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FEEDING VALUE OF PROCESSED HORSE EYE BEAN MEAL AS ALTERNATIVE PROTEIN SOURCE IN PULLET CHICKS DIETS

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ABSTRACT

The study was designed to evaluate the performance of pullet chicks fed graded levels of processed horse eye bean meal (HEBM) as partial replacement for soybean meal. The cracked beans were subjected to three processing methods viz: soaking in plain water for 48 hours, cooking for 90 minutes, and toasting on open fire at 100°C after sun-drying. The processed beans were milled to pass through a four mm mesh and used for diet formulation. Six experimental diets were formulated each at brooding and rearing phase, with diet 1 as control, while soybean meal in the control diets were replaced with the horse eye bean meal (HEBM) at 15, 30, 45, 60 and 75% in diets 2, 3, 4, 5, and 6, respectively. Three hundred and sixty (360) day-old Lohman black pullet chicks were used at brooding phase, while two hundred and seventy (270), 56 day – old chicks were used during the rearing phase of the experiment. Chicks were divided into six (6) groups on weight equalization bases and groups randomly placed on one of the six diets. The feeding trials lasted for eight weeks at brooding stage and twelve weeks during rearing period. Data generated were statistically analysed using analyses of variance procedures. The results revealed that level of HEBM in the diet did not significantly influenced the average daily feed intake, average daily weight gain and feed conversion ratio. Cost of feed consumed and cost per kg weight gain were significantly reduced with the inclusion of HEBM in pullet chicks' diets. It was concluded that 45 per cent of the soybean meal could be replaced by the HEBM in diets of pullets at the chick phase while HEBM can replace 60% of the soybean meal in the pullets' diet at rearing phase.

KEYWORDS: Horse eye bean, anti-nutrients, processing techniques, pullet chicks, brooding and rearing phase.

INTRODUCTION

Intensive poultry production has been identified as one of the means of attaining animal protein sufficiency in the diet of the average Nigerian (Ani and Adiegwu 2005).

Nigeria poultry industry is however facing tremendous setback and is on the verge of collapse arising from high cost of poultry feed, which accounts for 70-80% of the total cost of poultry production. The high cost of poultry feed has been traced to the increasing cost of maize, soybean and groundnut which are the main conventional sources of energy and protein, respectively (Effiong *et al.*, 2013).

A possible solution to the escalating cost of these ingredients is to explore the potentials of alternative feedstuffs as partial or total replacement for the expensive conventional feed ingredients.

The alternative vegetable protein being considered in this study is the horse eye bean (*Mucuna urens*) meal. Studies on the nutrient composition showed that the bean is a good source of protein (25-35%), carbohydrate (50-80%) and fat (8-11%). Effiong and Umoren, (2011) reported Glutamic acid, aspartic acid and leucine as the major amino acids in the horse eye bean. Umoren *et al.*, (2007) had reported that raw horse eye bean did not support growth of broilers and rats. This, they attributed to the presence of some anti nutritional factors which were present in the raw and cooked beans. The anti-nutritional factors in the horse eye bean meal include trypsin inhibitor, lectins, phytates, phenols, cynogenic glycosides, tannins and L- 3, 4 dihydroxyacetone (Effiong and Umoren, 2011).

Effiong and Umoren (2011) had recommended a multi-processing technique (combined soaking and cooking for 48 hours and 90 minutes, respectively and toasting) as processing method in eliminating the anti nutritional factors in the horse eye bean. The authors noted that the adopted processing methods reduced the levels of phytates, tannins, phenols, HCN and oxalates by 49, 30, 87 and 63%, respectively.

The objective of this study was therefore to determine the optimum replacement level of the soybean meal by the processed horse eye bean meal (HEBM) in the diet of pullet chicks at brooding and rearing phases.

MATERIALS AND METHODS

Processing of the horse eye bean

The horse eye bean was processed using methods that local farmers can easily adopt. The methods were; Soaking cracked beans in fresh clean water for 48 hours at room temperature (37°C), cooking for 90 minutes on open fire at 100°C (timing started from the point of boiling), and toasting sun-dried bean in frying pot, on open fire until they turned brown. The beans were then milled using 4mm screened

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hammer mill and thereafter used for feed formulation.

Experimental diets

Six (6) diets each were formulated during brooding and growing phase to provide 20 per cent crude protein and approximately 2,800 kcal ME/kg of metabolizable energy and 15 per-cent crude protein and 2700 kcal ME/kg of metabolizable energy, respectively (Table 1). Diet 1 was the control, containing soybean meal as sole plant protein. Diets 2 to 6 contained the HEBM, replacing 15, 30, 45, 60 and 75 per cent of soybean meal (SBM), respectively in the diets. The diets were presented in the form of mash.

TABLE 1: Composition of experimental diet

Ingredients	***Replacement levels (%) (Starter mash)***						***Replacement levels (%) (Grower mash)***					
	0	**15**	**30**	**45**	**60**	**75**	**0**	**15**	**30**	**45**	**60**	**75**
Maize	53.0	51.0	48.6	45.6	42.1	37.6	57.0	56.2	55.3	54.5	52.5	50.5
Fish meal	4.0	4.0	4.0	4.0	4.0	4.0	2.5	2.5	2.5	2.5	2.5	2.5
Soybean meal	24.5	22.5	20.2	17.5	14.2	10.0	8.3	7.8	7.1	6.0	5.1	3.7
Horse eye bean meal	-	4.0	8.7	14.4	21.2	29.9	-	1.4	3.0	4.0	7.7	11.1
Palm kernel cake	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Wheat offal	11.0	11.0	11.0	11.0	11.0	11.0	22.0	22.0	22.0	22.0	22.0	22.0
•Vitamin/mineral premix	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bone meal	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Lysine	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Methionine	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Calculated analysis												
Crude protein (%)	20.00	20.00	20.00	20.00	20.00	20.00	15.00	15.00	15.00	15.00	15.00	15.00
ME (Kal/kg)	2800	2801	2803	2806	2807	2809	2,718	2,719	2,719	2,723	2,720	2,720
Determined analysis												
% Crude protein	19.98	19.96	20.01	20.04	20.08	20.00	15.06	15.00	15.00	15.02	15.05	15.03
ME(Kcal/kg)	2796	2798	2800	2802	2805	2800	2709	2717	2718	2719	2715	2714

•Vitamin/ mineral premix containing the following per kg. Vitamin A 10,000000 I.U; Vitamin D3 2,000000I.U; Vitamin E 20,000IU; Vitamin K 2,250mg; Thiamine 1,750mg; Riboflavin B 5,000mg; Pyridoxine B6 2,750mg; Anti oxidant 125g; Niacin 27,500mg; Vitamin B12 15mg; Panthotenic acids 7,500mg; Biotin 50mg; Choline chloride 400g, manganese 80g; Zinc 50g; 1ron 20g; copper, 5g; Iodine 1.2g; Selenium 200mg; Cobalt 200mg

Experiment birds and design

A total of three hundred and sixty (360) day-old, Lohman black pullet chicks were used for this study during brooding phase. The chicks were weighed and grouped according to their body weights into six (6) groups each of fifty (60) chicks. Within each group, they were further divided into three (3) replicates of twenty (20) birds each such that the overall mean weights and weight ranges were similar across the groups. Groups were randomly allocated to the six experimental diets in a completely randomized design. Each diet was fed as mash throughout the experimental period. Feed and water were provided *ad libitum*.

At growing phase, two hundred and seventy (270), 56 day -old pullets were selected, weighed and grouped according to their body weight into six (6) groups of forty-five (45) birds. Each group had three replicates of fifteen birds. Groups were randomly allocated to the six grower mash (test diets) in a completely randomized design. The experiment lasted for 56 days for the brooding phase and 12 weeks during the rearing/growing phase.

Data collection and analyses

Feed intake (pen basis) was measured daily; the weights of birds were taken weekly. Both the feed intake and weight gain were used to calculate the feed conversion ratio. Economics of feeding HEBM to growing pullets was evaluated.

Data generated from the experiment, were statistically analyzed, using the analyses of variance procedure. Significant means were separated by Duncan's new multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Data for the performance of pullet chicks fed diet containing graded levels of processed horse eye bean meal are presented in Tables 2 and 3.

TABLE 2: Performance of pullet chicks fed diets containing graded levels of HEBM during brooding phase.

	Levels of HEBM (%)						
Parameters	**0**	**15**	**30**	**45**	**60**	**75**	**SEM**
Initial weight/bird (g)	50.00	50.00	49.58	50.83	50.42	50.42	± 0.12
Final weight/bird (g)	472.45	449.29	429.55	426.77	401.33	358.33	± 2.45
Weight Gain/bird (g)	422.45	399.29	379.55	375.28	350.91	308.33	± 2.46
Average daily weight gain/bird (g)	7.54	7.13	6.78	6.70	6.27	5.51	± 0.46
Average daily feed intake/bird (g)	29.59	27.61	28.60	28.07	28.82	28.74	± 0.32
Feed conversion ratio	3.96	3.87	4.22	4.19	4.60	5.22	± 0.19
Cost/kg feed (₦)	84.94	79.74	79.34	78.02	78.15	78.02	± 0.63
Cost of feed consumed (₦)	140.74^{a}	123.29^{cd}	127.07^{b}	122.64^{cd}	126.13^{b}	124.41^{bc}	± 1.01
Cost/kg weight gain (₦)	333.15^{c}	308.77^{e}	334.79^{c}	323.12^{d}	359.44^{b}	403.49^{a}	± 2.26

Means with different superscripts on the same row are significantly different (P < 0.05)
SEM - Standard Error of Mean

Table 3: Performance of growing pullet chicks fed graded levels of processed horse eye bean meal

Percentage levels of HEBM replacement							
Parameters	**0**	**15**	**30**	**45**	**60**	**75**	**SEM**
Initial weight/bird (g)	472.45	472.29	470.50	470.77	469.44	469.75	± 0.47
Final weight/bird (g)	1135.83 ^{ab}	1142.85 ^{ab}	1191.53 ^{a}	1206.28 ^{a}	1376.28 ^{a}	10240.00	± 3.14
Total weight gain/bird(g)	663.38 ^{ab}	670.56 ^{ab}	721.03 ^{a}	735.51 ^{a}	906.84 ^{a}	554.25	± 43.3
Average daily weight gain/bird (g)	7.90 $^{a b}$	7.98 ^{ab}	8.58 ^{a}	8.76 ^{a}	10.79 ^{a}	6.60 ^{c}	± 3.60
Average daily feed intake/bird (g)	47.02 ^{a}	40.54 ^{b}	46.08 ^{a}	43.05 ^{b}	35.92 ^{a}	47.40 ^{b}	± 7.05
Feed conversion ratio	6.32	5.39	5.5	5.20	4.48	6.25	± 0.26
Cost/kg of feed (₦)	66.94	61.74	61.34	60.02	60.15	59.37	± 1.03
Cost of feed consumed (₦)	88.36 ^{a}	69.77 ^{bc}	79.13 ^{b}	72.62 ^{b}	78.00 ^{b}	59.96 ^{d}	± 3.39
Cost/kg weight gain (₦)	133.17 ^{a}	103.98 ^{b}	109.75 ^{b}	98.67 ^{bc}	86.00 ^{c}	108.23 ^{b}	± 5.80

Means with different superscripts on the same horizontal line are significantly (P<0.05) different
SEM- Standard error of means

The result showed that increasing dietary level of processed HEBM did not significantly (P> 0.05) influence the final body weight and the average daily weight gains of the chicks during brooding, but increase the weight gain significantly (P < 0.05) at growing phase. The result revealed that values were slightly depressed with increase level of HEBM in the diet at brooding. The improved weight gain with increasing dietary level of HEBM during growing phase could be attributed to the fact that birds at this stage were more matured and were able to handle higher levels of the bean meal in the diet. The average daily weight gain recorded in this study was similar to the value 7.13g reported by Amaefule and Obioha (2005) for pullet chicks fed diets containing processed pigeon pea seed meal as replacement for soybean meal.

Dietary level of HEBM in the diet did not significantly (P>0.05) influence the average daily feed intake during brooding phase, but significantly influence the intake of birds at growing phase. The result of this experiment was however lower than values reported by Ani (2008) for pullet chicks on processed velvet beans diet. Variation in the average daily feed intake during growing phase did not follow any pattern and therefore could not be attributable to any dietary effects.

Efficiency of feed utilization by the chicks was poorer with increasing dietary level of HEBM at brooding phase. This may be attributed to the inability of the birds to effectively utilize the diets, probably due to the presence of Non starch polysaccharides (NSP) in the diets (Nadeem *et al*., 2005; Balamurugan and Chandrascharan, 2010). The significant improvement in the FCR during growing phase could be due to the facts that birds at this stage may have developed adequate digestive enzymes to effectively handle the feeds. Generally, High FCR values observed at growing phase could be attributed to a shift of attention of the pullets from growth to the reproductive organs development.

Cost/Kg of feed slightly decreased with an increase in the dietary level of HEBM. Values were statistically similar across the treatment groups.

Birds on control diet had significantly (P<0.05) higher cost of daily feed intake than birds on experimental diets during brooding phase but were statistically similar during rearing phase. Birds eating 15% and 30% HEBM diets had the least cost of feed consumption at brooding phase while birds on 75% HEBM diet recorded the least cost of feed consumption during rearing. The differences were significant among treatment groups.

The cost/Kg weight gain was significantly different among the treatment groups. Chicks on treatment diets had the lowest cost/kg weight gain relative to the control group. Birds on 60% HEBM diet had the least cost/kg weight gain, followed by those eating 45% HEBM diet. The significant reduction in the cost of feed/kg weight gain of birds fed experimental diets during rearing phase maybe attributed to their outstanding growth.

CONCLUSSION

The result of the feeding trial revealed up to 30% of the soybean meal could be replaced by the HEBM at brooding phase while 60% of the SBM could be replaced by HEBM during rearing phase without any deleterious effects on pullet chicks.

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