PERFORMANCE OF JAPANESE QUAIL BIRDS (*Coturnix coturnix*) FED ON WHOLE OR GROUND MILLET WITH OR WITHOUT ENZYME INCLUSION

S. B AFOLAYAN[1], A, SEKONI[2], J. O. JEGEDE[2] and M, AFOLAYAN[1]

[1]Samaru College of Agriculture, Ahmadu Bello University, Zaria, [2]National Animal Production Research Institute, Ahmadu Bello University, Shika- Zaria, jojegede@gmail.com

ABSTRACT

The performance of Japanese quail chicks (*Coturnix Coturnix* Japonica) fed on whole millet grain diets treated with or without enzyme as a dietary source of energy was studied. A total of one hundred and fifty unsexed two-week-old Japanese quail chicks (*Coturnix Coturnix* Japonica) of average weight (44g/bird) were used for the study. The birds were weighed in equal groups of 10 and randomly distributed over 15 pens after which they were placed on 5 dietary treatments. Three of these diets consist of enzyme-treated whole millet substituting maize at 25, 50 and 75% levels while the remaining two diets consist of 100% maize (Control diet) and 100% ground millet respectively. Enzyme Maxi-grain was used. The dietary energy and protein of each diet were 2900kcal/kg and 23%CP respectively. The experiment which was carried out in a completely randomized design (CRD) had each of the five treatments replicated three times with each replicate feed assigned to 10 chicks per pen. Parameters measured or calculated include feed intake, body weight gain, feed efficiency, feed costs, feed cost/kg weight gain and mortality. At the end of the study samples of birds from each replicate were slaughtered to determine weights of carcass, leg, heart, liver, gizzard, back, breast and intestine. The study lasted 6 weeks (February to April, 2014). The results showed that differences in the feed efficiency were not significant ($P>0.05$) while final weight, weight gain and feed costkg^{-1} weight gain decreased significantly ($P<0.05$) across the enzyme-treated diets, the feed intake and age at first egg drop increased significantly ($P<0.05$). Also, the results of carcass analysis did not show significant differences ($P>0.05$) in dressing percent, wing, leg, heart, liver and breast weights; however, the gizzard, back and intestinal weights were all significantly different ($P<0.05$). The Control gave the best performance, although its performance was not significantly different ($P>0.05$) from that of the diets containing 100% ground millet. Whole millet-containing diets had no adverse effects on mortality. It is therefore concluded from this study that enzyme-treated millet should not be used to substitute maize at higher than 50% level in quail chick diets.

INTRODUCTION

Of recent in Nigeria, quails production gained wider recognition and acceptance because of its high egg and meat quality, less capital investment requirement, relatively short turn-over cycle, less demand on land, labour and management (Badejo 1983). Quail production in Nigeria has been on the increase since the recognition of its food value. However, high feed cost characterized of poultry production is also a threat to profitable quail production in Nigeria. The search for efficient feeding and management practices is on-going. The feeding of ground mash diets adopted by most farmers has been identified as an important factor magnifying the cost of feeding poultry birds (Schvira, 2003). Attempt to reduce the feed cost has led to feeding whole grain to poultry in countries such as Australia and Canada. This practice reduces feed costs and wastage due to handling, processing, transportation and storage (Bennett, 2002, Schvira, 2003., Garcia and Dale, 2006; Biggs and Parsons, 2009 and Svihus, 2010). Increased gizzard activity (Bennett, 2002 and Svihus, 2010) improved fed conversion ratio (Bennett, 2002), increased pancreatic enzymes secretion (Svihus 2010), increased efficiency of exogenous enzymes and increased starch and amino acid digestibility (Biggs and Parsons, 2009) have also been identified as benefits of feeding whole grains to chickens. Maize is known to be the major source of energy in poultry production; accounting for 45-65% of poultry feeds. However with the current trend of global warming, inadequate fertilizer supply and increased transportation costs, the availability and affordability of maize especially in the semi-arid region is becoming difficult. Also, reducing cost of feeding by bye-passing grinding of maize is not feasible; particularly for the quails that cannot feed on whole maize grains. The search for viable alternatives to maize in poultry diet has become imperative. Millet has been suggested as one of

such alternatives to maize. It is draught tolerant, and has acceptable grain yields even on acidic soils of low fertility. The grain is small and may not require further grinding if it is to be incorporated into chicken's feeds. It will therefore be desirable and cost reducing if quails can perform efficiently when the grinding of millet is bye-passed in the course of diet formulation. Also the level to which enzymes addition can influence the whole millet diet utilization shall be examined in this work.

MATERIALS AND METHODS

A total of one hundred and fifty (150) unsexed two-week-old Japanese quails obtained from National Veterinary Research Institute, (VOM) Plateau State were used for the study. They were divided into equal groups of 10 birds, adjusting the groups' weight to approximately 44g/bird and distributed over 15 pens in a conventional deep litter poultry house. Each pen had a dimension of 3.05 by $1.22m^2$. Five (5) formulated diets consisting of 5 levels of millet substitution with maize (0, 25, 50, 75 and 100%), two forms of millet (whole or ground) and with or without enzyme inclusion were assigned to the 15 groups of birds, each to three replicates in a completely randomized design. Three of these diets consist of enzyme-treated whole millet substituting maize at 25, 50 and 75% levels while the remaining two diets consist of 100% maize (Control diet) and 100% ground millet with no enzyme inclusion respectively. Enzyme Maxi-grain was used. The dietary energy and protein of each diet were 2900kcal/kg and 23%CP respectively. The ingredients' composition as well as the calculated proximate chemical composition of the diets is presented in Table 1. The birds were brooded for three weeks while rearing continued for another three weeks. Feeds and water were supplied *ad-libitum* throughout the period of the experiment. Preventive drugs such as terramycin chick formula, vitalyte were occasionally administered to prevent disease outbreak and facilitate feed intake. The birds were weighed weekly during the study. Weighed left-over feed was subtracted from the total feed supply for the week to obtain feed consumption per week for each replicate. From the records taken, feed intake, weight gain, feed conversion ratio and feed costs per gain were calculated. Mortality records were kept and the egg production per pen was recorded. At the end of the study, two birds were picked randomly from each replicate. They were weighed individually before being slaughtered by cervical dislocation. The legs, heart, liver, gizzard, back, breast and intestine were removed and weighed. The study was carried out within the months of February and March and lasted 6 weeks. The data collected were summarized and subjected to Analysis of Variance (ANOVA). Where statistical significances were observed, the levels of significance were determined and the means were compared using Duncan Multiple Range Test (DMRT) according to SAS (2004).

RESULTS AND DISCUSSIONS

Growth Parameters

The average final weight of birds obtained across the treatment ranged from 105 to 108g/bird. These values are in agreement with the report of Makoto (2003) who gave the weight of adult Japanese quails as 100 – 140g/bird. The final weight as well as the weight gain of birds on diets with the highest percentage of whole millet (37.5%) was however significantly lower than those of the rest diets. This is expected from the standpoint of Schvira (2003) who from the feeding whole grain experiment conducted with chickens reported that whole wheat grains prolong gizzard grinding and slow digesta movement into the gut, hence nutrient distribution and utilization become negatively affected and market weight attainment becomes prolonged. Beside, possible coccidial problem development at high dilution rate was also insinuated. However, the negative performance reported in this study must have set in when the optimal dilution rate of the diet with whole grains have been exceeded as Schvira (2003) also reported that low dilution rate of 5% promotes gizzard and gut development; thereby promoting digestion and utilization of feed nutrients. The similarity of the weight gains in diets containing 12.5 and 25% whole grains with the Control diet observed in this study must have been a combination of the positive role played by the enzyme applied and ability of whole grains promoting gizzard development (Bennet, *et al* 2002., Hetland, 2004 and Svihus, 2010). While Bennet *et al* (2002) noted that whole grain feeding improved feed conversion ratio, Svihus (2010 reported that whole grain feeding increased the

efficiency of exogenous enzymes and increased starch and amino acid digestibility. In the case of the ground millet diet, the nutrients in the millet seemed to be more readily available than those of the whole millet feeds. The intake of control and diet containing 2.5% whole grain millet were significantly lower than those of other diets. The trend of the feed intake observed in this study can be attributed to progressive decrease in dietary energy as the level of dietary millet and fibre increased. This is because dietary energy level is a major determinant of rate of feed consumption. Animals eat to satisfy their energy needs and stop feeding once the body requirement for energy is met (Afolayan *et al*,. 2012), thus diets with lower energy contents are expected to be more consumed as experienced in this study. Considering the decline in the feed energy across the treatments (2983 – 2547Kcal ME/kg feed), significant differences were expected in the efficiency of utilization of the feeds; however, this was not so in this study probably because of the positive contribution of the Maxi-grain enzyme to the utilization of feeds containing the enzyme. The performance given by the ground millet diet showed that performance of quail chicks is not adversely affected at low feed energy of 2560kcal/kg ME and suggests that the energy of millet is better digested and utilized than the energy of maize. Although the differences observed in the efficiency of feed conversion were not significant (P>0.05), however, the significant difference (P<0.05) that occurred between the ground millet diet and other diets in terms of feed cost per kg weight gain was in agreement with Bennett *et al*.(2002), Garcia and Dale (2006) and Biggs and Parsons (2009) who had earlier highlighted the advantages of feeding whole grains to chicken as capable of reducing feed costs and wastages during feeding and handling.

Age at 1st egg Drop and Hen-day egg Production

The result produced by both enzyme treated 25.0 and 37.5% whole millet diets were significantly different (P<0.05) from those produced by the rest of the diets except in the case of Hen-day egg production where they produced similar results with the 12.5% enzyme treated whole millet and 50% ground millet diets. Egg production is known to be a function of feed quality, digestibility and utilization of feed nutrients. The result thus suggests that the 25.0 and 37.5% enzyme treated whole millet diets were not as digestible and nutritive as the other diets.

Carcass Evaluation

The result did not show any significant difference in Carcass percent. However, when the weights of carcass components were computed relative to whole carcass weight, the gizzard weight (3.65g) and weight of the intestines (9.72g) were found to be significantly (P<0.05) higher for the birds on 37.5% enzyme treated whole diet than the corresponding weights of birds on other diets; though similar weight of intestine (8.38g) was recorded for birds on 25.0% enzyme-treated whole millet diet. The greater weight of intestines of birds on whole millet diets is a reflection of longer intestine reported by Svihus and Hetland (2004) when whole wheat diet was fed to chickens. The ability of whole grain feeding and high dietary fibre to promoting gizzard development and activities was also manifested in the weights of gizzards of the birds on whole millet diets in this study.

Conclusion

The study showed that bye-passing grinding of millet grains in feed mill has a potential of reducing feed input cost, as the cost of grinding will no longer be there. It is also capable of increasing the profit compared with the use of ground maize provided that a digestive enzyme is applied to the whole millet feeds and the whole millet is not included beyond 25% level in diets. Ground millet can also be use as a sole source of energy in quail chick diets at the same level as ground maize without deleterious effects on birds.

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Table 1: Composition of Experimental Quail Diets (2-8wks)

	Levels of millet as % of diet				
Ingredients	0	12.5 (whole millet +EZ)	25.0 (whole millet+ EZ)	37.5 (whole millet + EZ)	50.0 (ground millet)
Maize	0.0	37.5	25.0	12.5	-
Millet	-	12.5	25.0	37.5	50.0
Groundnut	36.0	36.0	36.0	36.0	36.0
Wheat offal	7.5	7.5	7.5	7.5	7.5
Palm oil	2.5	2.5	2.5	2.5	2.5
Bone meal	2.0	2.0	2.0	2.0	2.0
Limestone	1.0	1.0	1.0	1.0	1.0
Common salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
ME (Kcal/kg)	2983	2874	2765	2656	2547
Crude protein (%)	23.06	23.08	23.11	23.13	23.16
Crude fiber (%)	3.19	3.94	4.69	5.44	6.44
Calcium (%)	1.17	1.18	1.19	1.20	1.20
Phosphorus (%)	0.72	0.73	0.73	0.74	0.75
Lysine (%)	1.02	1.04	1.06	1.07	1.09
Methionine (%)	0.53	0.53	0.53	0.53	0.53
Cystine (%)	0.35	0.38	0.42	0.46	0.50
Feed cost (₦/kg)	79.42	78.55	79.17	79.80	81.92

Table 2: Response of Quail Birds to Whole or Ground Millet Grains With or Without Enzyme Inclusion

	Level of enzyme-treated whole millet(%)			Ground Millet(%)			
Parameters	0.0	12.5	25.0	37.5	50.0	SEM	LOS
Initial weight (g/bird)	44.00	44.00	44.00	44.00	44.00	-	NS
Final weight (g/bird)	108.33^{a}	107.67^{ab}	106.33^{ab}	105.33^{b}	107.67^{ab}	1.3	*
Weight gain(g/bird)	64.33^{a}	63.67^{a}	62.33^{ab}	61.33^{b}	63.67^{a}	1.1	*
Feed intake (g/bird)	126.87^{b}	128.61^{b}	137.75^{a}	142.29^{a}	$139..25^{a}$	2.71	*
Feed Efficiency	1.97	2.02	2.21	2.32	2.19	1.1	NS
Age at 1st egg drop (days)	35^{a}	36^{a}	38^{b}	39^{b}	36^{a}	1.3	*
Hen-day egg production(%)	9.33^{a}	7.33^{ab}	6.33^{b}	6.00^{b}	8.00^{ab}	1.5	*
Feed cost/kg wt gain (N)	79.42^{a}	79.55^{a}	79.27^{a}	78.55^{a}	81.92^{b}	1.1	*

*Means followed by the same letter(s) in each column are not significantly different; SEM = Standard Error of Means, LOS = Level of Significance; NS = Not Significant; * = Significantly different and N = Naira*

Table 3. Carcass Characteristics of Quails Fed Whole or Ground Millet Grains With or Without Enzyme Inclusion

Parameters	Maize(%)	Level of enzyme-treated whole millet(%)			Ground millet(%)	SEM	LOS
	0.00	12.50	25.00	37.50	50.00		
Live weight(g)	108.33	107.67	106.33	105.33	107.67	3.6	NS
Carcass weight(g)	78.60[a]	77.53[a]	76.49[ab]	74.06[b]	77.63	1.3	*
Dressing percent	72.13	72.00	71.94	70.31	72.10	2.1	NS
Leg weight(g/100gCW)	19.2	19.35	19.13	17.42	18.80	2.1	NS
Wing weight(g/100gCW)	11.45	11.74	10.87	10.53	11.21	1.3	NS
Heart weight(g/100gCW)	0.89	0.77	0.66	0.68	0.90	1.1	NS
Liver weight(g/100gCW)	1.65	2.06	2.23	3.11	5.41b	1.7	NS
Gizzard weight(g/100gCW)	2.54[a]	2.71[a]	3.14a	3.65[b]	2.70[a]	1.0	*
Back weight(g/100gCW)	29.26[a]	26.32[a]	26.59[a]	25.65[b]	28.98a	3.3	*
Breast weight(g/100gCW)	31.16	30.96	29.21	28.22	29.75	3.1	NS
Intestinal weight(g/100gCW)	3.81[b]	5.93[b]	8.38[a]	9.72[a]	5.41[b]	3.7	*

*Means followed by the same letter(s) in each column are not significantly different; SEM = Standard Error of Means; LOS = Level of Significance; NS = Not Significant; * = Significantly different and CW = Carcass Weight*