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Research Article
Effect of Novizyme on Performance and Egg Quality of Laying Hens

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Abstract

Background and Objective: Layer farming is one of the most important and vast growing agribusinesses due to the high global demands for eggs. Chicken eggs are the best source of quality protein, vitamins, minerals, fats and are badly needed by the many millions of people who live in poverty. Therefore the current study was designed to find out the effects of (Novizyme) enzyme supplementation on parameters of performance and egg quality of Hi-sex layer hens. **Materials and Methods:** The study was conducted at the poultry production unit, training and research farm, College of the Animal Production University of Bahri, Elkadaru Area, Khartoum North. Sixty commercial layer hens (hi-sex) breed at 53 weeks of age were used. Birds were kept in a semi-closed housing system equipped with battery cages. Layer hens were randomly assigned into four dietary treatment groups (0, 0.05, 0.075 and 0.1% of feed) in a complete randomized design. **Results:** The supplementation of Novizyme in different graded levels in layers diet showed no significant effects in all measured parameters of performance, internal and external egg quality characteristics throughout the experimental period. **Conclusion:** Based on the obtained result of the present study, It can be concluded that the inclusion of Novizyme enzyme on layers diet at the level of inclusion tested do not improve performance and egg quality characteristics.

Key words: Novizyme, performance, egg quality, layers

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Eggs are a valuable food item that is relished by many people in many types of preparations such as frying, boiling and scrambling. In addition, eggs are also widely used in the baking and food industries. Egg products such as liquid and powdered eggs are also available for other industries due to their various positive attributes to food products such as emulsification, leavening, smoothness and flavor[1].

The main reason for adding enzymes into feed for poultry is to improve the utilization of feed and thus achieve better production performances. This is particularly interesting when there is a need for using feedstuffs of lower nutritional quality. Enzymes have a wide range of applications in broiler feed as well as in the feed for laying hens. In general, the purpose of adding enzymes in poultry nutrition is to complement the enzymes insufficiently produced by the animal (amylases and proteases) and to provide the animal with those enzymes not synthesized by them (cellulases)[2]. Digestive enzymes are required to digest feed in all animals and these enzymes are either produced by the animal body itself or by the beneficial microbes present in their gastrointestinal tract. Animals are not able to digest about 15-25% of the feed they eat, because the feed contains some indigestible components and or the animal bodies lack the specific enzyme which is required for the digestion of those specific feed nutrients[3]. Feed represents the largest cost (60-70%) in livestock and poultry production systems in Sudan. To reduce this cost, many producers supplement feed with additives such as enzymes to help them correct the situation. Novizyme is a type of enzyme that is currently available in the market which proved to be effective for use in layer feeding. It is a mixture of enzymes that include: xylanase, alpha-amylase, neutral protease, glucanase, cellulose. (www.americanbiosystems.com)[4,5]. The study has therefore been designed to investigate the effect of different levels of Novizyme on performance and egg quality of Hi-sex layer hens.

MATERIALS AND METHODS

Experimental site and duration: The study was conducted at the poultry production unit, training and research farm, College of the Animal Production University of Bahri, Elkadaru Area, Khartoum North, Sudan. The duration of the experiment was five weeks from 9/3 to 12/4 /2021.

Experimental birds and management: Sixty commercial layer hens (hi-sex) breed at 53 weeks of age were used. Birds were kept in a semi-closed housing system equipped with battery cages. The average minimum and maximum temperature were recorded daily during the experimental period (27 and 29°C, respectively). Layer hens were randomly assigned into four dietary treatment groups in a complete randomized design. Each group was represented by 15 layer birds which were distributed into 12 replicates of 5 birds. The replicate in the study was represented by battery cage (length 47 cm, width 40 cm and height 47cm). Layer hens were provided with clean drinking water freely throughout the experimental period. Vaccination program as recommended by the company was followed. Strict biosecurity program was maintained during the experiment inside and outside of the research shed to prevent any chance of disease occurrence. At the entrance, foot bath was maintained, where TH4+solution (highly effective against viral, bacteria and fungus) was used as a disinfectant.

Experimental material: Novizyme which is a mixture of enzymes was used as experimental material and included at graded levels of 0.0, 500, 1000 and 1500 g t^{-1} of feed, which represent (0.0, 0.50,0.1 and 0.15% of feed), respectively.

Experimental diets: Ingredients composition of the basal diet are shown in Table 1. Basal diet contained sorghum grains (52%), groundnut cake (20%), wheat bran (12%), super concentrates (5%) limestone (10%), NaCl (0.3%), Antimycotoxins, Premix and lysine (0.2%) each in addition to methionine (0.1%). The above composition yielded 2900 ME (kcal kg^{-1}),17.5% crude protein, methionine 0.22%, sodium 0.15%, lysine 0.52%, calcium 4.22% and available phosphorus at 0.43%. Based on this basal diet, four experimental diets which were approximately isocaloric and isonitrogenous but differing in the level of Novizyme were formulated. Novizyme was added as indicated above. The control diet on the other hand contains no Novizyme. The four diets were randomly assigned to birds in different groups (A, B, C and D) birds in group 1 (control) were supplied with a basal diet without the addition of the novizyme enzyme. Birds in group 2 were supplied with basal diet+Novizyme enzyme 500 g t^{-1} of feed. Birds in group 3 were supplied with basal diet+Novizyme enzyme 1000 g t^{-1} of feed. Birds in group 4 were supplied with basal diet+Novizyme enzyme 1500 g t^{-1} of feed.

Table 1: Ingredients composition of the basal diet

Ingredients	Percentage
Sorghum grain	2
Ground nut cake	20
Wheat bran	12
Super concentrate*	5
Limestone	10
Premix	0.2
NaCl	0.3
Lysine	0.2
Methionine	0.1
Antimycotoxins	0.2
Total	100
Chemical analysis	
ME (kcal kg^{-1})	2900
Crude protein (%)	17.5
Methionine	0.22
Sodium	0.15
Lysine	0.52
Calcium	4.22
Available phosphorus	0.43

- Each kg of super concentrate contained: Crude protein 35%, crude fat 2%, crude fiber 4.5%, calcium 6-8%, phosphorus 4.6%, lysine 6%, methionine 2.5%, premix 3%, sodium 2.3 ME: 2000 kca kg^{-1}
- Added vitamins kg^{-1}: Vitamin A 200.000 IU, vitamin D3 40.000 IU. Vitamin E 300 mg, vitamin K3 40 mg, vitamin B1 30 mg, vitamin B2 80 mg, vitamin B3 180 mg, vitamin B6 40mg, vitamin B12 120 mg, niacin 500 mg folic acid 15 mg biotin 400 mg choline chloride 10.000 mg
- Added minerals kg^{-1}: Iron 1.200 mg, zinc 1.000 mg, copper 120 mg, manganese 1.200 mg, iodine 10 mg and selenium 4 mg

Parameters investigated

Performance: Birds were adapted for the first week of the experiment. Afterwards, performance parameters (feed intake, egg production, percentage of egg production, egg weight and feed conversion ratio) in each cage was calculated on daily basis during the remaining 5 weeks of the experiment.

Egg quality: Parameters determined were external and internal egg quality characteristics (Egg weight, Shape index, Shell weight, Shell percentage, Shell strength, Shell thickness, Albumin height, Albumin index, Yolk height and Haugh unit).

Statistical analysis: The collected data from the four experiments were analyzed by using one-way analysis of variance (ANOVA), using PROC MIXED of SAS[4].

RESULTS AND DISCUSSION

Effect of different levels of novizyme enzyme on performance of layer hens: The effects of the addition of different levels of Novizyme on the performance of layer hens (feed intake, egg production, percentage of egg production, egg weight and feed conversion ratio) are indicated in Table 2. The table shows the influence of feed supplemented with different levels of Novizyme enzyme on the performance of hi-sex layer hens during the period 53-57 weeks of age. The results indicated that there was no significant ($p>0.05$) difference between all treatment groups (feed intake, egg production, percentage of egg production, eggs weight and feed conversion).

As regards feed intake birds fed 500, 1000 and 1500 g of Novizyme consumed 346.27, 329.67 and 332.27 g of feed respectively compared to birds in the control group which consumed 329.27 grams of feed. Feed intake was insignificantly ($p\geq0.05$) improved by 5.2% at the level of 500 g, decreased by 4.8% at 1000 g compared to 500 g and then increased by 0.79% at 1500 g. This inconsistent trend of feed intake indicates that the enzyme has no clear effect on feed intake.

On the other hand, the feed conversion ratio of layers fed the experimental diets showed 1.99, 2.026, 2.017 at 500, 1000 and 1500 g of the enzyme respectively compared to 1.967 produced by those fed the control. This parameter was insignificantly ($p\geq0.05$) increased at 1000 g and then decreased at 1500 g following the same trend as feed intake.

Layers kept under the present study produced 31.35, 32.13, 30.6 and 30.27 eggs respectively when fed the control and the experimental diets. Egg production was insignificantly ($p\geq0.05$) improved by 2.6% at the level of 500 g enzyme addition. Egg weight was 53.17, 52.72, 53.88 and 52.98 for layers fed the control diet and the experimental diets respectively reflecting similar inconsistently as other parameters tested. It was insignificantly ($p\geq0.05$) increased at 1000 g and then decreased at 1500 g. Table 2 also shows that egg production percentages of layers fed the control diet and the experimental diets were 89.52, 91.74, 88.40 and 87.10, respectively. Egg production percentages were insignificantly ($p\geq0.05$) improved by 2.5% at the level of 500 g enzyme addition.

The insignificant ($p\geq0.05$) decreasing trend of all performance parameters except feed intake at 1500 g enzyme level indicates that an increased level of Novizyme may not

Table 2: Effect of different levels of novizyme enzyme on the performance of layer hens

	Treatments				
Parameters	T_1 (0.0 g)	T_2 (500 g)	T_3 (1000 g)	T_4 (1500 g)	L.S
Feed intake (g)	329.27±40.75	346.27±43.86	329.67±43.65	332.27±55.76	NS
Feed conversion ratio	1.967±0.035.	1.997±0.042	0.062±2.026	2.017±0.069	NS
Egg weight	53.172±0.263	52.717±0.560	53.8800±550	52.982±0.392	NS
Egg production	31.33±0.485	32.13±0.413	30.60±0.660	30.27±0.790	NS
Egg production percentage	89.520±1.38	91.748±1.210	88.403±1.212	87.108±1.822	NS

Value is the Mean±SE of 3 replicate pens of 5 layers per pen for each treatment, NS: Not significance and LS: Level of significance

Table 3: Effect of different levels of Novizyme enzyme on external egg quality characteristics of layer hens

	Level of Novizyme				
Parameters	0.0 g	500 g	1000 g	1500 g	L.S
Shape index	78.48±1.93	72.13±3.95	76.88±0.99	72.36±0.34	NS
Shell weight	9.17±0.4	8.67±0.33	9.50±0.62	9.00±0.26	NS
Shell Percentage	16.41±0.8	16.09±0.6	17.85±1.25	16.08±0.57	NS
Shell strength	0.16±0.01	0.16±0.01	0.18±0.01	0.16±0.01	NS
Shell thickness	0.36±0.03	0.37±0.02	0.38±0.04	0.28±0.04	NS

lead to improved layer performance compared to the control. The current results agreed with Keshavarz[5], who reported that no significant effect of phytase enzyme supplementation on the performance of four strains of laying hens fed different levels of non-phytate phosphorus with and without phytase. The failure of the enzyme to improve layer performance may be attributed to the effects of other diets components that might have included elements that influenced the efficacy of the enzyme. Feed intake of birds kept under this study and fed on graded levels of Novizyme showed no difference between treatments. This result agreed with the previous study[6], which reported no significant difference in feed intake among treatments upon enzyme addition compared to control. As far as feed conversion ratio (FCR) is concerned, The present results agree with Augspurger *et al.*[7] and Silversides *et al.*[8], who found no change in FCR when different doses from a 6-phytase, produced by E. coli in White Leghorn hens. In addition, other researchers[6,9] another study also reported that enzyme addition improved feed conversion compared to control. Results of this study indicated that Novizyme addition at the levels tested produced a non- significant effect on egg weight. These results agree with Rojas *et al.*[10], who indicated that phytase supplementation had no significant effect on egg weight. On the other hand, this result disagrees with Ciftic *et al.*[11], who reported improved egg weight in layers fed increasing levels of microbial phytase. As regards, egg production results of this study suggested no significant difference between treatments. This result accords well with Roberts[12], who reported that egg production, from 55-65 weeks of age, was not affected by dietary enzyme supplementation. On contrary the present results contradicted with another study[13], who reported that enzyme addition improved egg production compared to control and thus improve hen's productivity.

Effect of different levels of Novizyme enzyme on external and internal egg quality characteristics of layer hens: The effects of the addition of different levels of Novizyme on external egg quality characteristics (shape index, shell weight, shell percentage, shell strength, shell thickness) are shown in Table 3. The eggs produced by layers fed the control and three levels (500, 1000 and 1500 g) of Novizyme had shape indices of 78.48, 72.13, 76.88, 72.36 and their shells weighed 9.17, 8.67, 9.5 and 9.00 g with a percentage of 16.41, 16.09, 17.85, 16.08, respectively. At the same time, the shell strength and shell thickness of the eggs were 0.16, 0.16, 0.18 and 0.16, 0.36, 0.37, 0.38 and 0.28, respectively.

On the other hand, the internal egg quality characteristics (albumin height, albumin index, haugh unit) are indicated in Table 4. The table shows that the supplementation of Novizyme in different graded levels in layers diets produced no significant ($p<0.05$) effects in all measured parameters as compared to birds in the control group. The respective values obtained for albumen height were 8.09, 7.82, 7,14 and 7.4 and for the Albumen Index were 10.03, 12.21, 9.73, 11.95 and those for the Haugh unit were 90.97, 89.82, 85.66 and 86.38.

The above results of external and internal egg quality characteristics indicate that the enzyme Novizyme has no observable effects on both of the external and internal egg quality characteristics at the levels tested under the condition of this study. However, birds fed 1000 g of the enzyme scored insignificantly ($p\geq0.05$) higher values in all measured

Table 4: Effect of different levels of Novizyme enzyme on internal egg quality characteristics of layer hens

	Level of Novizyme				
Parameters	0.0 g	500 g	1000 g	1500 g	L.S
Albumin height	8.09±0.35	7.82±0.41	7.14±0.39	7.40±0.54	NS
Albumin index	10.03±1.45	12.21±0.89	9.73±0.84	11.95±1.33	NS
Haugh unit	90.97±1.68	89.82±2.22	85.66±2.14	86.38±3.47	NS

parameters of the external quality except shape index which was insignificantly higher in the control group. This observed insignificant ($p \geq 0.05$) effect at the 1000 g level may indicate that Novizyme has very slight effects on these parameters at this level of enzymes inclusion. In addition, results obtained under the 1500 g inclusion level consistently showed lower values compared to values seen under the 1000 g level which may indicate that more enzyme addition could not lead to higher values of the tested parameters. On the other hand, birds fed 1000 g of the enzyme scored the least values of internal egg quality parameters that were insignificantly ($p \geq 0.05$) different from other treatments which may indicate that Novizyme has very slight effects on the investigated parameters at this level of enzyme inclusion.

Since there were no previous studies on the effects of this enzyme on the measured parameters based on the literature search done, for comparison with present results, findings from studies using other enzymes shall be used for the comparisons. In a study using Phytase enzyme in layer diet, another researcher[8] reported no significant effects of Phytase supplementation in normal, corn-soybean meal feed on dry and wet shell percentage which supports the result of this study as regards shell percentage.

As regards the results of the Haugh unit in this study it accords well with the result reported[14], who assessed the effects of the addition of an enzyme complex to layers feed and found that such addition had no effects on Haugh units. On the other hand, this result contradicted the result reported[15], who reported that supplementation with phytase enzyme in the diet of layers increased Haugh unit significantly ($p<0.05$) compared to the control group. The contradictions between the two results can be attributed to types of enzymes and management conditions and strains of layer used. The overall findings of the study described above suggest that Novizyme additions on layers diet have no clear effects on both of the external and internal egg quality attributes.

CONCLUSION

Results have shown that the inclusion of Novizyme as a feed supplements layers diet based on local Sudanese ingredients does not improve layers performance and egg quality characteristics at the age between 53-58 weeks. Instead, Novizyme supplementation produces an inconsistent trend in all measured parameters which indicates that levels of inclusions higher than the levels tested will not result in better layers performance and egg quality characteristics. It is therefore recommended that Novizyme not be added to layers diets based on local ingredients such as sorghum and groundnut cakes. However, the addition of the enzyme at levels higher than the level tested under the present study may underline the economic feasibility of diet.

SIGNIFICANCE STATEMENT

This study ruled out that Novizyme addition can not be beneficial for layer feeding utilizing local feed ingredients as a major component of the basic diet. This study will help researchers to uncover factors found in local feedstuff ingredients that are capable of forming nutritionally undesirable complexes that affect the enzyme action. Thus a new theory on enzyme incorporation in poultry diets may be arrived at.

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