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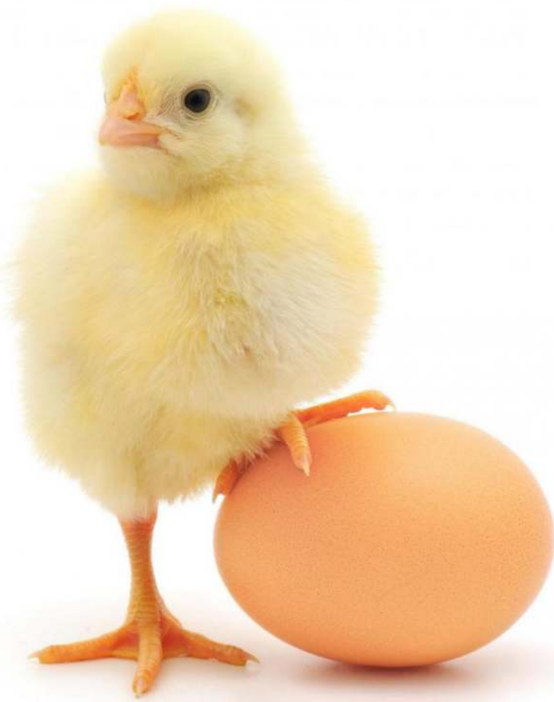

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Evaluation of Cellulolytic Enzyme Supplementation on Production Indices and Nutrient Utilization of Laying Hens Fed Soybean Hull Based Diets

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Abstract: A 120-day feeding trial was conducted to evaluate cellulolytic enzyme supplementation on production indices and nutrient utilization of laying hens fed soybean hull based diets. Seven experimental layers diets were formulated incorporating soybean hull meal at 0%, 10%, 20%, 30% (without enzyme supplementation) and 10, 20 and 30% (with 2.0% enzyme supplementation) dietary levels respectively. One hundred and forty seven (147), Shikka brown layers already 12 months in lay were divided into 7 groups of 21 birds each and randomly assigned to the 7 treatment diets in a completely randomized design (CRD). There were significant differences ($P<0.05$) in feed intake, feed conversion ratio, hen-day production, feed cost/dozen eggs, egg weight, Haugh unit, digestibility of crude protein, ether extract and crude fibre among the groups. However, there were no significant differences ($P>0.05$) among the groups in body weight, egg yolk colour, shell thickness, albumen and yolk indices, horizontal and oblong circumferences and digestibility of dry matter and ash respectively. The group on 30% dietary level of soybean hull meal (without enzyme supplementation) performed significantly ($P<0.05$) better than the other groups in hen-day egg production, feed cost/dozen eggs and egg weight. The results of this experiment suggest that 2.0% “safzyme” cellulolytic enzyme supplementation at 30% dietary level of soybean hull meal in layer diet could not significantly affect the performance of laying hens.

Key words: Cellulolytic enzyme supplementation, soybean hull, production indices, laying hens

Introduction

In the last two decades, there had been gross animal protein deficiency in human nutrition in Nigeria. Increase poultry production is the solution to the yawning gap of animal protein intake deficiency in Nigeria.

Soybean millruns or soybean flakes are by-products of the soybean milling industry. Soybean hull has estimated feeding value of 74-80% of that of maize when included in moderate to high quantity of maize based finisher diets (Esonu, 1998). It contains high level of potentially digestible fibre and can replace some or all grains in the diet of beef cattle (Hibberd and Chase, 1986). Soybean hulls contain 22.75% crude protein, 18.15% crude fibre, 14.60% ether extract, 8.00% ash and 20.90% NFE (Esonu *et al.*, 1997).

Soybean hull which is high fibre material has the potential of replacing substantially other bulk materials as brewers' dried grain, wheat offal, cotton seed hulls and rice bran in livestock diets. It also has in addition an advantage of not attracting any competition between humans and livestock for food. The increasing number of processing plants (mills) gives a measure of assurance of the availability of soybean hulls at relatively low cost to livestock farmers. However the limitation of soybean hull in poultry diet is probably its high fibre content, but Van Soest (1985) reported that soybean hull represent a case of no real lignifications.

Enzymes are proteins, but conjugated with co-factors to function. Enzymes are necessary for digestion and other chemical reactions in the body (Ramlingam, 2002). Enzyme supplementation can improve digestion, prevent or reduce gas production and bloat, reduce adverse feed reaction, control some feed allergies in animal body, leading to better utilization of feed nutrients. The trial herein reported was therefore designed to evaluate safzyme, a cellulolytic enzyme supplementation on production indices and nutrient utilization of laying hens fed soybean hull based diets.

Materials and Methods

Soybean [Glycine Max (L) Merrill] hulls used for this experiment were obtained from individuals engaged in soybean flour mill business in Owerri and Umuahia towns of Nigeria. The hulls were produced by toasting soybean seeds and passing it through a cracking machine and separated by blowing with fan or by winnowing against air current. The hulls were subsequently passed through a hammer mill to reduce the particle size. Sample of the hulls was then subjected to proximate analysis according to AOAC (1995). Mineral

Table 1: Chemical Composition of Soybean Hull Meal

Nutrients	%DM
Dry matter (in air dry meal)	84.40
Crude protein	22.75
Crude fat	14.60
Ash	9.00
Crude fibre	18.15
Acid detergent fibre	47.00
Neutral detergent fibre	74.00
Nitrogen free extract	20.90
Minerals	
Calcium	0.60
Sodium	0.01
Potassium	1.70
Phosphorus	0.22

analysis was carried out by the method of Grueling (1966) (Table 1) Safzyme ® (a cellulolytic enzyme) used was also procured from a feed store in Owerri.

Potency test for enzyme activity: The potency of the enzyme was tested before the commencement of the experiment using cellulose acetate and distilled water, in the Animal Science and Technology Laboratory, Federal University of Technology, Owerri. The result confirmed the potency of the enzyme. Seven (7) experimental layer's diets were formulated such that they contained soybean hull meal at 0, 10, 20 and 30% dietary levels (without enzyme supplementation) and 10, 20 and 30% dietary levels (with 2.0% enzyme supplementation) respectively (Table 2). One hundred and forty-seven (147) Shikka brown layers 12 months in lay were divided into 7 groups and randomly assigned to the, seven treatment diets in a completely randomized design(CRD). Each treatment was further sub-divided into three replicates of seven birds. Feed and water were provided ad-libitum. The birds were weighed at the commencement and termination of the trial. Feed intake was recorded daily and eggs collected twice daily, morning (9.00am) and afternoon (3.00pm). Total number of eggs laid per treatment was recorded. Seven (7) eggs daily from each treatment were used in the determination of Haugh unit, Yolk and Albumen index, shell thickness and Yolk colour. The egg size (oblong and horizontal circumference of each egg were measured using a thin thread and thereafter measuring such length along a graduated ruler in centimeters), shell thickness was measured using a micrometer screw gauge (the membrane from each egg shell was removed and measurements taken from three points on each shell, the thickness value of each egg was the average value for the three measurements). Venier calipers was used to measure albumen and yolk heights and width respectively. Yolk colour was scaled on a Roche colour fan or chart (Vuilleumier, 1969) and the scores recorded. The yolk and albumin indices and Haugh units were subsequently computed and recorded. The experiment lasted for 120 days.

At the end of the 120th day, seven birds were randomly selected from each treatment and transferred to metabolic cages for fecal collection, determination of nutrient utilization and proximate composition. The 7-days samples were pooled, ground and then analyzed for dry matter, crude protein, crude fibre, ether extract and total Ash (AOAC, 1995). Data collected were subjected to analysis of variance (Snedecor and Cochran, 1978). When analysis of variance indicated significant treatment effect, means were compared using Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

Results

The chemical composition of soybean hull meal is presented in Table 1, while the nutrient composition of the experimental diets is shown on Table 2. Data on the performance, egg quality and Digestibility of nutrients are presented in Table 3. There were significant differences ($P<0.05$) in feed intake, feed conversion ratio, hen-day egg production, feed cost/dozen eggs, egg weight, Haugh unit, digestibility of crude protein, ether extract and crude fibre among the groups. However, there were no significant differences ($P>0.05$) among the groups in body weight gain, egg yolk colour, shell thickness, albumen and yolk indices, horizontal and oblong circumferences and digestibility of dry matter and ash respectively.

Discussion

The enhanced performance of the layers in terms of hen-day egg production at 30% dietary level of soybean hull (without enzyme supplementation) could probably be due to increased availability of nutrients and adequate dietary crude fibre level. Crude fibre activates the intestine and more occurrences of peristaltic movement, more endogenous enzyme production resulting in efficient digestion of nutrients (Esonu *et al.*, 2002). It has been reported that adult birds digest substantial amount of fibre than young chicks (Esonu *et al.*, 1997; Olomu *et al.*, 1983; Esonu *et al.*, 2004), feed intake of the birds was inconsistent with increasing dietary levels of soybean hull meal. The results on feed intake disagree with earlier studies in this station with broilers and rabbits (Esonu *et al.*, 1997; Esonu, 1998).

The values recorded for internal characteristics of the eggs were in line with that reported for normal fresh eggs (Esonu *et al.*, 2004; and Emenalom, 2001). The comparable performance of the groups on soybean hull meal (both enzyme supplemented and non-enzyme supplemented) is interesting. It could probably be that the enzyme "safezyme" did not enhance the digestibility and utilization of cellulose and other nutrients in the soybean hull meal as anticipated. It would also appear

Table 2: Composition of treatment diets

Ingredients	Inclusion levels of soybean hull null (%)						
	Non-enzyme supplementation				Enzyme supplementation (2.0%)		
	0	10	20	30	10	20	30
Yellow maize	50.00	50.00	50.00	45.00	50.00	50.00	45.00
Soybean hull	0.00	10.00	20.00	30.00	10.00	20.00	30.00
Groundnut meal	20.00	15.00	15.00	10.00	15.00	14.00	9.00
Palm kernel meal	5.50	5.00	0.00	0.00	4.00	0.00	0.00
Wheat offal	9.50	5.00	0.00	0.00	5.00	0.00	0.00
Enzyme	0.00	0.00	0.00	0.00	2.00	2.00	2.00
Fish meal	5.00	5.00	5.00	5.00	4.00	4.00	4.00
Oyster shell	5.50	5.50	5.50	5.50	5.50	5.00	5.50
Bone meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Vitamin premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Calculated Chemical Composition (% in Dm)							
Crude protein	18.77	18.42	19.11	18.61	17.75	18.59	18.09
Crude fibre	4.75	6.02	6.27	7.64	5.71	6.17	7.54
Ether extract	4.95	5.96	6.68	7.56	5.77	6.61	7.49
Calcium	3.82	3.89	3.92	3.93	3.83	3.86	3.90
Phosphorus	0.99	0.99	0.95	0.95	0.96	0.92	0.92
ME(Kcal/kg)	2628.00	2563.10	2588.00	2568.90	2518.10	2505.50	2548.30

*To provide the following per kg of feed: vitamin A, 10,000.iu, vitamin D_3, 2000iu; vitamin B_1, 0.75mg; Nicotinic acid 2.5mg, calcium panthothenate, 12.50mg, vitamin B_{12}, 2.5mg, vitamin K_3, 2.5mg; vitamin E, 2.5mg; Cobalt 0.40mg; Biotin 0.50mg, folic acid, 1.00mgl choline chloride, 25mg, copper 8.00mg, manganese 64mg, iron 32mg, zinc 40mg, iodine 0.8mg, flavomycin - 100mg, spiromycin 5mg, DL-methionime 50mg, selemium 0.16mg, L-lysine 120mg.

Table 3: Effect of different levels of soybean hull meal with or without enzyme supplementation on the performance of laying hens

Parameter	Inclusion levels of soybean hull meal (%)							
	Non-enzyme supplementation				Enzyme supplementation (2.0%)			
	0	10	20	30	10	20	30	SEM
Av. Initial body wt.(g)	1750.0	1400.0	1500.0	1600.0	1500.0	1550.0	1650.0	33.25
Av. Final body wt (g)	1770.0	1420.0	1515.0	1615.0	1520.0	1570.0	1665.0	31.90
Av. Feed intake (g/day)	156.3	127.86	160.72	112.86	117.15	135.00	155.00	38.87
Av. Hen-day egg prod. (%)	57.14^{b}	57.14^{b}	59.52^{b}	64.29^{a}	57.94^{b}	55.55^{b}	52.38^{b}	1.39
Av. egg weight (g)	57.72^{a}	56.00^{a}	58.22^{a}	60.67^{b}	57.77^{a}	57.97^{a}	56.23^{a}	0.61
Feed conversion ratio	2.71	2.24	2.76	2.06	2.02	2.33	2.70	0.12
Egg yolk colour	3.77	3.35	3.73	3.58	3.46	3.77	3.73	0.06
Feed cost/dozen eggs (N)	90.51^{a}	73.68^{ab}	92.64^{a}	65.04^{b}	67.44^{b}	77.76^{ab}	89.28^{a}	4.51
Egg quality characteristics								
Haugh unit (Hu)	76.86^{a}	69.80^{b}	82.80^{a}	82.80^{a}	76.57^{a}	74.35^{a}	81.02^{a}	1.68
Shell thickness (mm)	0.28	0.29	0.28	0.30	0.29	0.31	0.21	0.04
Albumen index	0.11	0.12	0.11	0.10	0.12	0.12	0.10	0.04
Yolk Index	0.46	0.47	0.47	0.46	0.48	0.48	0.44	0.01
Horizont circumference(cm)	13.48	13.57	13.37	13.44	13.60	13.62	13.36	0.12
Oblong circumference (cm)	15.84	16.00	15.66	15.76	15.88	15.79	15.84	0.04
Nutrient digestibility and utilization; %								
Dry matter	81.00	77.16	83.00	77.88	75.23	78.17	81.43	1.04
Crude protein	74.92^{a}	68.23^{a}	58.65^{b}	54.81^{b}	67.95^{b}	59.01^{b}	55.32^{b}	2.90
Crude fibre	76.00^{a}	63.00^{b}	65.48^{b}	60.67^{b}	60.13^{b}	65.39^{b}	60.33^{b}	2.11
Neutral ether extract	82.30^{a}	76.47^{b}	75.83^{b}	72.33^{b}	75.09^{b}	76.27^{b}	73.43^{b}	1.20
Ash	56.92	59.52	60.13	57.23	58.05	58.22	59.63	0.47

ab means within rows with different superscript are significantly ($P<0.05$) different.

that utilization of soybean hull meal by laying hens, is relatively high at the level offered in this study. In view of the comparable performance of the hens in the control (0%) and the groups on soybean hull meal, except for the group on 30% dietary level without enzyme supplementation. It is difficult to explain this deviation. Again this observation disagrees with earlier reports by Esonu *et al.* (2004). The intensity of yolk colour did not increase with increase dietary level of soybean hull meal. This is an indication that the material is a poor egg pigmenter. Chesson (1993) reported that dietary inclusion of appropriate exogenous enzyme results in partial degradation, solubilization of cell wall poly-saccharides, and reduce digester viscosity in the small intestine. This allows for greater digestion and absorption of nutrients and hence improved performance of the birds. However the results of this trials suggest that 2.0% safzyme, cellulolytic enzyme supplementation at 30 % dietary level of soybean hull meal in layer's diet could not significantly affect the performance of laying hens.

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