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EVALUATION OF THE OPTIMUM INCLUSION LEVEL OF 30 MINUTES STEAM-BOILED CASTOR BEAN CAKE ON THE PERFORMANCE OF BROILER CHICKENS.

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ABSTRACT

An experiment was conducted to evaluate the optimum inclusion level of 30 minutes steam-boiled castor bean cake on the performance of broilers. Steam-boiled Castor bean cake was used to replace groundnut cake (GNC) at graded levels of 25, 50, 75 and 100%. Birds on 100% and 75% replacement died during the 1st and 2nd weeks, respectively. Birds on 50% replacement survived while those on 25% replacement compared favourably with the control. It was concluded that 30 minutes steam-boiled castor bean cake CBC can replace GNC up to 50% level in broiler diets, without adverse effect on their performance, beyond this level, there will be high mortality.

Keywords: castor bean cake (CBC), performance, broiler, steam-boiled, inclusion, groundnut cake (GNC).

Target audience: Farmers, Nutritionists.

INTRODUCTION

CBC is an alternative feed resource that may help reduce competition and 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). Vilhjamsdottir and Fisher (1971) reported that CBC is rich in phosphorus, nitrogen, potassium, zinc, copper and manganese. It also 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 some toxins such as ricin and ricinine. CBC must be processed to de-activate the toxins to enhance its utilization in diets for monogastric animals. An earlier study was conducted where CBC was steam-boiled for 30, 40, 50 and 60 minutes, respectively and used in broiler diets at inclusion level of 15%, boiling for 30 minutes gave the best result. This study was therefore carried out to evaluate the optimum level of inclusion of CBC steam-boiled for 30 minutes to serve as replacement for GNC in broiler diets.

MATERIALS AND METHODS

Experimental site and source of castor bean seeds.

The study was conducted at the poultry unit of the Department of Animal Science, Faculty of Agriculture, ABU Zaria while Castor been seeds were purchased from a local market in Shika Village of 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 with 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.

The cake obtained after the oil extraction was wrapped in jute sac and steam-boiled for 30 minutes. The cake was then spread on concrete floor to dry before being milled and incorporated into the diets.

Experimental diets and design (starter phase).

Two hundred and twenty (225) day-old hubbard broiler chicks were purchased from Obasanjo Farms Otta, Ogun State, Nigeria. They were allotted into five dietary treatments of forty five (45) birds each. Each group was sub-divided into three replicates of fifteen (15) birds each 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 CBC in their diets. CBC replaced GNC at graded levels of 25, 50, 75 and 100%, respectively replacing GNC for treatments two to five. Parameters measured include initial and final weights, 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 phase, the birds were pooled together, fed a common feed for one week before being randomized for the finisher phase. However, because of the high mortality rate recorded at the starter phase in treatments four and five, this phase had only three treatments. Treatments four and five were removed. One hundred and eighty (180) five (5) weeks old broiler finisher chickens were used in this phase. The birds were divided into three groups of sixty birds, subdivided into three groups of twenty birds each. Treatment one was devoid of CBC while treatments two and three had CBC replacing GNC at 25 and 50% levels, respectively. Parameters measured include initial and final weights, 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 CBC and experimental diets were taken to the Bio-chemical Laboratory of the Department of Animal Science, A.B.U. Zaria and subjected to proximate analysis according to procedures described by A.O.A.C. (1990). Data generated from the experiment was subjected to analysis of variance using the SAS general linear model, while

treatment means were separated using the Duncan"s Multiple Range Test according to procedures described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Results on the evaluation of the optimum inclusion level of 30 minutes steam-boiled CBC as replacement for GNC on the performance of broiler chickens at starter and finisher phases are presented in tables 3 and 4 respectively. At both the starter and finisher phases, birds fed the control diet (0% CBC) showed the best result on productive parameters of average daily weight gain, average daily feed intake and average daily water intake. However feed to gain ratio, feed cost per kg gain and mortality did not differ significantly (statistically) across the treatments. Birds fed the control diet showed the best performance in those parametres studied because CBC was not included in their diet. CBC has been reported to contain toxins such as ricin and ricinine that inhibit digestion and utilization of feeds Vilhjamsdottir and Fisher (1971). However, birds on treatment two performed better than those on treatment three on parameters of average daily weight gain, average daily feed intake, average daily water intake. Mortality observed was not attributed to the experimental diet since it was statistically similar across the treatments. But mortality recorded at the 1st and 2nd weeks of the experiment was attributed to the experimental diet though the treatments were stopped. This agrees with Cadha 2006 who states that boiling with alkali reduce the toxins 98% but dry heating at 206^0C destroys the allergens completely.

Table 1: Composition of experimental diets for experiment 2 broiler starter.

	Graded levels of 30 minutes steam-boiled Castor bean cake				
Ingredient	T 1	T 2	T 3	T 4	T 5
Maize	49.72	46.97	44.32	39.57	33.83
GNC	33.38	27.78	22.10	18.47	00.00
CBC	00.00	08.35	16.68	25.04	49.27
Soya full fat	05.00	05.00	05.00	05.00	05.00
Wheat offal	08.00	08.00	08.00	08.00	08.00
Bone meal	02.50	02.50	02.50	02.50	02.50
Limestone	00.50	00.50	00.50	00.50	00.50
Methionine	00.20	00.20	00.20	00.20	00.20
Lysine	00.15	00.15	00.15	00.15	00.15
Salt	00.30	00.30	00.30	00.30	00.30
Premix	00.25	00.25	00.25	00.25	00.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis					
ME(Kcal/kg)	2862.20	2868.11	2876.32	2861.56	2900.38
CrudeProtein	23.00	23.00	23.00	23.00	23.00
Ether Extract	05.30	06.56	08.83	10.13	13.72
Crude Fibre	03.71	04.84	05.55	06.73	09.92
Calcium	01.01	01.11	01.21	01.31	01.59
Phosphurus	00.81	00.90	00.98	01.07	01.31

Lysine	01.31	01.16	01.01	00.90	00.40
Methionine	00.54	00.50	00.46	00.43	00.31
Cystein	00.18	00.16	00.14	00.13	00.05
Cost/Kg(N)	N66.26	N62.93	N59.63	N55.71	46.71

Vit-Mineral Premix provides per kg diet: Vit. A,13.340i.u; D3,2860i.u; Vit E, 10i.u; Vit K,2.68i.u; Calcium pentothenate10.68mg; Mn,133.34mg; Fe 66.68mg; Zn,53.34mg; Cu 3.2mg; Iodine 1.86mg; Co 0.268mg; Se 0.108mg. CBC- Castor bean cake, M.E-Metabolisable energy, GNC- Groundnut cake, SBM- Soya bean meal

Table 2: Composition of experimental diets for broiler finisher

Graded levels of 30 minutes steam-boiled Castor bean cake					
Ingredient	T 1	T 2	T 3	T 4	T 5
Maize	55.79	53.84	51.89	49.94	43.94
GNC	24.00	20.76	16.71	12.66	00.00
CBC	00.00	06.00	12.00	18.00	36.66
Soya full-fat	05.00	05.00	05.00	05.00	05.00
Wheat-offal	10.00	10.00	10.00	10.00	10.00
Bone-meal	03.00	03.00	03.00	03.00	03.00
Limestone	00.50	00.50	00.50	00.50	00.50
Methionine	00.20	00.20	00.20	00.20	00.20
Lysine	00.15	00.15	00.15	00.15	00.15
Salt	00.30	00.30	00.30	00.30	00.30
Premix	00.25	00.25	00.25	00.25	00.25
Total	100.00	100.00	100.00	100.00	100.00

Calculated analysis

ME(Kcal/kg)	2880.86	2904.95	2909.45	2913.95	2928.58
Crudeprotein	20.00	20.00	20.00	20.00	20.00
Ether extract	05.09	06.03	06.93	07.83	10.62
Crude fibre	03.57	04.41	05.22	06.02	08.53
Calcium	01.15	01.20	01.29	01.36	01.58
Phosphorus	00.86	00.93	00.99	01.05	01.24
Lysine	01.42	01.16	01.21	01.27	01.42
Methionine	01.09	00.56	00.62	00.69	00.85
Cystein	00.49	00.18	00.20	00.23	00.30
Cost	N59.80	N57.95	N55.66	N53.36	N46.23

Vit-Mineral Premix provides per kg diet: Vit. A,13.340i.u; D3,2860i.u; Vit E, 10i.u; Vit K,2.68i.u; Calcium pentothenate10.68mg; Mn,133.34mg; Fe 66.68mg; Zn,53.34mg; Cu 3.2mg; Iodine 1.86mg; Co 0.268mg; Se 0.108mg.
CBC; Castor Bean Cake,
M.E; Metabolisable Energy,
GNC; Groundnut Cake,
SBM; Soya Bean Meal,
i.u; International Unit. Amend like table 1

Table 3: Effects of graded levels of steam-boiled Castor bean cake on the Performance of Broiler starter Chickens (0-4 Weeks)

	Graded levels of 30 minutes steam-boiled CBC in %				
Parametres	T1(0)	T2(25)	T3(50)	SEM	LOS
Initial body wt.	60.00	60.00	60.00	-	NS
Final body wt.	863.20[a]	634.50[b]	620.90[b]	211.44	*
Av daily wt gain (g)	28.68[a]	24.10[b]	20.03[c]	06.16	*
Av. daily feed intake (g).	28.67[a]	24.09[b]	20.03[c]	06.16	*
Feed to gain ratio.	2.72	3.23	2.86	00.22	NS
Feed cost/kg gain(N)	180.28	196.66	185.14	21.56	NS
Av. daily water intake (ml)	105.16[a]	93.63[b]	83.71[c]	02.50	*
Mortality (%)	0.00	0.33	0.33	00.47	NS

[abc]=Means with different superscript on the same row differ significantly ($p<0.05$)
NS=Not significant ($P>0.05$)
SEM=Standard error of means
*=Significant at $P<0.05$

Table 4: Effects of Graded levels of steam-boiled Castor bean cake on the Performance of broiler finisher chickens (5-8 weeks)

	Graded levels of 30 minutes steam-boiled CBC in %				
Parametres	T 1(0)	T 2(25)	T 3(50)	SEM	LOS
Initial body wt.(g)	1190.00	1190.00	1190.00	-	NS
Final body wt.(g)	3010.00[a]	2621.61[b]	2680.77[b]	117.53	*
Av daily weight gain (g)	65.02[a]	52.46[b]	51.30[b]	3.76	*
Av daily feed intake (g).	165.46[a]	154.28[b]	149.47[c]	4.08	*
Feed to gain ratio.	2.61	3.07	2.90	0.25	NS
Feed cost/kg gain(N)	156.11	178.18	166.79	11.50	NS
Av daily water intake (ml)	567.16[a]	508.39[b]	511.36[b]	13.98	*
Mortality (%)	0.00	0.67	0.67	0.74	NS

[abc]=Means with different superscript on the same row differ significantly ($p<0.05$)
NS=Not significant ($P<0.05$)
SEM=Standard error of mean
*=Significant at $P<0.05$

CONCLUSION

Evaluation of the optimum inclusion level of 30minutes steam-boiled CBC on the performance of broiler chickens was conducted. The control diet was devoid of CBC while treatments two through five had CBC replacing GNC at graded levels of 25, 50, 75 and 100% levels, respectively. Treatments four and five had very high mortality at weeks two and one of the starter phase of the experiment due to residual toxins not completely removed.. The study therefore concluded that 30 minutes steam-boiled CBC can supplement or even replace up to

50% GNC in broiler diets. However further studies is recommended such as treatment with enzymes.

REFERENCES

A.O.A.C. (1990): Association of Official Chemists, Official Methods of Analysis, 15th Edition, Washington D.C.

Balogun, T. F., Kaankuka, F.G. and Bawa, G.S. (2001). Effect of boiling fullfat soyabean on its amino acid profile and on performance of pigs. Nig. Journal of Animal production 28(1): 45-51.

Bawa, G.S. (2003). Effects of cooking time on the levels of antinutritional factors and nutritive value of Dolichos lablab (*Lablab purpureus* C.V. Rongai) seeds for pigs. Unpublished Ph. D Dissertation, Dept. of Animal Science, A.B.U. Zaria, Nigeria.

Cadha, Y. R. (2006); Ricinus. The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. Volume 9: Rh-So Publication and Information Directorate, CSIR, New Delhi. Pages 26-36.

Duncan, D. B.(1955); Multiple Range Test and Multiple F Test Biometrics 11; 1-14.

Steel, R.G.O. and Torrie, J. H. (1980); Principles and Procedures of Statistics. A Bio-metrical Approach. McGraw Hill Books Company Inc. New York.

Vilhjalmsdottir, L and Fisher, H. (1971). Castor bean meal as a protein source for chickens. Detoxification and determination of limiting amino acids. *Journal of Animal Nutrition,* 101:1185