EFFECT OF ENZYME SUPPLEMENTATION OF LOW PROTEIN DIETS ON PERFORMANCE AND EGG QUALITY PARAMETERS OF LAYING HENS

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ABSTRACT

The study evaluated the effect of enzyme supplementation on performance and egg quality parameters of laying hens. Twenty (20) weeks old layer hens were randomly allotted to 13.5% protein diets whose methionine and lysine levels have been adjusted to meet the NRC (1994) requirements for laying hens with or without enzyme supplementation for 12 weeks. Enzyme A is a Non-Starch Polysaccharide (NSP) degrading enzyme with some protease activities while Enzyme B is an NSP-degrading enzyme. There were five (5) dietary treatment groups containing enzyme A (0.1g/kg), enzyme A (0.2g/kg), enzyme B (0.1g/kg), enzyme B (0.2g/kg), and the control diet was without enzyme. Growth performance and egg quality parameters data were collected weekly. Feed intake, weight gain, Hen Day Production (%), feed/dozen egg (kg) and feed cost/dozen egg (₦) were significantly ($p<0.05$) improved with enzymes supplementation than in layers fed the control diet. Egg weight (g) and egg quality parameters were not affected ($P>0.05$) by enzymes supplementation. The study concluded that while enzymes supplementation improved the performance parameters of layers fed low CP diets compared to the control, the reduced egg weight was not corrected. The study therefore suggested the need for other measures to improve the egg weight of layers in early laying stage to improve the egg weight.

Keywords: Enzyme, Laying hens, Dietary protein, Nitrogen economy.

INTRODUCTION

Supplementation of diets with exogenous enzymes is one of the measures used in reversing reduced performance in layers fed low protein diets. Enzymes are supplemented in animal feed to improve nutrient digestibility and availability, reduce effects of antinutritional factors and reduce negative environmental impacts (Li *et al*., 2010). Enzymes have been noted to restore the nutritional value of feed with inadequate nutrient density thereby resulting in performance better or at least similar to a normal feed density (Pack and Bedford, 1997). Enzyme supplementation in layers fed low protein diets has led to increased performance, improved bone and intestinal health (De Lima *et al.,* 2012). This improved performance in layers fed enzymes supplemented low protein diets has been linked to increased nutrient utilization and hydrolysis of Non-Starch Polysaccharides (NSPs), among others (Leeson and Summer, 2001; Pourreza *et al*., 2007).

Incorporating enzymes into corn-soybean meal diets has been shown to improve the performance of a diet even when the nutrient density is adequate (Costa *et al*., 2008). Consequently, when enzymes with the ability to degrade NSP are utilized in the diets of chicken, they help in the degradation of cell wall, which in turn exposes increased amount of starch to digestive enzymes, thereby resulting in the availability of more nutrients for production processes. The objective of this study is to assess the effects on enzymes supplementation on the performance and egg quality parameters of layers fed low protein diets.

MATERIALS & METHOD

Experimental Birds and Design: A total of two hundred and ten (210) 20-week-old Isa Brown layers were randomly allotted to 13.5% protein diets whose methionine and lysine levels have been adjusted to meet the NRC (1994) requirements for laying hens with and without enzyme supplementation. The study was carried out in battery cages fitted with automatic drinkers. Each treatment had three (3) replicates of fourteen (14) layers per replicate. There were five dietary treatments containing Enzyme A (0.1 g/kg), Enzyme A (0.2 g/kg), Enzyme B (0.1 g/kg), Enzyme B (0.2 g/kg) and the control diet

without enzyme supplementation. The experimental diets were offered to the birds for a period of 12 weeks (Table 1).

Table 1: Composition of Basal low protein, enzyme supplemented layers' diet* (% DM)

Diets	Basal
Maize	57.90
SBM	10.20
Wheat Bran	20.50
Fish meal (72% CP)	1.00
Bone meal	3.00
Lysine	0.20
Methionine	0.20
Salt	0.25
Premix**	0.25
Oyster shell	7.00
Analysed Nutrient Composition (%)	
Energy (ME kcal/kg)***	2520.3
Crude protein	13.54
Crude Fibre	8.05
Crude Fat	7.01
Ash	8.07

* Diet 1 (Enzyme A) – Basal diet + Enzyme A 0.1g/kg feed; Diet 2 (Enzyme A) – Basal diet + Enzyme A 0.2g/kg feed; Diet 3 (Enzyme B) – Basal diet + Enzyme B 0.1g/kg feed; Diet 4 (Enzyme B) – Basal diet + Enzyme B 0.2g/kg feed; Diet 5 (Control) – Basal diet + No enzyme supplementation
**Supplied the following per kg of diet as specified by the manufacturer: Vitamin A, 12500 IU; Vitamin D_3, 2500 IU; Vitamin E, 50.00 mg; Vitamin K_3, 2.50mg; Vitamin B_1, 3.00 mg; Vitamin B_2, 6.00 mg; Vitamin B_{12}, 0.25 mg; Panthothenic acid, 5.00 mg; Nicotinic acid, 20.00 mg; Folic acid, 1.00 mg; Choline chloride, 300 mg; Manganese, 100 mg; Iron, 50 mg; Zinc, 45 mg; Copper, 2.00 mg; Iodine, 1.55 mg; Cobalt, 0.25 mg; Selenium, 0.1 mg
***Calculated value

The Enzymes: Enzyme A and Enzyme B were supplied by Adisseo France S. A. S. and DSM Nutritional Products Ltd. Poland, respectively. Enzyme A is a non-starch polysaccharide degrading enzyme preparation (from non-genetically modified fungus *Penicillium funiculosum*) containing β-glucanase, xylanase, cellulase, pectinase and protease. Enzyme B is a specific blend of beta-glucanases, cellulases and xylanases produced by a strain of *Trichoderma reesei*. The enzymes are naturally stable and efficient for degrading NSP of feedstuff.

Data Collection: Daily feed intake, weight gain, egg production records, egg weight, feed/dozen egg, cost of feed/dozen and egg quality parameters were determined as described by Park *et al*., *2002)* and Ojebiyi *et al*., 2018.

RESULTS AND DISCUSION

Performance of Layers Fed Enzyme Supplemented Low CP Diets

Performance parameters of layers fed enzyme supplemented low CP diets are presented in Table 2.

Table 2: Effects of enzymes supplementation on the performance of layers fed low CP diet

Parameter	Diets*					SEM
	Enzyme A (0.1)	Enzyme A (0.2)	Enzyme B (0.1)	Enzyme B (0.2)	Control	
Feed intake (g/b/d)	91.94^{a}	91.84^{ab}	91.16^{b}	91.07^{b}	89.88^{c}	0.25
Weight gain (g/b/d)	2.12^{a}	1.50^{b}	0.88^{c}	1.44^{b}	0.58^{d}	0.13
Egg weight (g)	50.47	50.68	50.10	50.16	50.85	0.26
Mortality	0.00	0.00	0.00	0.00	0.00	0.00

HDP (%)	65.59[a]	58.69[b]	54.82[c]	59.51[b]	51.39[d]	0.58
Feed/dozen egg (kg)	1.67[c]	1.85[bc]	1.98[ab]	1.79[bc]	2.11[a]	0.12
Feed cost /dozen egg (₦)	123.91[d]	138.20[c]	146.92[b]	133.71[c]	155.51[a]	3.21

[a,b,c] Values on the same row with different superscripts are significantly different ($p<0.05$). * Enzyme supplementation level is in g/kg.

The no mortality recorded in all the treatments in this study suggests that the layers were able to tolerate 13.5% protein diet. Significantly higher ($P<0.05$) feed intake, weight gain, and Hen Day Production (HDP) demonstrates a better handling of the diets by layers in the enzymes supplemented groups than those in the control group. Lower ($P<0.05$) feed/dozen egg (kg) and feed cost/dozen egg (₦) occasioned by enzyme supplementation in the present study may be a pointer to sustainable use of enzymes to reduce cost of egg production through improved feed utilization efficiency. However, enzymes supplementation did not improve weight of egg compared to the control in the present study. Mixed results have been reported on the effects of low protein diets supplemented with enzymes on the performance of layers at various stages of growth (Gunawardana *et al*., 2009; Mutahar *et al*., 2011). This suggests the need for other strategies such as supplementing some other limiting amino acids in the low protein diets to correct the compromised egg weight.

Egg Quality Parameters of Layers Fed Enzyme Supplemented Low CP Diets

The egg quality parameters of layers fed enzyme supplemented low CP diets are presented in Table 3.

Table 3: Effects of enzymes supplementation of low CP diet on egg quality Parameters

Parameter	Diets*					SEM
	Enzyme A (0.1)	Enzyme A (0.2)	Enzyme B (0.1)	Enzyme B (0.2)	Control	
Shell thickness (mm)	0.33	0.31	0.32	0.32	0.34	0.01
Shell weight (g)	5.00	4.33	4.83	4.67	5.17	0.27
Yolk index	4.19	4.28	4.36	4.08	4.07	0.13
Albumen index	0.61	0.62	0.63	0.61	0.64	0.02
Haugh unit	89.37	89.64	91.02	90.58	91.08	1.46

[a,b,c] Values on the same row with different superscripts are significantly different ($p<0.05$). *Enzyme inclusion level is in g/kg.

None of the egg quality parameters measured in this study was affected ($P>0.05$) by the treatment effects, which may be due to similarity in strains, diet and environment, and the fact that enzymes supplementation did not significantly improve the egg quality. De Lima *et al*. (2012) noted that enzymes supplementation of low protein diets in layers promoted similar egg quality. The finding of the present study suggests that enzymes supplementation does not affect the egg quality parameter as much as it affects laying performance of layers fed enzyme supplemented low protein corn-soybean meal-based diets.

CONCLUSION

The result of this study showed that there is value in enzymes supplementation in layers fed low protein diets, particularly as it affects some performance parameters including growth, feed intake feed utilization efficiency and hen day production without negatively affecting the egg quality parameters. However, egg weight of layers fed low protein diets was not corrected by enzymes supplementation in the current study. This finding suggests the need for the adoption of other strategies such as supplementing some other limiting amino acids in the low protein diets to correct the compromised egg weight of birds fed low protein diets.

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