THE FEEDING AND ECONOMIC VALUE OF MAIZE COB MEAL FOR BROILER CHICKENS

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Summary

The feeding value of maize cob meal was investigated in a trial involving one hundred and forty Arbor Acre day-old chicks raised to eight weeks of age. The maize cob meal which contained 32.5% fibre, 2.5% protein and had a gross energy value of 2,550 kcal/kg, was incorporated into the experimental diets at either 0, 2.9, 5.8, 11.6 or 23.2% level. All diets were formulated to contain 3,200 kcal/kg of metabolisable energy and approximately 22% protein by varying the proportions of maize and whole cooked soyabean meal in the diets. The inclusion of maize cob meal up to 11.6% in the diet did not significantly ($p > 0.05$) affect body weight gains, feed consumption and utilization, as well as carcass yield and dressing percentage. However, at the 23.2% level of maize cob meal inclusion, body weight gains, feed utilization and carcass yields were significantly ($p < 0.05$) reduced. The use of maize cob meal reduced feed cost for raising birds and either maintained or improved gross profit returns with up to 11.6% level of inclusion in the diet. It was concluded that maize cob meal can be included up to 11.6% in the diet of broiler chickens provided dietary energy concentration is maintained at 3,200 kcal of metabolisable energy per kilogramme of feed by using high energy density feed ingredient such as boiled whole seed soyabean meal.
(**Key Words**: Maize Cob Meal, Broiler Chickens, Nutritional, Economic Performance)

Introduction

In most of East, Central and Southern Africa, maize (*Zea mays* L.) seed together with its milling by-products such as maize bran, maize germ and No. 3 maize meal, form the major portion of pig and poultry diets (Ochetim and Nicholson, 1978). Unfortunately, the production of maize in the region is often inadequate to even satisfy the requirements for human consumption. Consequently, the quantities of pig and poultry feeds available in the region have been limited. This inadequate production of feeds remains as one of the major factors limiting the development and expansion of pig and poultry farming, especially in the rural areas of the region. However, increased feed production could be realised if more maize by-products could be utilized. A cheap and abundant supply of maize cob, the maize harvest by-produce obtained following shelling, is available in the region and especially in the rural areas.

A major use of maize cob to date has been as a source of fuel energy for cooking. It's use as a feed has been restricted to ruminants because of its high fibre content. However, in some situations, for example, where there may exist readily available high energy feed ingredients, it may be possible to replace part of the maize used in practical type broiler diet with maize cob. In most of the rural areas of the region, there is a fair amount of cultivation of oilseed crops such as soyabeans, groundnuts, sesame, sunflower etc. It is therefore possible that advantage could be taken of the availability of these high energy oilseed crops together with the abundant supply of maize cobs in the rural areas in the formulation of poultry diets while minimising the use of maize seeds. This experiment was designed to test the nutritional and economic effects of partial replacement of maize in the diet with graded levels of maize cob meal on the performance of broiler chickens.

Materials and Methods

Ingredients

Maize cobs, maize and soyabean seeds used were obtained from the University of Zambia

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Received September 7, 1992
Accepted May 8, 1993

Farm, Liempi. Soyabean seeds were boiled in water in a drum for 15 minutes to destroy trypsin inhibitors (Ochetim and Bogere, 1979). The seeds were then sun-dried. Local dried fish, Kapenta, was used for making fish meal. These ingredients were ground to pass through 2-mm sieve in readiness for use in the making of the various diets. The rest of the other materials were purchased from National Milling Comparny Ltd., Lusaka.

Test Diets

Five experimental diets were formulated (table 1). The diets were formulated to contain 3,200 kcal/kg of metabolisable energy and to contain approximately 22% protein. Maize cob meal, which was assumed to have metabolisable value of 850 kcal/kg, was included at either 0, 2.9, 5.8, 11.6 or 23.2% level in the experimental diets. Since maize cob meal is low in energy and protein (NRC-NAS, 1977), the level of whole cooked ground soyabean meal was variedly increased in the diets as more cob meal substituted for maize. The fish meal, Kapenta, was used primarily to off-set the inherent methionine deficiency in maize - soyabean meal - based diets (Ochetim et al., 1984).

TABLE 1. COMPOSITION OF EXPERIMENTAL DIETS

	Diets				
	Level of maize cob meal in diet (%)				
	0	2.9	5.8	11.6	23.2
Ingredients (%)					
Maize	58	49	45	37.3	19.2
Maize cob meal	0	2.9	5.8	11.6	23.2
Cooked soyabean meal	20.2	26.3	27.4	29.3	35.8
Sunflower meal	15	15	15	15	15
Fish meal, kapenta	4	4	4	4	4
Limestone flour	1.2	1.2	1.2	1.2	1.2
Dicalcium phosphate	1	1	1	1	1
Salt	0.3	0.3	0.3	0.3	0.3
Trace mineral-vitamin premix*	0.3	0.3	0.3	0.3	0.3
Chemical composition, calculated					
Metabolisable energy (kcal/kg)	3,200	3,200	3,200	3,200	3,200
Protein (N × 6.25) (%)	22.2	22.2	22.2	22.2	22.2
Lysine (%)	1.2	1.2	1.2	1.2	1.2
Methionine + Cystine (%)	0.8	0.8	0.8	0.8	0.8
Calcium (%)	1.1	1.1	1.1	1.1	1.1
Phosphorus (%)	0.8	0.8	0.8	0.8	0.8

* Supplied per kilogramme of diet: 6,600 IU vitamin A, 2,200 IU vitamin D, 6.6 IU Vitamin E, 3.3 mg menadione, 5.5 mg riboflavin, 33 mg niacin, 8.8 mg panthothenic acid, 495 mg choline, 1.1 mg thiamin, 1.1 mg pyridoxine, .0099 mg vitamin B_{12}, .11 mg biotin, .66 mg folacin, 1 mg selenium, 62.5 mg ethoxyquin, 80 mg iron, 50 mg manganese, 25 mg zinc, 100 mg copper, 1 mg iodine.

Animals

One hundred and forth, one day-old Arbor Acre chicks used were purchased from Hybrid Poultry Hatchery, Chamba Valley, Lusaka. The chicks were randomly divided into twenty groups, with each group consisting of seven birds. Four such groups were randomly assigned to each of the five dietary treatments. The seven birds in each group were confined to a pen measuring 1 × 1.5 m.

The pens were heated with infrared lamps during the first two weeks of the feeding period. Feed and water were available to the birds at all times. Birds were weighed at the beginning of the experiment and thereafter once every week. Data on feed consumption were recorded weekly.

At the end of the feeding trial, four birds were randomly chosen from each group and slaughtered for the determination of carcass yields and dressing percentages.

Chemical and Statistical Analyses

The feed ingredients and the formulated diets were analysed for gross energy using an oxygen Parr bomb calorimeter and for proximate principles (AOAC, 1980). Data on body weight gains, feed consumption and utilization, carcass yields and dressing percentages were analysed according to the analysis of variance and significant differences were determined at the 5% level of probability (Steel and Torrie, 1980).

Results and Discussion

The maize cob meal used contained 32.5% fibre, 2.5% protein and had a gross energy value of 2,550 kcal/kg. These values are typical to those reported in the literature and indicate maize cob meal to be high in fibre but low in protein and energy (NRS-NAS, 1977). The relatively high level of fibre is responsible for the low energy content of maize cob meal.

Data on feed consumption, body weight gain, feed utilization, carcass weights and dressing percentages are indicated in table 2. There were no significant ($p > 0.05$) differences in feed consumption between the different groups. Average feed consumption figures at 0, 2.9, 5.8, 11.6 and 23.2% levels of maize cob meal in the diets were 4.25, 4.28, 4.30, 4.37 and 4.38 kg, respectively. Body weight gains did not differ ($p > 0.05$) with up to 11.6% level of maize cob meal inclusion in the diet. The 23.2% level of maize cob meal use, however, significantly ($p < 0.05$) reduced body weight gain.

TABLE 2. PERFORMANCE OF EXPERIMENTAL BIRDS

	Diets					
	Level of maize cob meal in diet (%)					SEM*
	0	2.9	5.8	11.6	23.2	
No. of chickens	28	28	28	28	28	
Av. body weight gain to 8 weeks (kg)	1.95[a]**	1.95[a]	1.91[a]	1.87[a]	1.59[b]	0.09
Av. feed intake per bird (kg)	4.25[a]	4.28[a]	4.30[a]	4.37[a]	4.38[a]	0.21
Feed conversion ratio	2.18[a]	2.22[a]	2.25[a]	2.33[a]	2.76[b]	0.11
Av. dressed carcass weight (kg)	1.48[a]	1.48[a]	1.45[a]	1.43[a]	1.21[b]	0.10
Dressing percentage	74.8[a]	74.8[a]	74.8[a]	75.2[a]	72.2[a]	3.15

* SEM: Standard error of treatment means.

** Treatment means in each row followed by similar letters are not significantly ($p > 0.05$) different.

Feed conversion ratios at 0, 2.9, 5.8, 11.6 and 23.2% levels of inclusion of maize cob meal were 2.18, 2.22, 2.25, 2.33 and 2.76, respectively. Except at the highest level of maize cob meal inclusion in the diet, feed conversion ratios did not differ ($p > 0.05$) between the diets. Data on dressed carcass weights indicated no significant ($p > 0.05$) differences with up to 11.6% inclusion of maize cob meal. The dressed carcass weights obtained from birds fed maize cob meal at 0, 2.9, 5.8, 11.6 and 23.2% levels were 1.48, 1.45, 1.43 and 1.22 kg, respectively. There were no differences ($p > 0.05$) in the dressing percentages between the dietary treatments.

All diets were formulated to be isonitrogenous and to contain similar levels of metabolisable energy. Thus, since feed intake is largely controlled by the energy density of the diet, (NRC-NAS, 1977), as expected, there were no significant differences in feed consumption between the dietary treatments. The depression ($p < 0.05$) in body weight gain at the 23.2% level of maize cob meal used paralleled the reduction in feed utilization at that level. This suggests that, even if the diets are kept isocaloric and isonitrogenous, the use of maize cob meal at 23.3% adversely affects growth performance and feed utilization. These adverse effects appear to be associated with increased fibre intake and nutrient density on such high maize cob meal diet. Crude fibre

analysis of the diets indicated a progressive increase in the level of fibre in the diets, viz 4.1, 4.3, 5.1, 6.0 and 9.5% at the 0, 2.9, 5.8, 11.6 and 23.2% levels of maize meal cob, respectively. Since feed intake did not differ ($p > 0.05$) between the dietary treatments, the increasing level of maize cob meal in the diet must have resulted in increased dietary fibre intake with the resultant depression in growth performance and feed utilization noted at the 23.2% level on maize cob meal used. In order to obtain satisfactory growth performance and good feed efficiency, dietary fibre level in broiler feeds should not exceed 5% (NRC-NAS, 1977). Fibre levels higher than 5% reduce growth rate and feed efficiency. The 23.3 % level of maize cob meal used, resulted in a diet with a very high fibre content, 9.5%, and this must have accounted for, at least in part to, the poor performance noted. Similarly, but to a very slight extent, the slight but insignificant ($p > 0.05$) reduction in final body weight and feed efficiency observed at the 11.6% level of maize cob meal could be attributed to its slightly higher, 6%, than accepted level of fibre, 5%, in broiler feeds. It is also possible that the poor performance of birds at the highest level of maize cob meal inclusion could have been due to the effects of reduced nutrient density.

Carcass data obtained indicated that, although there were no differences ($p > 0.05$) in dressing percentage between the dietary groups, carcass yield differed ($p < 0.05$) in a manner similar to that noted on body weight gains. This indicates that the level of maize cob meal had no effect on dressing percentage and therefore the differences observed in carcass weights must have been due to differences in final body weights at slaughter time. Dressing percentage is a percent expression of carcass weight as a function of live weight at slaughter time.

An attempt was made to evaluate the economics of using these diets (table 3). There were marginal reductions in feed costs measured either as cost per kilogramme of feed or total feed cost used in raising birds to eight weeks of age. The gross profit income realised less costs of day old chicks and feeds indicated no differences in returns between 0, 2.9 and 11.6% levels of maize cob meal in the diet. The return at these levels of maize cob meal inclusion was ZK 0.94 per bird. However, there was a slightly higher level of return of ZK 0.98 at the 5.8% level of maize cob meal inclusion in the diet. At the highest level of maize cob meal inclusion of 23.2 %, the level of return per bird was the lowest, being only ZK 0.42.

TABLE 3. ECONOMIC EVALUATION OF BROILER PERFORMANCE

	Diets				
	Level of maize cob meal in diet (%)				
	0	2.9	5.8	11.6	23.2
Feed cost per kg (ZK)*	0.52	0.51	0.49	0.48	0.47
Feed cost per bird to slaughter (ZK)	2.21	2.18	2.10	2.09	2.06
Cost of day-old chick (ZK)	0.55	0.55	0.55	0.55	0.55
Total cost of feeds plus day-old chick (ZK)	2.76	2.73	2.65	2.64	2.61
Av. dressed carcass weight (kg)	1.48	1.48	1.45	1.43	1.21
Carcass value at ZK 2.50 per kg (ZK)	3.70	3.70	3.63	3.58	3.03
Return per bird at slaughter less feed and day-old costs (ZK)	0.94	0.94	0.98	0.94	0.42

* Zambian currency called Zambian Kwacha. At the time of trial, 1 ZK was equivalent to US$ 0.40.

Conclusion

It is concluded that maize cob meal can be included up to 11.6% level in the diet of broiler chickens when the dietary energy concentration is maintained at 3,200 kcal/kg of feed by using high energy density feed ingredient such as boiled soyabean seed meal. This level of maize cob meal leads to approximately 36.7% reduction in the level of maize inclusion in the diet and results

in marginal reductions in feed cost and cost of raising chickens to slaughter weight.

Acknowledgements

Thanks are due to Mr F. Sinyangwe for the feeding and care of experimental chicks. The project was financially supported by the University of Zambia Research Funds.

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