UTILIZATION OF GRADED LEVELS OF PEARL MILLET AS DIETARY ENERGY SOURCE BY JAPANESE QUAILS

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Abstract
The experiment was carried out to investigate the inclusion levels of pearl millet in the diets of quails (Coturnix coturnix japonica). Four hundred and eighty (480) two weeks old quail birds were used for the study in an experimental diets that contained 10, 20, 40, 60, 80, and 100% Pearl millet (PM) with 24% CP& 2888kcal/kgME and 20% CP& 2778 kcal/kgME for growing and laying phases, respectively. The experiment lasted for 119 days and data were collected weekly; the parameters measured include feed intake (FI), total weight gain, water intake, egg weight, hen day egg production, and egg quality. At growing phase (2-6 weeks), the parameters measured were significantly different across the dietary levels of Pearl millet. At the laying phase (6-17 weeks) all the parameters measured were significantly (P<0.01) differences except in FI (26.70-30.60 g). It can be concluded that pearl millet can replace maize at 100% levels in diets of Japanese quails without adverse effects on growth performance and hen day egg production.
Key words: Pearl millet, Japanese quail, performance, layer, egg production,

Introduction
Cereal grains, especially maize which form the bulk of energy in poultry feeds are in short supply as a result of industrial and human needs (Nworgu *et al.,* 1999). In view of this, evaluation of pearl millet as alternative energy feedstuffs to maize becomes imperative in areas where their uses are less common. Millet is the most widely grown cereal that has been successfully cultivated in the semi-arid region of Africa and its production cost is relatively low. However, it has little industrial uses in Nigeria (Nyannor *et al.,* 2007). Pearl millet (*Pennisetum glaucum)* is considered as a staple food in Africa and India where it is used to make flour, bread, porridge and "couscous". As a feedstuff it is mainly grown to produce silage, hay (FAO, 2002).

Feeds are the most expensive production input which accounts for 65-75% of the cost of poultry production (Adelowo, *et al,*. 2018). Maize which is the best and major source of dietary energy for quail production has a high competition between human and animal. In view of this, it is highly necessary to search for suitable substitutes for maize in a developing country like Nigeria (Elangovan *et al.,* 2004). This study investigates the performance, carcass characteristics and egg quality of Japanese quails (*Coturnix coturnix japonica*) fed various inclusion levels of Pearl millet (*Pennisetum glaucum)* as energy source.

Materials and Methods
The experiment was conducted at the teaching and research farm of the Federal College of Animal Health and Production Technology, NVRI Vom, Plateau State. Four hundred and eighty (480) two weeks old Japanese quail were used for the study. Initial weight was recorded and the birds were randomly distributed into six treatments with four replicates of 20 chicks in a completely randomised design. Six experimental diets were formulated for the study (Tables 1 and 2). The diets contained 24% CP and 2800kcal/kg ME, and 20% CP and 2600kcal/kg ME for phase I and phase II respectively: the Treatments are; I. Contained 100% Maize as sole source of energy, II. Containing Maize 80%, Millet 20% energy source, III. Containing Maize 60%, Millet 40% energy source, IV. Containing Maize 40%, Millet 60% energy source, V. Containing Maize 20%, Millet 80% energy source, VI. Contained 100% Millet as sole energy source. The diets for both experiments were formulated to meet the nutrient standard of quail, (NRC, 1994) and water was given *ad-libitum* throughout the growing and laying period. Sample of formulated diets was analysed for proximate composition using the method described by AOAC (2006) at Biochemistry Laboratory Department of National Veterinary Research Institute, Vom, Nigeria. The quails were weighed weekly with digital

scale, the parameters measured include feed intake, weight gain, final weight and feed conversion ratio was calculated. Mortality was recorded as it occurred. All the chicks were subjected to same management practices throughout the experimental period. The brooding was done with100watt bulb as sources of heat.

Statistical Analysis: Data obtained from the experiment were analysed using the statistical analysis of variance (ANOVA) procedure of SAS (2010) and significant level of p=0.05, and p=0.01 were used. The treatment means were compared using the New Duncan multiple range test of the same software.

Table 1: Composition of the experimental diets for grower Phase (2-6 weeks)

	Diets (%)					
Ingredients	T1	T2	T3	T4	T5	T6
Maize	50.00	40.00	30.00	20.00	10.00	0.00
Millet	0.00	10.00	20.00	30.00	40.00	50.00
Maize Offal	7.13	7.60	8.05	8.50	8.95	9.42
Groundnut Cake	34.37	33.90	33.45	33.00	32.55	32.08
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00
Limestone	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	2.00	2.00	2.00	2.00	2.00	2 .00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Premix *	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition						
ME (kcal/kg)	2888.00	2888.00	2888.00	2888.00	2888.00	2888.00
Crude Protein(%)	24.00	24.00	24.00	24.00	24.00	24.00
Crude fibre (%)	4.60	4.60	4.60	4.60	4.60	4.60
Ether extract (%)	4.98	4.98	4.98	4.98	4.98	4.98
Calcium (%)	0.80	0.80	0.80	0.80	0.80	0.80
Phosphorus (%)	0.29	0.29	0.29	0.29	0.29	0.29
Lysine (%)	1.13	1.13	1.13	1.13	1.13	1.13
Methionine (%)	0.83	0.83	0.83	0.83	0.83	0.83

*Bio-mix premix supplied per kg diet-vitamin A, 10,000.00 i.u; vitamin D, 2,000.00 i.u; Vitamin E 23,000.00mg; Niacin 27.5mg; Vitamin B_1 1,800mg; Vitamin B_6 30mg; Vitamin B_{12} 0.015mg, Vitamin K_3 200mg; Pantothenic Acid 7,500; Biotin H_2 0.06; Folic Acid 0.75mg; Chlorine 300.00mg; Cobalt 0.2mg; Copper 30mg; Iodine 1.00mg; Iron 200.00mg; Manganese 0.04mg; Selenium 0.2mg; Zinc 30mg; Antioxidant 1.25mg. T1 100% maize, T2 – 80% maize, 20%millet, T3 – 60% maize, 40% millet, T4 – 40% maize, 60% millet, T5 – 20% maize, 80% millet and T6 100% millet.

Table 2: Composition of experimental diets for egg production phase (6-17 weeks)

	Diets (%)					
Ingredients	T1	T2	T3	T4	T5	T6
Maize	50.00	40.00	30.00	20.00	10.00	0.00
Millet	0.00	10.00	20.00	30.00	40.00	50.00
Maize Offal	18.90	19.36	19.80	20.27	20.71	21.19
Ground Nut Cake	22.60	22.14	21.70	21.23	20.79	20.31
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00
Limestone	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition						
ME (kcal/kg)	2778.00	2778.00	2778.00	2778.00	2778.00	2778.00

Crude protein (%)	20.00	20.00	20.00	20.00	20.00	20.00
Crude fibre (%)	4.50	4.50	4.50	4.50	4.50	4.50
Ether extract (%)	4.85	4.85	4.85	4.85	4.85	4.85
Calcium (%)	2.39	2.39	2.39	2.39	2.39	2.39
Phosphorus (%)	0.40	0.40	0.40	0.40	0.40	0.40
Lysine (%)	1.14	1.14	1.14	1.14	1.14	1.14
Methionine (%)	0.86	0.86	0.86	0.86	0.86	0.86

Results and Discussions

Table 3: Performance of Quail Birds Fed the Experimental Diets (2 - 6 weeks)

	Diets						
Parameters	T1	T2	T3	T4	T5	T6	SEM
Feed Intake/bird (g)	12.05^{b}	13.29^{a}	13.45^{a}	13.54^{a}	13.46^{a}	13.43^{a}	0.15^{***}
Weight Gain/bird (g)	90.75^{c}	100.5^{b}	115.25^{a}	113.75^{a}	101.00^{b}	95.75^{b}	0.52^{***}
Initial Weight/bird (g)	20.75	20.50	21.25	21.75	20.50	21.00	0.53^{NS}
Final Weight/bird (g)	111.50^{b}	121.00^{ab}	136.50^{a}	135.50^{a}	121.50^{ab}	116.75^{b}	0.54^{***}
Feed Conversion Ratio	4.65^{b}	4.63^{b}	4.09^{a}	4.17^{a}	4.66^{b}	4.90^{c}	0.06^{***}
Age at 1st egg (days)	39	43	39	39	41	40	1.04^{NS}
Av. Wt. 1st egg (g)	6.00	7.00	5.50	6.75	6.50	6.75	0.49^{NS}
Mortality (Number)	4	3	2	1	4	2	-

^{abc}= means with different superscript on the same row are significantly different, *** = significant at (P<0.001), NS = Not Significant; SEM = Standard Error of Mean.

Table 4: Performance of Japanese quail layers fed the Experimental Diets (6-17 weeks)

	Diets						
Parameters	T1	T2	T3	T4	T5	T6	SEM
Feed Intake (g)	30.60	29.22	26.70	28.72	30.50	28.12	0.98^{NS}
Final Weight (g)	154.53^{b}	164.63^{a}	159.82^{b}	169.97^{a}	167.00^{a}	166.60^{a}	2.94^{***}
Total Weight Gain (g)	43.03^{a}	43.63^{a}	23.32^{b}	34.47^{ab}	45.50^{a}	49.85^{a}	1.01^{***}
Daily Weight Gain (g)	0.56^{a}	0.57^{a}	0.30^{b}	0.45^{ab}	0.59^{a}	0.65^{a}	0.01^{***}
Hen Day Egg Production	59.77^{ab}	86.10^{a}	91.50^{a}	79.01^{a}	80.00^{a}	68.50^{b}	2.35^{***}
Mortality (number)	6	7	7	7	7	11	-

^{abc}= means with different superscript on the same row are significantly different, *** = significant at (P<0.001), NS = Not Significant, SEM = Standard Error of Mean.

The result in this study shows the feed intake at the starter phase (FI) as 12.05-13.54g/day compared to the 10.52 to 11.04g/day reported by Abubakar *et al.* (2007) for quail chicks fed varying levels of rumen content in diets, but at variance with a study conducted at NVRI with observation in daily feed intake of 22.26g per quail at six weeks. Increased feed consumption on weekly basis as the quail grow older as reported by Edache *et al.* (2005). The FI at finisher phase 26.70-30.60 g/day were similar across the diets. This agrees with the observation of Café *et al.* (1999) in their study on feed intake of quails fed graded levels of millet diets. The results of water intake at the starter (20.19 – 23.40 ml/day) and finisher (31.68 – 50.52 ml/day) phase revealed that, the higher the feed intake the higher amount of water consumed. The results of weight gain (WG) recorded during starter phase ranged from 2.59 to 3.29 g/day while that of the finisher period ranged from 0.30 to 0.65 g/day. This is

similar to the reports of NVRI (1996) who evaluated the response of Japanese quails to diets containing three protein levels (20, 22 and 24% CP) and found that birds fed with high protein diet (24% CP) had best growth performance. This also agrees with the reports of Gheeisari *et al.* (2011) which indicated that increasing dietary protein in different stages of growth cause increase in body weight gain of Japanese quail. The result of feed conversion ratio in this study ranges from 4.09-4.90 and is similar to the observation of Al-Hanafy (2012) who reported that during the starting phase (1-6weeks) a significant improvement in feed conversion ratio was recorded.

Conclusion

The study revealed that quail birds fed with the highest inclusion (50%) of pearl millets in their diets were not different in the final weight, weight gain and feed conversion ratio of quails in the control diet and those in diets replaced with hundred percent pearl millet. Hence, pearl millet can replace maize in the diets of Japanese quails without adverse effects on performance and egg production.

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