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Influence of Dietary Fermented Corn-Cob on the Performance of Broilers

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Abstract: Two experiments were designed to investigate the effect of fermentation of corncob on the performance and nutrient retention of broilers. In Trial 1, day-old broiler chicks were fed either a maize-based control diet or diets containing unfermented Corncob (CC), CC fermented for 5, 10, 15 and 20 days. CC was used to quantitatively replace maize at 10% of total diet. The diets were fed during a 5-week period. In Trial 2, five-week old broilers were fed finisher rations containing corncobs fermented for 0, 5, 10, 15 and 20 days in replacement for maize over a 4-week period. Inclusion of corncob irrespective of duration of fermentation did not affect feed intake ($p>0.05$) at both the starter and finisher stages. Weight gain, feed: Gain ratio and protein efficiency ratio were however significantly influenced by duration of fermentation ($p<0.05$). The longer the duration of fermentation, the better the performance of the birds on such diets. Nutrients' retention was also significantly influenced by duration of fermentation of corncob ($p<0.05$). Birds on unfermented corncob had the least retention of dry matter, crude protein and ether extract in both trials. At 10% level of inclusion of total diet, CC fermented for 20 days gave results similar to the control diet.

Key words: By-product, broiler production, conventional feed stuff alternative, dietary fermented, performance of broilers

INTRODUCTION

The most important factors militating against increased commercial poultry in developing countries are high cost and scarcity of feed (Atteh *et al*., 1995). The high cost of feed is due to the competition between man and livestock for grains. Grains, especially maize constitute about 50-65% of compounded poultry feed. Research efforts are presently looking into alternatives to cereal grains that will be cheap and readily available. One of such alternative is corncob, a waste product of maize grain shelling. The militating problem affecting the utilization of corncob in chicken diet is the high fibre content. The use of fermentation procedures to improve the nutritive value utilization of fibrous feeds types as well as the generation of high protein by fermentation has been reported (Cantner, 1995; Rajagopal, 1977).

Corncob is currently being thrown away after processing maize and in order to stop this trend, it is better to incorporate this by-product in monogastric animals' diets. Also, the demand for maize grain by both human and animals is at an increase. Hence, utilization of this by-product will reduce the attendant competition between man and animals especially monogastric animals. It is against this backdrop that the aim of the experiment was directed, that is, to investigate the effect of dietary replacement of maize grain by fermented corncob on the performance of broilers under tropical environment.

MATERIALS AND METHODS

Dry corncob, collected during the dry season were milled through a screen size of 3.5mm in an hammer mill. The milled corncob was mixed with water to form slurry. The slurry was placed in plastic buckets and sealed to ensure air-tight system for 0, 5, 10, 15 and 20 days, after which it was removed and sun dried, bagged, ready for use. Two trails were carried out.

Trial 1: Effect of dietary corncob fermented for different duration for starters: Unsexed "Ross 38" broilers (!44), day old were used for this experiment. The birds were randomly allotted to 6 dietary treatments (Table 1) on weight equalization.

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Table 1: Gross composition of broiler starter/finisher diets (%)

	Dietary treatments (starter)						Dietary treatments (finisher)					
	1	2	3	4	5	6	1	2	3	4	5	6
Maize	50.00	40.00	40.00	40.00	40.00	40.00	55.00	45.00	45.00	45.00	45.00	45.00
Corn-cob	-	10.00	10.00	10.00	10.00	10.00	-	10.00	10.00	10.00	10.00	10.00
Fixed	50.00	50.00	50.00	50.00	50.00	50.00	45.00	45.00	45.00	45.00	45.00	45.00

*Starter 16.00% full fat soybean; 15.00% Groundnut cake; 10.00% Biscuit waste; 5.00% Blood meal; 2.00% Fishmeal; 1.00% Bone meal; 0.5% Oyster shell; 0.25% Salt; 0.25% Premix, *Finisher 11.00% Full fat soybean; 12.00% Groundnut cake; 14.00% Biscuit waste; 6.00% Blood meal; 1.5% Bone meal; 0.25% Salt; 0.25% Premix

basis. Each treatment was replicated 4 times with 6 birds each. Diet 1 was the maize based control while diets 2, 3, 4, 5 and 6 were the test diets in which 0, 5, 10, 15 and 20 days fermented corncob quantitavely replaced maize at 10% of the total diet. The diets were fed *ad lib* for 35 days during which time feed intake and weight gain were recorded.

A nutrient retention study was conducted when the chicks were 4 weeks old. Weighed quantities of feed were supplied and excreta collected over 72 h using the collection method. Excreta samples were oven-dried at 70°C prior to grinding and chemical analysis.

Trial 2: Effect of dietary corn-cob fermented for different duration on finishers: One hundred and eight growing broilers of five weeks of age (previously raised on a commercial starter mash) were randomly allocated to six broiler finisher diets shown in Table 1. Thus, there were 18 finishing broilers per dietary treatment, each of which is made up of 6 replicates of 3 birds per replicate. Diets and water were supplied *ad lib* during the 28 days experimental period.

A nutrient retention study similar to that in Trial 1 was undertaken when the birds were 8 weeks old. Excreta samples were treated as described for Trial 1.

Chemical statistical analysis: Fermented cobs, feed and excreta samples were subjected to proximate analysis using the method of AOAC (1995). Nitrogen was determined by the Kjedahl procedure while fat was determined by petroleum ether (bp. 60-80^{0}C) extraction using a soxhlet apparatus. Data collected were subjected to analysis of variance using the model for completing randomized design, significant treatment means were partitioned using the Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The percentage chemical composition of fermented corncob, unfermented corncob and experimental diets are shown in Table 2 and 3

The effect of dietary inclusion of fermented corn-cob on the performance of starter broiler (Trial 1) and the corresponding performance of finisher broilers (Trial 2) on similar diets are shown in Table 4. Feed intake, irrespective of duration of corn-cob fermentation was not significantly ($p>0.05$) affected during the two trials. Dietary treatment however affected ($p<0.05$) average daily weight gain at both the starting and finishing stages of broiler growth. Birds on diets containing unfermented corncob (Diet 2) had the least weight gain (15.36 and 40.90 g day^{-1}) in Trials 1 and 2, respectively. Diet 6 (containing corncob fermented for 20 days) sustained the highest daily weight gain of 20.89 and 52.34 g day^{-1} in the two trials respectively. Diets containing corn cob fermented for the durations of 10 and 15 days though did not support a significantly greater weight gain compared to the control diet in both trials was however, numerically better than the control diet. The significantly lower weight gain observed among birds on the unfermented corn-cob might be attributed to high fibre content. This result agrees with the finding of Isikwenu *et al.* (2000), that corn-cob had a depressive effect on chick growth. The observed better weight gain among birds on fermented corn-cob may be attributed to the conversion of fibres into soluble carbohydrates and enhancement of feeding value (Adeyemi and Adeyemi, 2000). The

Table 2: Chemical composition of corn cob

	Unfermented	Fermentation (days)			
Composition	0	5	10	15	20
Dry matter	86.61	93.84	93.61	92.22	92.09
Crude protein	2.92	4.01	10.84	16.28	22.69
Crude fibre	35.56	31.91	30.80	28.87	27.53
Ether extract	0.58	1.01	0.87	0.93	0.98
Ash	2.98	3.22	3.18	3.32	3.29
Nitrogen free extract	54.27	53.27	47.09	42.82	37.51
Metabolizable energy kcal kg^{-1}	2065.71	2122.07	2172.69	2198.54	2050.90

Table 3: Chemical composition of experimental diets

	Control	Unfermented		Fermentation (days)		
		0	5	10	15	20
Composition	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Dry matter	91.13	92.81	91.89	91.80	93.31	91.92
Crude protein	22.79	22.88	23.98	24.03	24.16	24.82
Crude fibre	3.78	5.22	5.11	4.92	4.81	4.71
Ether extract	3.44	3.38	3.56	3.49	3.70	3.68
Ash	6.48	6.39	6.58	6.73	6.79	6.81
Nitrogen free extract	54.64	54.94	52.66	52.53	53.85	51.90
Metabolizable energy kcal kg^{-1}	3064.34	3073.41	3047.90	3042.96	3108.26	3061.81

Table 4: Effect of increasing the duration of fermentation of corn-cob on the performance of broilers

Dietary treatment	Starting phase (0-5 weeks old)				Finishing phase (5-9 weeks old)			
	Feed intake (g/bird/day)	Weight gain (g/bird/day)	Feed: gain ratio	Protein efficiency ratio	Feed intake (g/bird/day)	Weight gain (g/bird/day)	Feed: gain ratio	Protein efficiency ratio
1. Control	52.82	18.86b	2.82b	1.52b	124.14	48.84a	2.55b	1.83ab
2. 0-day fermentation (Unfermented CC)	53.77	15.36c	3.52a	1.25a	126.37	40.90b	3.10a	1.59b
3. 5-day fermentation	51.84	17.80b	2.82b	1.50b	121.82	46.24ab	2.63b	1.87ab
4. 10-day fermentation	52.86	19.05b	2.77b	1.57b	124.43	51.99a	2.40b	2.07a
5. 15-day fermentation	57.76	19.40ab	2.98b	1.48b	127.94	52.22a	2.48b	2.02a
6. 20-day fermentation	53.99	20.40a	2.58b	1.68c	126.87	52.34a	2.48b	2.05a
SEM	± 2.24	± 0.39	± 0.5*	± 0.7*	± 3.16	± 1.88*	± 0.13*	±0.10*

Means in the same column followed by different letter are significantly different ($p<0.05$)

Table 5: Nutrient retention (%) of broilers on diets containing fermented corn-cob

Dietary treatment	Trial 1			Trial 2		
	DM	Protein	Fat	DM	Protein	Fat
1.	83.54a	66.22a	70.68a	82.21a	63.92	65.08a
2.	70.92b	52.99d	62.56b	76.24e	61.53	52.34c
3.	76.58ab	61.49c	68.09b	78.20d	62.93	59.83b
4.	78.95ab	61.57bc	70.03a	80.51c	63.07	60.15b
5.	82.02a	62.32b	69.56b	81.42a	62.79	63.36ab
6.	82.28a	61.21b	70.11a	82.42a	64.04	64.96a
SEM	±1.01-	±0.61*	±0.77*	±0.25*	±1.08	±0.98*

*Mean in the same column followed by different letter are significantly different ($p<0.05$)

fermentation process may also have resulted in the production of microbial protein. Increase in protein synthesis as a result of fermentation had been reported by previous workers (Noomhorn *et al*., 1992; Garg and Neelakantan, 1982; Rajugopal, 1977).

Birds on fermented corncobs had a relatively similar feed conversion ratio with those on control diet ($p>0.05$) and were significantly different from those on diets containing unfermented corn cob (Diet 2). The observed trend might be due to the high fibre of the unfermented cob which tends to limit nutrient availability (Nwokolo *et al*., 1985). The observed better performance among birds on fermented corn cob might be due to the release of nutrients locked up in the cob and the availability of the microbial proteins to the birds. This result confirms the findings of Rajagopal (1977) that microbial protein from corn cob might be useful as a dietary source of protein. The Protein Efficiency Ratio (PER) follows the same trend as feed conversion ratio in both trials. Birds on diet containing unfermented corn cob had a significantly lower protein efficiency ratio compared to birds on other diets ($p<0.05$). This might also be due to the high fibre content of the feed since fibre tends to decrease efficiency of protein and feed utilization (Stanogias and Pearce, 1985). The PER was not significantly different among diets containing fermented corn cob in Trial 1, but in Trial 2 significant differences were observed. Birds on diets containing corn cob fermented for 10, 15 and 20 days had better PER values compared to the control and diet 2 (unfermented corn cob). This observation might be due to the availability of microbial protein due to conversion of cellulose to protein during fermentation (Garg and Neelakantan, 1982).

The results of nutrients retention trials are summarized in Table 5. During the chick stage, no significant ($p>0.05$) difference was observed in the retention of crude protein and ether extract between Diet 1 (control) and Diet 6. Diet 2 (containing fermented corn cob) was least digestible. Dry Matter (DM) and Ether Extract (EE) digestibility were significantly ($p<0.05$) influenced as the duration of fermentation of corn-cob increased during the finishing stage. Birds fed diet containing unfermented corn cob had the least dry matter and ether extract digestibility. The DM and EE digestibility increased as the duration of fermentation was elongated. This might be attributed to the progressive reduction in crude fibre since crude fibre affects the digestibility of other constituents (Isikwenu *et al.,* 2000). However the crude protein digestibility was not significantly ($p>0.05$) affected. This result is in line with the submission of Eggum (1973) that when the source of crude fibre does not contribute significant amount of protein in the diets, as was the case with corn-cob in this study, increased level of crude fibre would not affect protein digestibility.

CONCLUSION

It is concluded that fermented corn-cob can be utilized in broiler diet at both the starter and finisher phases up to 10% of the diet. The longer the duration of fermentation, the better the feeding value of the by-product.

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