per treatment (1 bird per replicate) were randomly picked and housed in individual cages. They were then fasted for 24hrs. After the 24hrs of fasting, feeding for fecal collection was started immediately. A known quantity of each diet was weighed per bird for the period of the study. The birds were fed *ad libitum*. All faeces voided were collected by placing a polythene sheet on the floor of the cages. The faeces were cleaned of wasted feed, feathers and other foreign materials to avoid contamination. The faeces collected from each bird were labelled according to treatment and sun dried. After four days of faecal collection, faecal samples collected were dried in the oven at 70°C for 24hrs. The dried faecal samples were allowed to equilibrate with atmosphere and then weighed. The faecal samples were bulked and samples were collected for proximate analysis. The dried samples were assayed for their proximate composition (Dry matter, Crude Protein, Ether extract, Crude fibre and Ash) in the Animal Science Laboratory, Ahmadu Bello University, Zaria. The percentage digestibility was calculated using the formular below;

$$\text{Nutrient Digestibility (\%)} = \frac{\text{Nutrients in diet} - \text{Nutrients in feaces}}{\text{Nutrient in diet}} \times 100$$

Statistical Analysis

Data from both experiments were analyzed using the general linear models (GLM) procedure of SAS software (SAS, 1994). Data were subjected to analysis of variance. Where the analysis of variance was significant, Duncan's multiple range test was used to separate treatment means.

RESULTS AND DISCUSSION

Tables 2 shows the proximate composition of the diet. The effect of pearl millet inclusion level on the nutrient digestibility of laying Japanese quails is shown in table 3. The crude protein digestibility of laying Japanese quails fed 50% pearl millet was significantly higher ($P<0.05$) than that of the control (0% pearl millet). Quails fed 100% pearl millet had similar ($P>0.05$) crude protein digestibility with both the 50% pearl millet fed group and those fed the control. Laying Japanese quails fed 50 and 100% pearl millet had similar ($P>0.05$) crude fibre digestibility, ether extract digestibility, ash digestibility and nitrogen free extract digestibility compared to the control (0% pearl millet). As found in this study, Baurhoo *et al.* (2010) observed crude protein digestibility between broilers fed pearl millet and maize. Also similar with the ash digestibility obtained in this study, Chiripasi *et al.* (2013) observed that pearl millet can replace maize in guinea fowl diets without negatively affecting mineral retention. The effect of pearl millet form on the nutrient digestibility of laying Japanese quails is shown in table 4. The crude protein digestibility of laying Japanese quails fed whole pearl millet was higher ($P<0.05$) than that of the control. Quails fed ground pearl millet had similar ($P>0.05$) crude protein digestibility with both the whole pearl millet and the control fed groups. Quails fed the control digest crude fibre better ($P<0.05$) than those fed ground pearl millet. While those fed whole pearl millet have similar ($P>0.05$) crude fibre digestibility to those of the ground pearl millet or the control. Ether extract digestibility was highest ($P<0.05$) for the whole pearl millet fed quails followed by those fed the control and the least was for those fed ground pearl millet. Ash digestibility was higher ($P<0.05$) in the whole pearl millet based diet compared to the ground pearl millet based diet. The control has similar ($P>0.05$) ash digestibility with both the whole pearl millet and ground pearl millet diets. Laying Japanese quails fed whole pearl millet and ground pearl millet had similar ($P>0.05$) nitrogen free extract digestibility compared to the control. This is contrary to the report of Garcia (2006) who observed that digestibility of starch was slightly, but significantly, improved when whole millet was incorporated into the diet. Biggs and Parsons, (2009) also observed that at 7d and 21d chicks fed 10% whole barley had an improved digestibility of most amino acids when compared with chicks fed the maize-soyabean meal diet and that at 21d, whole sorghum had little positive effect on amino acids digestibility. The improvement in nutrients' digestibility was hinged to increased gizzard size and function as reported by these authors. This stimulation might not have occurred or was not significant in this study as feeding whole pearl millet did not affect gizzard weight (data not shown). The effect of enzyme supplementation of pearl millet diets on the nutrient digestibility (%) of laying Japanese quails is shown in table 5. Laying Japanese quails fed pearl millet without enzyme, pearl millet with enzyme or the control (0% pearl millet) had similar ($P>0.05$) crude protein digestibility, crude fibre digestibility, ether extract digestibility, ash digestibility and nitrogen free extract digestibility. Contrary to the findings of this study, Baurhoo *et al.* (2011) discovered supplemention of pearl millet diets with enzyme increased crude protein digestibility in broilers chickens.

Conclusions

From the results of this study, it can be concluded that grinding or enzyme supplementation of pearl millet based diets did not improve nutrients' digestibility of Japanese quails.

REFERENCES

Baurhoo, N., Baurhoo, B., Mustafa, A. F. and Zhao, X. (2010). Comparison of corn-based and Canadian pearl millet-based diets on performance, digestibility, villus morphology, and digestive microbial populations in broiler chickens. *Poultry Science, 90*(3), 579-586.

Baurhoo, N., Baurhoo, B. and Zhao, X. (2011). Effects of exogenous enzymes in corn-based and Canadian pearl millet-based diets with reduced soybean meal on growth performance, intestinal nutrient digestibility, villus development, and selected microbial populations in broiler

chickens. *Journal of Animal Science, 89*:4100-4108

Bennett, C. D. , Classen, H. L. and Riddell, C. (2002). Feeding broiler chickens wheat and barley diets containing whole, ground and pelleted Grain. *Poultry Science, 81*:995–1003

Biggs, P. and Parsons, C. M. (2009). The effects of whole grains on nutrient digestibilities, growth performance, and cecal short-chain fatty acid concentrations in young chicks fed ground corn-soybean meal diets. *Poultry Science, 88* :1893–1905.

Chiripasi, S. C., Moreki, J. C., Nsoso, S. J. and Letso, M. (2013). Effect of feeding yellow maize, white sorghum and pearl millet as energy sources on mineral intake, retention and utilisation by guinea fowl under intensive management system. *ARPN Journal of Science and Technology, 3*(1):124 – 137.

Engberg, R. M., Hedemann, M. S., Steenfeldt, S., and Jensen, B. B. (2004). Influence of whole wheat and xylanase on broiler performance and microbial composition and activity in the digestive tract. *Poultry Science, 83*:925–938.

Garcia, A. R. (2006). *Evaluating Feed Components for Formulation of Pre-Starter Diets for Broiler Chickens*. A Doctoral dissertation, University of Georgia. Athens, Georgia

Statistical Analysis System, (1994). Statistical users guide. SAS institute Inc. Cary, North Carolina, U.S.A.

Svihus, B. (2010). Challenging current poultry feeding dogmas by feed intake restriction and the use of coarse feed ingredients. In P. Selle (Ed) 21st Annual Australian Poultry Science Symposium Sydney, New South Wales, 1 – 3 February, 2010.

Singh, D. N. and Perez-Maldonado, R. (1999). Nutritional value of pearl millet as poultry feed. A report for the Rural Industries Research and Development Corporation. RIRDC Project No DAQ-243A

Table 1: Composition (%) of Experimental Diets

Ingredients	0%PM	50%WPM	100%WPM
Maize	56.0	28.0	-
Pearl millet	-	28.0	56.0
Soyabean meal	21.0	21.0	21.0
Groundnut cake	10.0	10.0	10.0
Maize offal	4.0	4.0	4.0
Palm oil	1.9	1.9	1.9
Limestone	5.0	5.0	5.0
Bone meal	1.3	1.3	1.3
Salt	0.25	0.25	0.25
Vit. Premix	0.25	0.25	0.25
Lysine	0.10	0.10	0.10
Methionine	0.2	0.2	0.2
Total	100.00	100.00	100.00
Calculated Analysis			
Crude protein (%)	19.6	20.3	21.0
ME (kcal/kg)	2889	2645	2401
Ether extract (%)	2.5	2.5	2.5
Crude fibre (%)	2.9	4.4	5.9
Calcium (%)	2.5	2.5	2.5
Phosphorus (%)	0.6	0.5	0.5
Lysine (%)	1.1	1.1	1.2
Methionine (%)	0.5	0.5	0.5
Feed cost(₦/kg)	92.90	95.46	100.22

PM-pearl millet, WPM-whole pearl millet, GPM–ground pearl millet, EN–enzyme

Table 2: Proximate composition (%) of feed samples (Experiment 2)

Parameter	0%PM	50%WPM 50%M	100%WPM
Dry Matter	92.56	91.17	92.70
Crude Protein	21.56	22.06	22.81
Crude Fibre	4.39	6.22	7.51
Ether extract	6.02	5.68	5.39
Ash	5.39	6.04	6.34
Nitrogen free extract	62.64	60.00	57.95

PM- pearl millet, WPM- whole pearl millet, GPM–ground pearl millet, EN–enzyme

Table 3: Main effect of Pearl Millet inclusion level on the Nutrient Digestibility (%) of Laying Japanese quails

	Inclusion level			
	Control	50%	100%	SEM
Parameter				
Crude Protein (%)	79.94^{b}	84.45^{a}	83.38^{ab}	1.31
Crude Fibre (%)	62.90	55.92	52.39	3.73
Ether extract (%)	91.50	92.99	91.65	0.61
Ash (%)	79.73	82.04	78.64	1.76
Nitrogen free extract (%)	70.29	73.80	71.51	2.11

$^{a, b, c}$ means in a row with no common superscript(s) differ significantly (P<0.05)
SEM – standard error of mean

Table 4: Main effect of Pearl millet form on the Nutrient Digestibility (%) of Laying Japanese quails

	Pearl millet form			
	Control	WPM	GPM	SEM
Parameter				
Crude Protein (%)	79.94^{b}	85.81^{a}	82.01^{ab}	1.31
Crude Fibre (%)	62.90^{a}	59.37^{ab}	48.94^{b}	3.73
Ether extract (%)	91.50^{b}	93.81^{a}	90.84^{c}	0.61
Ash (%)	79.73^{ab}	84.65^{a}	76.04^{b}	1.76
Nitrogen free extract (%)	70.29	75.09	70.22	2.11

$^{a, b, c}$ means in a row with no common superscript(s) differ significantly (P<0.05)
SEM–standard error of mean, WPM: whole pearl millet, GPM: ground pearl millet

Table 5: Main effect of Enzyme supplementation of pearl millet diets on the Nutrient Digestibility (%) of Laying Japanese quails

	Enzyme			
	Control	PM-EN	PM+EN	SEM
Parameter				
Crude Protein (%)	79.94	84.45	83.38	1.68
Crude Fibre (%)	62.90	55.92	52.39	4.68
Ether extract (%)	91.50	93.00	91.65	0.98
Ash (%)	79.73	82.03	78.64	2.89
Nitrogen free extract (%)	70.29	73.80	71.51	2.45

$^{a, b, c}$ means in a row with no common superscript(s) differ significantly (P<0.05)
SEM – standard error of mean, PM-EN: pearl millet without enzyme,
PM+EN: pearl millet with enzyme