USING LOCAL FEED MATERIALS FOR FEEDING EGG PRODUCING BIRDS IN THE KINGDOM OF TONGA

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Summary

A trial involving 200 day-old 288 Shaver chicks in a randomised experimental design tested the effects of using diets based on local feed materials (LF). Commercial imported counterpart feeds (CF) served as control diets. Birds were raised from 0-6 w on Chick Starter feed, from 7-17 w on Pullet Developer feed and from 18 to 72 w on Layer feed. The results obtained indicated that there were no significant differences in the performance of birds fed LF and CF diets during the Chick Starter and Pullet Developer phases. During the Laying phase, there were also no differences in laying percentage, (66 vs 65) and in egg size (62 vs 63 g) between LF and CF diets. However, birds fed on LF diet had a better egg yolk colour score, (4 vs 1) than those fed on CF diet. Feed cost was lower on LF than CF diets and the feed cost for producing eggs was approximately 50 percent lower on LF compared to CF (P$ 0.06 vs P$ 0.12). It was concluded that the use of locally available feed resources produces comparable performance to that obtained using commercial imported feeds. Secondly, using local materials markedly reduces feed cost and cost of producing eggs.
(**Key Words** : Local Feed Materials, Kingdom of Tonga, Performance of Egg Producing Birds)

Introduction

Like other governments in the South Pacific region, the government of the Kingdom of Tonga is concerned about attaining self-sufficiency in egg production to meet domestic demand. To this end, commercial layer farming is being actively encouraged. Through Tongan Development Bank, credit facilities are available for people who are interested in poultry farming to help them to either set up or expand their operations. Indeed, many farmers have taken advantage of the existing credit facilities and there are now a number of both small and large scale layer farmers in the Kingdon. Unfortunately, the biggest obstacle facing these farmers is the high cost of feeds (Sione, 1989).

There are three feedmills in the Kingdom of Tonga. At the moment, however, none of them is in operation. When they were functioning, they relied very heavily on imported feed ingredients. These ingredients were then blended together to produce the so-called 'local feeds'. These feeds were very expensive. In the absence of any functioning feedmill in the country at present, all layer farmers are relying on imported commercial feeds. These feeds are very expensive. In view of the current high cost of imported feeds, there is now keen interest in developing locally available feed ingredients for use in the feeding of table egg producing birds. This experiment was therefore designed to test the nutritional and economic effects of using locally available feed ingredients in the feeding of table egg producing birds in the Kingdom of Tonga.

Materials and Methods

Ingredients and Diets

With the assistance of staff in the Livestock Division of the Department of Agriculture in the Kingdom of Tonga, potentially useful feed resources for use in feed production were identified. These ingredients were yellow maize, cassava, coconut meal and coral sand. In addition, the other imported feed ingredients namely, meat and bone meal, table salt and trace mineral and vitamin premix were obtained locally from commercial sources.

The locally produced and imported feed ingredients were analysed for their chemical

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composition according to standard procedures (AOAC, 1980). Based on the nutrient contents of the feed ingredients as well as their prices, least cost nutritionally adequate diets were formulated. These diets were referred to as locally based diets (LF) (table 1). There were three such diets, namely Chick Starter feed (CSL), Pullet Developer feed (PDL) and Layer feed (LFL). Imported counterpart feeds (CF) viz: Chick Starter (CSI), Pullet Developer (PDI) and Layer feed (LFI) served as control diets.

Birds and Management

A total of 200 day-old 288 Shaver chicks were used in a randomised experiment consisting of two dietary treatment groups replicated four times. The 200 day-old chicks were randomly divided into eight groups with each group consisting of 25 birds. Four such groups were allocated to the CSL diet and the other four groups to the CSI diet. At seven weeks of age the birds were changed over to their respective Pullet Developer feeds, (PDL and PDI). From 18 to 72 weeks of age, birds were raised on their respective Layer feeds (LFL and LFI). Birds were raised on deep litter floor system with water and feed available at all times. The rooms were maintained under natural day-length throughout the experimental period. During the laying phase, laying nests were provided at the rate of one nest per four birds.

Data were collected on mortality, growth performance, feed intake and feed efficiency during the Chick Starter and Pullet Developer phases. In addition, during the laying phase, data were collected on egg production and egg quality. Egg quality was assessed in terms of egg weight, incidence of cracked shells and egg yolk colour as determined by a score scale ranging from 1 to 5; with 1 rated as very pale yellow, 2 as pale yellow, 3 as yellow, 4 as deep yellow and 5 as dark deep yellow.

During both rearing and egg production phases data were obtained on cost of feeds as well as cost of feed used in producing eggs.

Statistical Analysis

Data obtained on the nutritional performance of birds were analysed as a completely randomised

TABLE 1. COMPOSITION AND PRICES OF LOCALLY FORMULATED CHICK STARTER, PULLET DEVELOPER AND LAYER FEEDS

	Diets		
	Chick starter	Pullet developer	Layer feed
Ingredients (%)			
Maize	24.0	12.0	12.0
Cassava	23.5	35.5	36.0
Coconut meal	24.0	28.0	24.0
Meat and bone meal	28.0	24.0	24.0
Coral sand	0.0	0.0	3.5
Salt	0.3	0.3	0.3
*Mineral-vitamin premix**	0.2	0.2	0.2
Chemical composition			
Dry matter (%)	90.0(90.0)**	90.0(90.1)	89.9(90.0)
Protein (N × 6.25) (%)	21.5(20.9)	18.0(16.2)	17.9(17.8)
Fat (%)	4.1(4.2)	3.8(3.7)	3.7(3.6)
Fibre (%)	5.1(4.9)	5.8(5.2)	5.6(5.4)
Calcium (%)	1.7(1.2)	1.5(0.8)	3.5(3.2)
Phosphorus (%)	0.8(0.8)	0.7(0.6)	0.7(0.6)
Metabolisable energy calculated (kcal/kg)	3,150(3,120)	3,000(2,900)	2,900(2,900)
Feed cost (P$ per kg)***	3.35(0.80)	0.35(0.80)	0.32(0.73)

* This was a commercial imported premix.

** Values in parenthesis are for imported counterpart feeds.

*** P$. Currency of Kingdom of Tonga called Tonga Panga. At time of trial 1 P$ = 0.75 U$.

experimental design with differences reported at the 5 percent level of probability (Steel and Torrie, 1980). Economic analysis was assessed by comparing percentage changes in the costs of feeds from using LF over CF diets in feeding birds and in egg production.

Results and Discussion

Data on chemical composition of local feed resources used in the formulations of the experimental diets have earlier been reported upon (Ochetim, 1988).

The chemical composition of the experimental diets are shown in table 1. Although there were slight differences in the nutrient contents between the diets formulated using local feed materials and imported commercial feeds, all the diets satisfied the nutrient requirements for the different groups of birds (NRC-NAS, 1984).

Data on the performance of birds during the Chick Starter, Pullet Developer and Laying periods are indicated in table 2. Mortality levels were lower ($p < 0.05$) on CSI during the starter period but did not differ ($p > 0.05$) between the diets during the pullet rearing phase. Mortality rates during the chick rearing phase were 7.2 and 4.3 % on CSL and CSI, respectively. Corresponding values during pullet developer phase were 2.4 and 2.5%, on PDL and PDI, respectively. The higher mortality level on CSI diet during starter period appeared to be due to lack of coccidiostat in the feed. Most of the death was due to coccidiosis.

TABLE 2. PERFORMANCE OF BIRDS DURING EXPERIMENTAL PERIOD

Phase	Diets		SEM*
	Local feed (LF)	Imported feed (CF)	
Chick Starter (0-6 w)			
Average initial chick weight (gm)	45	45	1.2
Average chick weight at 6 w (gm)	640	650	8.9
Average daily feed intake (gm)	45	46	0.3
Feed to gain ratio	1.9	1.9	0.1
Mortality rate (%)	7.2	4.3	0.9
Pullet Developer Phase (7-17 w)			
Average pullet weight at 17 w (kg)	1.3	1.4	0.1
Average daily feed (gm)	90	90	3.2
Feed to gain ratio	2.6	2.7	0.2
Mortality rate (%)	2.4	2.5	0.2
Laying Phase (18-72 w)			
Average daily feed intake (gm)	142	140	3.1
Average hen house egg production (%)	66	65	2.5
Feed intake per egg production (gm)	172	168	3.9
Average egg weight (gm)	62	63	1.9
Cracked egg incidence (%)	0.7	1.2	0.4
Egg yolk colour rating**	4	1	0.1

* Standard error of dietary treatment means.

** Egg yolk colour rating based on score of 1 to 5 as indicated in text.

There were no significant differences in the growth performance, feed intake and feed efficiency by birds on the two dietary treatments during both chick starter and pullet developer phases. Body weights at six weeks of age were 640 and 650 gm on CSL and CSI diets, respectively. Average daily feed intakes on the CSL and CSI diets during this period were 45 and 46 gm, with respective feed conversion ratios of 1.9 and 1.9. During the pullet developer phase,

average daily feed intakes on PDL and PDI were 90 and 90 gm, respectively. At 17 weeks of age, average weights of birds were 1.3 and 1.4 kg on PDL and PDI diets, and the respectively feed conversion ratios during this phase were 2.6 and 2.7. This similarity in performance reflects the similarities in the levels of nutrients in the LF and CF diets (table 1).

Performance of birds during the egg laying phase from 18 to 72 weeks of age indicated no significant differences in average daily feed intake between the dietary treatments. There were also no significant differences in average hen house egg production. Hen house egg production values were 66 and 65 percent, on LFL and LFI, respectively. The incidence of cracked shells was lower ($p < 0.05$) on LFL than LFI diet; being 0.7 and 1.2 percent, respectively. Egg weights were slightly lighter but not significantly so on LFL compared to LFI. Average egg weights were 62 and 63 gm, respectively. However, yolks from birds fed LFL were much more deeply yellow pigmented unlike those from LFI which appeared very pale yellow in colour. These differences were reflected in the egg yolk score, which was ranked as 4 on LFL and 1 on LFI.

The differences in the incidence of cracked eggs on the two diets appeared to reflect differences in calcium levels of the diets. The LF contained a higher (3.5 vs 3.2%) calcium than CF diet. It has been suggested that layer feed in hot humid tropics should contain a slightly higher level of calcium than used in the temperate parts of the world (NAS-NRC, 1984). The imported feeds came from New Zealand, a temperate country.

The much more deeply yellow appearing yolks observed on LF eggs must have been due to the level of pigmentors in the ingredients used, especially yellow maize. However, it is difficult to make a comparison on the cause for the differences since the composition of the commercial feeds are unknown and no analysis could be carried out to determine the level of xanthophylls in the diets.

Economic analysis revealed that using local available feed resources reduced feed cost and cost of feeding birds (table 3). The locally produced CSL, PDL and CFL were much cheaper than their imported counterpart feeds. Similarly, cost of feeding birds during the chick starter, pullet developer and layer phases were much lower on locally made feeds than on the imported feeds. Of greater significance and interest were the reduction by nearly 45 percent in the cost of producing an egg using LFL compared to LFI. The feed cost of producing an egg was lowered from P$ 0.12 on LFI to P$ 0.06 on LFL. The labour input cost in local feed production was costed in this analysis. This is very important in order to derive the true economic worthiness of using locally produced feed resources. However,

TABLE 3. ECONOMIC EVALUATION OF THE PERFORMANCE OF BIRDS FED LOCALLY BASED FEEDS AND IMPORTED FEEDS

Feed cost*	Diets		% Change**
	Local feed (LF)	Imported feed (CF)	
Chick starter feed, cost per kg (P$)	0.400	0.800	50
Pullet developer feed, cost per kg (P$)	0.360	0.700	49
Layer feed, cost per kg (P$)	0.360	0.730	51
Average daily feed cost per bird during chick starter phase (P$)	0.022	0.040	50
Average daily feed cost per bird during pullet developer phase (P$)	0.033	0.070	52
Average daily feed cost during laying phase (P$)	0.055	0.100	45
Feed cost per egg production (P$)	0.066	0.120	45

* Cost of ingredients, processing and labour.

** Percent reduction in cost from using LF over CF feed.

other factors such as the reliability of the supplies of local feed resources also need to be assessed.

The results of this trial indicated that there are available in the Kingdom of Tonga local feed resources which can be used in the formulation of nutritionally balanced rations for table egg producing birds. Diets based on such feeds produced similar growth performance in birds compared to that obtained on imported feeds. In addition, the use of such locally produced feeds improved the quality of eggs both in terms of shell strength and yolk colour. Most important, however, was the fact that using local feed materials reduced feed cost and cost of producing eggs.

The biggest problem facing Tongan table egg producers at the moment is the high cost of imported feeds (Hakohako, 1988). Consumers are concerned not only over the high price of eggs but also on the poor egg quality especially the very pale nature of the yolk produced on imported feeds (Sione, 1989). The results of this trial have provided solutions to these current producer and consumer concerns of the Tongan poultry egg industry. However, what will be required is to translate these findings into practical realities. This will call for a need to develop well planned and co ordinated policies which encourage the production, processing and utilization of local feed resources in feed production. If this could be achieved, the local feed resources would play an important role in the feed production programm for table egg birds in the Kingdom of Tonga and with real possibility that some of the feedmills which have closed down could begin to function once again.

Conclusions

The results of this trial indicated that there are available in the Kingdom of Tonga local feed resources which can be used in combination with some imported feed materials to produce nutritionally adequately diets. Such diets produce similar performance to that obtained on imported feeds in table egg producing birds. Using local feed materials markedly reduced the cost of feeds and cost of egg production, in addition to improving egg quality.

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