PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 8 (2): 112-115, 2009
ISSN 1680-5194

Replacement Value of Normal Maize with Quality Protein Maize (*Obatampa)* in Broiler Diets

P.A. Onimisi[1], J.J. Omage[1], I.I. Dafwang[2] and G.S. Bawa[1]
[1]Department of Animal Science, University of Ahmadu Bello, Samaru Zaria, Nigeria
[2]National Agricultural Extension and Rural Liaison Services (NAERLS),
Ahmadu Bello University, Zaria, Nigeria

Abstract: Three hundred and sixty days old Ross Broiler Chicks were used in a completely randomized design feeding trial to evaluate the benefits of replacing Normal Maize (NM) with Quality Protein Maize (QPM) (*Obatampa* variety*)* in Broiler diets. There were 6 treatments of 3 replicates each and each replicate had 20 chicks. Six diets were formulated in which the NM in diet was replaced by QPM at 0, 25, 50, 75 and 100% representing T1, T2, T3, T4 AND T5, respectively while T6 was normal maize base diet balanced for lysine. The appropriate diets were fed to the birds for 4 weeks in the starter phase and 4 weeks in the finisher phase. At the starter phase, there was gradual numerical increase in weight gain as QPM increased in the diet. T5 was significantly better than T1-T4 but T6 was the overall best performance. Feed consumption was similar for T1-T5 but significantly higher for T6. Feed/gain ratio improved as QPM increased in the diet ($p<0.05$). Dressing % and weights of organs expressed as % of live weight and body parts expressed as % of dressed weight were not different statistically ($p>0.05$).

Key words: Normal maize , quality protein maize, broiler diets

Introduction

Maize has become the world's chief animal feed. It provides more feed than any other grain. It is out standing being high in energy, low in fibre and easily digested by most livestock species. Maize has remained a critical feed ingredient in Monogastric diets particularly poultry. About 70% of maize produced worldwide is utilized in livestock feed. The normal maize varieties are however low in their lysine and tryptophan contents in addition to the low protein level as is common to all cereals (NRC, 1988; FAO, 2004). Thus normal maize like other cereal proteins contains on the average about 2% lysine which is less than one-half of the concentration recommended for human nutrition by food and Agricultural Organization of the United Nations (Prasanna *et al*., 2001; Akande and Lamidi, 2006). The normal maize without supplementation with high protein and high lysine sources in diets will lead to malnutrition in poultry.

The discovery of the Opapue-2 mutant maize in 1964 whose protein content contained about twice the levels of lysine and tryptophan found in normal maize brought a great hope in the effort to improve maize as a feedstuff. Further breeding work led the concept of quality protein maize (CIMMYT-international center for maize and wheat improvement, 2001; Prasanna *et al*., 2001; Vasal, 2006). Limited feeding trials have been conducted all over the world in past 3 decades to evaluate the superiority of QPM as feedstuff over the normal maize. Almost in all cases QPM fed animals performed better than the animal fed normal maize. However, there is paucity of data in Nigeria on the utilization of QPM in livestock diets as the adoption of QPM is rather very low in Nigeria (Akande and Lamidi, 2006). A series of research was therefore embarked upon to evaluate *Obatampa,* a QPM variety developed in Ghana (Okai *et al*., 2005) which is being promoted in Nigeria and its potential as poultry feed. The aim of this work was to evaluate the replacement value of normal maize with *Obatampa* and the impact on growth parameters and carcass characteristics

Materials and Methods

Three hundred and sixty daily old Ross broiler chicks were assigned to six treatment diets in a complete randomization under a deep litter system. Each treatment had 3 replicates with 20 chicks in each replicate. Six diets were formulated. Diet 1 was a standard diet based on Groundnut cake (GNC) and normal maize (NM). In diets 2-5, the normal maize was replaced at 25, 50, 75 and 100% with QPM, respectively. Diet 6 was NM based diet balanced with synthetic lysine. Similarly diets were formulated at the finisher phase to meet the requirements for energy and protein. In each phase, weighed feeds were supplied and water *ad lib* for the entire period of the experiment.

Data collection: Initial and final weight was taken at the beginning and end of each phase. Weight gains and feed consumption were measured weekly. Feed/gain ratios were computed.

Carcass analysis: At the end of the finisher phase, 3 chickens were taken from each treatment, which represented the average weight of the group for carcass evaluation. Live weight for each chicken was taken before slaughter. Dressing percentage, weight of organs and various parts of the body were measured. The organs were expressed as a percent of live weight while the cut parts were expressed as percentage of dressed weight.

Data analysis: All data obtained were subjected to Analysis of variance and test of significance using the Duncan multiple range tests according to the General linear model of SAS (1995).

Results and Discussion

Treatment diets: Table 1 and 2 show the diets fed to the Broiler chicken at the starter and finisher phase, respectively. Diets met standard requirements.

Performance of broiler chicks: Table 3 shows the performance characteristics of the broiler chicks fed the treatment diets for 4 weeks. Final weight and weight gain numerically increased linearly as QPM increased in the diet though not statistically significant until T5 which had 100% QPM. T5 was significantly higher than all other levels of replacement with QPM but lower than T6, the NM diet supplemented with synthetic lysine, which had the best performance.

Table 1: Composition of broiler starter diet

	Treatment					
Ingredient	1	2	3	4	5	6
Maize	54.00	40.50	27.00	13.50	0.00	54.00
QPM	0.00	13.50	27.00	40.50	54.00	0.00
GNC	39.20	39.20	39.20	39.20	39.20	38.95
Wheat offal	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Common salt	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.00	0.00	0.00	0.00	0.00	0.25
Vit-min premix[A]	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 analysis						
ME kcals kg^{-1}	3.025	3.025	3.025	3.025	3.025	3.018
Crude protein (%)	23.280	23.280	23.280	23.280	23.280	23.170
Crude fibre (%)	6.140	6.140	6.140	6.140	6.140	6.110
Ether extract (%)	5.000	5.000	5.000	5.000	5.000	4.990
Calcium (%)	1.000	1.000	1.000	1.000	1.000	1.000
Phosphorus (%)	0.860	0.860	0.860	0.860	0.860	0.860
Lysine (%)	0.870	0.880	0.900	0.910	0.930	1.110
Methionine (%)	0.530	0.530	0.530	0.530	0.530	0.530

Table 2: Composition of broiler finisher diet

	Treatment					
Ingredient	1	2	3	4	5	6
Maize	60.00	45.00	30.00	15.00	0.00	60.00
QPM	0.00	15.00	30.00	45.00	60.00	0.00
GNC	30.15	30.15	30.15	30.15	30.15	30.00
Wheat offal	5.00	5.00	5.00	5.00	5.00	4.90
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00	1.00	1.00
Common salt	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.00	0.00	0.00	0.00	0.00	0.30
Vit-min premix[A]	0.30	0.30	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
ME Kcals kg^{-1}	2.953	2.953	2.953	2.953	2.953	2.948
Crude protein (%)	20.120	20.120	20.120	20.120	20.120	20.030
Crude fibre (%)	5.380	5.380	5.380	5.380	5.380	5.350
Ether extract (%)	4.630	4.630	4.630	4.630	4.630	4.620
Calcium (%)	1.330	1.330	1.330	1.330	1.330	1303.000
Phosphorus (%)	0.840	0.840	0.840	0.840	0.840	0.840
Lysine (%)	0.740	0.750	0.770	0.790	0.800	1.030
Methionine (%)	0.500	0.500	0.500	0.500	0.500	0.500

Table 3: Performance of broiler chicks

	Treatment							
Parameters	1	2	3	4	5	6	SEM	LOS
Initial Wt (g bird^{-1})	44.7	44.7	44.7	44.7	44.3	44.8	0.29	NS
Final Wt (g bird^{-1})	264^{c}	283^{c}	303^{c}	308^{c}	427^{b}	666^{a}	26.89	*
Total Wt Gain (g bird^{-1})	219^{c}	238^{c}	258^{c}	263^{c}	383^{c}	621^{a}	26.94	*
Total Feed Con (g bird^{-1})	696^{b}	737^{b}	707^{b}	777^{b}	808b	1144^{a}	42.15	*
Feed/gain ratio	3.62^{d}	3.14^{cd}	2.66^{bc}	2.63^{c}	2.12	1.85^{a}	0.19	*

SEM: Standard Error of Means;a,b,c : Means with different superscripts on the same row are significantly different ($p<0.05$); LO S: Level of Significance. NS: Non Significant difference ($p>0.05$); *: Significant difference ($p<0.05$)

Table 4: Performance of broiler finishers

	Treatment							
Parameters	1	2	3	4	5	6	SEM	LOS
Initial Wt (g bird^{-1})	413	413	409	407	410	408	2.27	NS
Final Wt (g bird^{-1})	1230^{b}	1227^{b}	1220^{b}	1303^{a}	1363a	1366^{a}	63.95	*
Total Wt Gain (g bird^{-1})	817^{b}	814^{b}	811^{b}	896^{a}	953^{a}	956^{a}	63.71	*
Total Feed Con (g bird^{-1})	2452^{ab}	2315^{bc}	2241^{c}	2312^{bc}	2455^{b}	2522^{a}	55.76	*
Feed/Gain ratio	2.97^{b}	2.79^{ab}	2.91^{ab}	2.81^{ab}	2.62^{a}	2.66^{ab}	0.087	*

SEM: Standard Error of Means; a,b,c : Means with different superscripts on the same row are significantly different ($p<0.05$); LO S: Level of Significance, NS: Non Significant difference ($p>0.05$); *: Significant difference ($p<0.05$)

Feed consumption was however not significantly different from T1-T4. Similar, levels of feed consumed produced a linearly increasing but non-significant weight gains from T1-T4 which became significantly higher at T5.

Higher levels of QPM in the diet increased the lysine contents of the diet (Table 1). Lysine is known to be the first critical and limiting amino acid in maize and chicks performance. Lysine is crucial in protein synthesis for the growth of tissues. It is also found to be important in the absorption of calcium from the intestinal mucosa. Dietary supplementation with lysine can increase intestinal calcium absorption and prevents an increase in calcium excretion in the urine after calcium load. Lysine is also involved in the cross linking process of bone collagen and in the biosynthesis of carnitine and elastin (Civitelli *et al*., 1992; Flodin, 1997). The improvement in the weight gain may therefore primarily be due to increasing level of lysine in the diet as QPM increases.

Additionally, Tryptophan obviously increased in the diets as QPM increases. Tryptophan is both an essential amino acid and the biological precursor of the B-vitamin, niacin. Increase in tryptophan helps prevent pellagra in man. This is also an improvement over the normal maize varieties which are low in available niacin, often leading to the deficiency of this important B-vitamin and bodies deficient in it develop pellagra, characterized by dermatitis, diarrhea and dementia (NRC, 1988). QPM improved growth of chicks than NM as also reported by Jarkin *et al*. (1970).

Feed conversion efficiency of the birds increased with increasing level of QPM in the diet. The 100% QPM diet had the best feed/gain ratio but lower than T6.

Performance of broiler finishers: Table 4 shows the performance of birds at the finisher phase. The final weight and weight gain follow a similar pattern. There were no significant differences between T1-T3 and between T4, T5 and T6. However, T4-T6 were significantly better than all the other treatments. Feed consumption was significantly different for the treatments. T6 consumed more feed than T1, T2, T4 and T5, which were not significantly different. T3 consumed the least feed.

T4 and T5, the 75 and 100% replacement of normal maize with QPM consumed less feed than T6 but gained similar weight. QPM improved the feed for better gains by birds. Similarly, T3 consumed significantly lower amount of feed than T1 and T2 but with non significant differences in weight gains among the 3 treatment. T3 which had 50% replacement of NM with QPM proved to be a better feed than T1 and T2 which had 0 and 25% QPM, respectively. The reasons for these observed improvements in weight gains as QPM increased in the diet is as discussed in the starter phase i.e. lysine increased in the diet as QPM increased in the diet. Tryptophan also increased also leading to more available niacin for the body. The lower ratio of Leucine and Isoleucine observed in QPM may also have contributed to the better performances observed in the birds fed higher levels of QPM. QPM had less Leucine and Isoleucine than normal maize, which reduces the preponderance of Leucine. The higher levels of Leucine and Isoleucine in normal maize are known to interfere with proteins synthesis. Researchers also believe that the lower ratio of these amino acids boosts the production of niacin thereby also helping to overcome pellagra (NRC, 1988; Bai, 2002).

Table 5: Results of digestibility study

	Treatment							
Parameters	1	2	3	4	5	6	SEM	LOS
Dressing (%)	71.6	71.1	70.8	70.3	69.2	68.6	1.17	NS
Tie (% of Dressed wt)	22.2	20.9	21.9	20.9	22.9	21.5	0.94	NS
Breast (% of Dressed wt)	14.8	15.4	14.2	17.2	14.1	15.3	1.06	NS
Back (% of Dressed wt)	14.0	13.8	14.0	14.2	13.7	16.0	0.91	NS
Liver (% of Live wt)	2.17	1.97	2.17	1.93	2.00	2.33	0.16	NS
Lungs (% of Live wt)	0.74	0.73	0.56	0.54	0.82	0.64	0.08	NS
Kidney (% of Live wt)	0.54	0.48	0.64	0.45	0.51	0.62	0.06	NS

SEM: Standard Error of Means; LOS: Level of Significance; NS: Non Significant difference (p>0.05)

Higher levels of QPM improved feed/gain ratio though not in such a definite pattern as observed in the starter phase.

Carcass analysis: Table 5 shows the result of the carcass study. All the parameters measured were not significantly for all the treatments. The feeding of QPM did not stimulate the development of these organs and the sections of the body beyond that of NM.

Conclusion: Quality protein maize in poultry diet improves growth performance of broilers. Generally, feed formulated with *Obatampa* resulted into higher weight gains than NM. QPM did not result into significant changes on carcass and organ development of broilers.

References

Akande, S.R. and G.O. Lamidi, 2006. Performance of Quality Protein Maize Varieties and Disease Reaction in the Derived Savanna Agro-Ecology of South-West Nigeria. Afr. J. Biotechnol., 5: 1744-1748.

Bai, X., 2002. Nutritional Evaluation and Utilisation of Quality Protein Maize Zhong Dan 9409 in Broiler Feed. M.Sc thesis. Chinese Academy of Agricultural Sciences, Beijing 1000081, P.R China.

CIMMYT, 2001. International Center for Maize and Wheat Development, Final Progress Report: The Improvement and Promotion of Quality Protein Maize in Selected Developing Countries, Mexico City, Mexico.

Civitelli, R., D.T. Villareal, D. Agnusdei, P. Nardi, L.V. Avioli and C. Gennari, 1992. Dietary L-Lysine and Calcium Metabolism in Humans. Nutr., 8: 400-405.

FAO, 2004. Protein Sources For the Animal Feeds Industry. FAO Expert Consultation Workshop Report, F.A.D. Rome.

Flodin, N., 1997. The Metabolic Roles, Pharmacology and Toxicology of Lysine. J. Anim. Coll. Nutr., 16: 7-21.

Jarkin, R., C. Albertazzi and R. Bressani, 1970. Value of Opaque-2 Corn for Chicks. J. Agric. Food Chem., 18: 268.

NRC, 1988. Quality Protein Maize. National Academy Press, Washington D.C. USA., pp: 41-54.

Okai, D.B., S.A. Osei W.L. Haag and B.D. Dzah, 2005. The Role of QPM in Pig Nutrition and Production. Paper Presented at the Sasakawa Global 2000. Training Workshop on QPM Development and Seed Delivery System, Kumasi, Ghana.

Prasanna, B.M., S.K. Vasal, B. Kassahun and N.N. Sign, 2001. Quality Protein maize Current Sci., 81: 1308-1319.

S.A.S., 1995. Statistical Analysis System Institute, User's Guide. 6th Edn. North Carolina, U.S.A.

Vasal, S.K., 2006. Quality protein maize story. Food and Nutr. Bull., 21: 445-450.