

EFFECT OF DURATION OF STEAM-BOILED CASTOR BEAN CAKE ON PERFORMANCE OF BROILER CHICKENS

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ABSTRACT

The effect of duration of steam-boiled castor bean cake on the performance of broiler chickens was investigated. Castor bean cake was steam boiled for 0, 30, 40, 50 and 60 minutes respectively for treatments one to five and included at 15% in their diets. Apart from the control diet which had no inclusion of castor bean cake, birds fed diets with castor bean cake steam boiled for 30 minutes showed the best results in average daily weight gain, feed intake, feed to gain ratio and feed cost per kilogram weight gain. The declined performance with increasing durations of steam boiled castor bean cake was attributed to possible compromise of the protein quality. The study therefore concluded that castor bean cake can supplement other protein sources in broiler diets at 15% inclusion level if it is steam boiled for 30 minutes. Further steaming of castor bean cake beyond 30 minutes is not productive as it may alter the protein quality.

Keywords: castor bean cake, performance, broiler, steam-boiled

INTRODUCTION

Castor bean cake is an alternative feed resource that may help reduce dependence on conventional feedstuffs if adequate attention is paid to its processing and utilization. Depending on the extent of decortication, the crude protein content varies between 21-45% as reported by Cadha (2005). It was reported by Vilhjamssdottir and Fisher (1971) that castor bean cake is rich in phosphorus, nitrogen, potassium, zinc, copper and manganese. Similarly, it contains essential amino acids such as Arginine 10.0%, Histidine 1.70%, Leucine 5.60%, Isoleucine 4.60% and Threonine 3.20% (Cadha, 2006). Despite these potentials, there are limitations to its use due to the presence of toxins such as ricin and ricinine. Castor bean cake must be processed to deactivate the toxins and enhance its utilization in diets for monogastric animals. Hence, the study was carried out to evaluate the effect of varying durations of steam boiled castor bean cake on the performance of broiler chickens.

MATERIALS AND METHODS

Experimental site and source of castor beans

The study was carried out at the poultry unit of the Department of Animal Science, A.B.U. Zaria. Castor bean seeds were obtained from a local Market in Shika village, Kaduna state.

Oil extraction (the screw press method)

Castor bean seeds were taken to National Research Institute for Chemical Technology (NARICT),

Zaria for oil extraction using the cold press method. Castor bean seeds were first pounded in a mortar using a pestle before wrapping the paste in a cheese cloth and subjecting it to cold press. The oil dripped from the paste and was collected in a container.

Preparation of castor bean cake for feeding trials

The cake was collected after oil extraction and later treated by steam-boiling for 0, 30, 40, 50 and 60 minutes respectively for treatments one to five.

Experimental diets and design (starter phase)

Two hundred and twenty five (225) day old broiler chicks were purchased from Obasanjo farms, Otta, Ogun State Nigeria. They were allotted to five dietary treatments in three replicates with fifteen (15) birds per replicate in a completely randomized design. The birds were housed on deep litter and reared in accordance with standard management practices. Birds in treatment one did not have castor bean cake in their diets. Castor bean cake was steam boiled at 30, 40, 50 and 60 minutes respectively for treatments two to five and included at 15% in their diets. Parameters measured include initial and final weight gain, feed intake, feed conversion ratio, feed cost per kilogram weight gain and mortality as it occurred.

Experimental diets and design (finisher phase)

At the end of the starter the birds were pooled together and randomized for the finisher phase. Two hundred and ten (210) 5weeks old broiler

finisher chickens were used in this phase. The birds were assigned to five dietary treatments in three replicates with fourteen birds per replicate in a completely randomized design. Birds in treatment one did not have castor bean cake in their diets. Castor bean cake was steam boiled at 30, 40, 50 and 60 minutes respectively for treatments two to five and included at 15% in their diets. Parameters measured include initial and final weight gain, feed intake, feed conversion ratio, feed cost per kilogram weight gain and mortality as it occurred.

Laboratory and statistical analysis

Representative samples of the castor bean cake and the experimental diets were taken to the Biochemical Laboratory of the Department of Animal Sciences, A.B.U. Zaria and subjected to proximate analysis according to procedures described by A.O.A.C. (1990). Data obtained from the experiment was subjected to analysis of variance using the SAS general linear model and treatment means were separated using Duncan's Multiple Range Test according to procedures described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Results on the effect of duration of steam-boiled castor bean cake on the performance of broiler chickens at starter phase and finisher phase are presented in Table 3 and Table 4 respectively. At both starter and finisher phases, birds fed the control diet (0% castor cake) showed the best result in productive parameters of average daily weight gain, average daily feed intake, feed conversion ratio and feed cost per kilogram weight gain. Birds fed the control diet showed the best performance in all parameters studied because castor bean cake was not included in their diet. Castor bean cake has been reported to contain toxins such as ricin and ricinine which inhibit digestion and utilization of feed (Vilhjodottir and Fisher, 1971). The decline in productive parameters observed for birds in treatment two to five may have resulted from the compromised quality of the protein due to prolonged steam boiling. Bawa *et al.* (2003) reported a decrease in crude protein content of lablab seeds due to prolonged cooking time. Balogun *et al.* (2001) also reported similar findings with soyabeans cooked at various durations of time. Birds fed castor bean cake steam boiled for 30 minutes showed the best result in all productive parameters due to reduction

in toxins in the cake while the protein quality remained intact. Longer durations of steam boiling beyond 30 minutes may have compromised the protein quality hence, the declined performance. Mortality observed at both starter and finisher phases was not attributed to the experimental diet because mortality was also observed for birds on the control diet (0% castor bean cake).

CONCLUSION

The effect of duration of steam-boiled castor bean cake on the performance of broiler chickens was investigated. Apart from the control diet which had no inclusion of castor bean cake, birds fed diets with castor bean cake steam boiled for 30 minutes showed the best results in average daily weight gain, feed intake, feed to gain ratio and feed cost per kilogram weight gain. The declined performance with increasing durations of steam boiled castor bean cake was attributed to possible compromise of the protein quality. The study therefore concluded that castor bean cake can supplement other protein sources in broiler diets at 15% inclusion level if it is steam boiled for 30 minutes. Further steaming of castor bean cake beyond 30 minutes is not productive as it may alter the protein quality.

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bean meal as a protein source for chickens. Detoxification and determination of limiting

Table 1: Composition of experimental diets for broiler starter (0-4 weeks)

Ingredients	Duration of steam-boiling castor bean cake (minutes)				
	1(0)	2(30)	3(40)	4(50)	5(60)
Maize	49.72	57.71	57.71	57.71	57.71
GNC	33.38	10.39	10.39	10.39	10.39
CBC	0.00	15.00	15.00	15.00	15.00
SBM	5.00	5.00	5.00	5.00	5.00
Wheat-offal	8.00	8.00	8.00	8.00	8.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	0.50	0.50	0.50	0.50	0.50
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.15	0.15	0.15	0.15	0.15
Salt	0.30	0.30	0.30	0.30	0.30
Premix*	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)	2986	2948	2948	2948	2948
Crude protein	23.00	23.00	23.00	23.00	23.00
Ether extract	5.08	7.30	7.30	7.30	7.30
Crude fibre	3.91	5.87	5.87	5.87	5.87
Calcium	1.17	1.19	1.19	1.19	1.19
Phosphorus	0.88	0.96	0.96	0.96	0.96
Lysine	1.16	1.24	1.24	1.24	1.24
Methionine	0.49	0.53	0.53	0.53	0.53
Cost/Kg(N)	N64.82	N58.72	N57.64	N56.23	N55.82

Table 2: Composition of experimental diets for broiler finisher (5-9 weeks)

Ingredient	Duration of steam-boiling castor bean cake (minutes)				
	1(0)	2(30)	3(40)	4(50)	5(60)
Maize	55.79	50.91	50.91	50.91	50.91
GNC	24.00	10.00	10.00	10.00	10.00
CBC	0.00	15.00	15.00	15.00	15.00
SBM	5.00	5.00	5.00	5.00	5.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Bone-meal	3.00	3.00	3.00	3.00	3.00
Limestone	0.50	0.50	0.50	0.50	0.50
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.15	0.15	0.15	0.15	0.15
Salt	0.30	0.30	0.30	0.30	0.30
Premix*	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)	3131	3166.40	3166.40	3166.40	3166.40
Crude protein	20.01	20.00	20.00	20.00	20.00
Ether extract	5.02	7.17	7.17	7.17	7.17
Crude fibre	3.75	5.64	5.64	5.64	5.64
Calcium	0.56	0.88	0.88	0.88	0.88

Phosphorus	0.57	0.78	0.78	0.78	0.78
Lysine	1.01	1.05	1.05	1.05	1.05
Methionine	0.46	0.50	0.50	0.50	0.50
Cost/Kg(N)	N67.56	N63.54	N61.32	N59.66	N57.23

Table 3: Effects of duration of steam-boiled castor beans cake on the performance of broiler starter chickens (0-4 weeks)

Parameters	Duration of steam-boiling of castor bean cake (minutes)					SEM	LOS
	1(0)	2(30)	3(40)	4(50)	5(60)		
Initial body wt(g)	96.67	96.67	96.67	96.67	96.67	0.00	NS
Final body wt(g)	863.22 ^a	574.22 ^b	448.81 ^c	557.22 ^b	480.18 ^c	40.34	*
Av. daily wt gain(g)	27.38 ^a	17.05 ^b	12.57 ^c	16.44 ^b	13.69 ^c	44.05	*
Av. feed intake(g/d)	337.17 ^a	205.59 ^{bc}	279.09 ^b	302.59 ^a	243.72 ^b	47.93	*
Feed to gain ratio	1.67 ^a	2.71 ^b	2.97 ^{bc}	2.63 ^b	3.04 ^c	0.38	*
Feed cost/kg gain(N)	108.51 ^a	158.18 ^b	137.96 ^{ab}	149.29 ^b	137.96 ^{ab}	13.56	*
Mortality	0.00	0.00	0.33	0.00	0.33	0.36	NS

^{abcd} = means with different superscript on the same row differ significantly (P<0.05); NS=Not significant (P>0.05); SEM=Standard error of mean; LOS=Level of significance

Table 4: Effects of duration of steam-boiled castor bean cake on the performance of broiler chickens (5-9 weeks)

Parameters	Duration of steam-boiling castor bean cake (minutes)					SEM	LOS
	1(0)	2(30)	3(40)	4(50)	5(60)		
Initial body wt(g)	685.67	632.78	691.33	664.89	663.00	72.68	NS
Final body wt(g)	2066.33 ^a	1752.70 ^b	1624.40 ^{bc}	1514.20 ^c	1597.60 ^c	229.47	*
Av. wt gain (g/d)	49.30 ^a	39.86 ^b	33.33 ^c	30.32 ^c	33.38 ^c	6.07	*
A v. feed intake (g/d)	135.86 ^a	120.49 ^b	114.20 ^c	111.13 ^c	113.38 ^c	12.14	*
Feed : gain ratio	2.99 ^a	3.17 ^b	4.55 ^c	4.50 ^c	4.94 ^d	0.38	*
Feed cost/kg gain(N)	202.39 ^a	243.44 ^b	273.98 ^c	268.61 ^c	240.64 ^b	37.84	*
Mortality	1.00	1.33	1.00	0.67	1.33	0.89	NS

^{abcd} =Means with different superscript on the same row differ significantly (P<0.05); NS=Not significant (P>0.05); SEM=Standard error of mean; LOS=Level of significance; *=Significant at P<0.05