

Supplementation of exogenous enzymes to laying hen diets containing alfalfa: Influence upon performance and egg yolk cholesterol and pigmentation

F. KHAJALI^{1*}, M. ESHRAGHI², F. ZAMANI² and E. FATHI²

¹Faculty of Agriculture, Shahrekord University, ² Faculty of Veterinary Medicine, Shahrekord Free University, Shahrekord, Postal code: 88186/34141, Iran

*Corresponding author: khajali@agr.sku.ac.ir

The aim of the present study was to determine the effects of inclusion of alfalfa in Hy-line W36 laying hen diets meal with and without exogenous enzyme supplementation on production performance and egg yolk cholesterol content and pigmentation. One hundred and eight laying hens were allocated to three treatments as follow 1) a commercial layer diet as a control without alfalfa meal, 2) a diet included 10% alfalfa meal without enzyme mixture, and 3) a diet included 10% alfalfa meal with enzyme mixture. Enzyme mixture consisted of β -glucanase and arabinoxylanase activities. The results showed that the inclusion of alfalfa meal had no significant effect on egg production, egg weight, egg mass, feed conversion ratio, shell thickness, albumen height, shell resistance against breaking and egg shape index. However the use of alfalfa meal caused a significant reduction in egg yolk cholesterol content ($P < 0.05$). The inclusion of alfalfa meal increased the pigmentation degree of egg yolk color (4 vs 6). Application of enzyme in alfalfa diet had no significant effect on aforementioned criteria.

Keywords: alfalfa meal; laying hen; enzyme; egg; cholesterol

Introduction

Dehydrated alfalfa meal is a fibrous feedstuff containing mainly β -glucan and xylan polysaccharides (Mourao et al., 2006). Dehydrated alfalfa is high in xanthophylls and usually used at very low levels in laying hen nutrition to increase the degree of pigmentation of the egg yolk (Fetcher & papa, 1985). β -glucanase and arabinoxylanase can be supplemented to diets containing alfalfa to improve the efficiency and energy utilization by the hens (Mourao et al., 2006). It may be possible to use alfalfa at moderate levels when exogenous enzymes are supplemented and in the meantime reduce the egg yolk cholesterol content with aid of hypocholesterolemic effects of alfalfa. In the present study, alfalfa meal was used at 10% level with or without the inclusion of exogenous enzymes and it's influence upon the production traits and egg yolk cholesterol content was evaluated.

Material and methods

One hundred and eight 80-wk-old Hy-line W36 hens were used in a 6-wk experimental period (2wk adaptation and 4wk collecting data) consisting of three treatments with three replicates each. Replicates were composed of 3 adjacent cages of four birds per cage. Treatments were: 1) a corn-soybean meal diet without alfalfa meal which was considered as a control, 2) a diet including 10% alfalfa meal without enzyme supplementation, and 3) a diet including 10% alfalfa meal with enzyme supplementation (table 1). Enzyme mixture consisted of β -glucanase and arabinoxylanase activities and was used at the level of 400ppm. Hens had free access to feed and water.

Records of egg production, egg weight and feed intake were recorded daily. Egg quality measures and egg yolk cholesterol content were measured on all eggs produced by the treatments. Data were analyzed in a completely randomized design using SAS Software.

Table 1. Composition of the experimental diets

Feed Ingredients	Control	Alfalfa	Alfalfa+Enzyme
Corn	64	57	57
Soybean meal	23	14.28	14.28
Alfalfa	-	10	10
Fish meal	0.5	2.95	2.95
Plant oil	3.0	3.94	3.94
Dicalcium phosphate	2.3	1.08	1.08
Oyster shell	6.5	9.95	9.95
Vitamin premix	0.25	0.25	0.25
Mineral premix	0.25	0.25	0.25
Enzyme	-	-	400 pm

Results and discussion

The results of the experiment were summarized and presented in table 2. Incorporation of alfalfa in the diet reduced feed intake, egg production and egg mass but not to the significant levels. Supplementation of β -glucanase and arabinoxylanase improved the aforementioned criteria but these effects were not significant ($p > 0.05$). Feed conversion ratio was not significantly influenced by inclusion of alfalfa either in absence or presence of enzyme supplement ($p > 0.05$). The present findings were consistent with the results of House and co-workers (2001) who indicated that inclusion of 10% alfalfa in the laying hen diets did not have significant impact on egg production, egg mass, feed intake and feed conversion ratio. However, Mourao and coworkers (2006) demonstrated that egg production, egg mass and feed intake were significantly reduced by inclusion of alfalfa to laying hen diets at level of 15% and addition of β -glucanase and xylanase could not overcome the situation. They concluded that the enzyme mixture that they used was not the most appropriate for the cell wall polysaccharides of alfalfa. By taking all these reports together, it is possible that higher level of alfalfa in the study of Mourao et al (2006) accelerated the passage rate of digesta and the hydrolytic capacity of exogenous polysaccharidase remained unused.

The inclusion of alfalfa in the laying hen diet had no significant effects on egg shell thickness, shell breaking strength and albumin height. These findings agree with those reported by House et al. (2001) and Mourao et al (2006). However, hens fed diets containing alfalfa tended to produce eggs with higher score of yolk pigmentation assessed by egg yolk color fan. This is due to higher intakes of xanthophyll occurred in alfalfa leading to its deposition in the yolk. Enzyme supplementation had no impact on yolk color.

Table 2. Laying hen response to alfalfa containing diet with or without enzyme

Criteria	Treatments			SEM
	Control	Alfalfa-enzyme	Alfalfa+ enzyme	
Hen-day egg prod (%)	60.8	54.8	61.8	4.20
Hen-day feed intake(g)	100.6	97.4	98.6	7.15
Egg weight (g)	63.2	62.1	65.2	1.51
Egg mass (g/b)	1182.09	1118	1181.8	31.69
FCR	2.33	2.39	2.28	0.09
Egg/shell thickness (mm)	0.40	0.40	0.41	0.007
Egg shell strength (kg/cm ²)	3.38	3.51	3.51	0.26
Albumin height (mm)	4.82	5.51	4.75	0.04
Egg yolk color	4	6	6	
Yolk cholesterol (mg/g)	10.35 ^a	7.6 ^b	8.3 ^b	0.38

Mean within each row with different superscripts are significant (p< 0.05)

Finally, the inclusion of alfalfa in laying hen diets significantly reduced the yolk cholesterol content (P<0.05). Reduced yolk cholesterol content as a result of feeding alfalfa can be partly explained by the presence of saponins in this feedstuff which have hypocholesterolemic effects (Sidhu & Oakenfull, 1986). Moreover, alfalfa fibers could increase biliary clearance which led to reduced yolk cholesterol content (Calvert & Yeates, 1982)

In conclusion, alfalfa meal contributed to deeply pigmentation of the egg yolk with yellow and considerably reduction in yolk cholesterol content. In the meantime, incorporation of alfalfa at the level used in this experiment did not influence layer performance and egg quality. Supplementation of exogenous enzymes had no significant effects on layer performance and egg quality characteristics.

REFERENCES

1. CALVERT, G. D., and YEATES, R. A. (1982) Adsorption of bile salts by soya-bean flour, wheat bran, Lucerne (*Medicago sativa*), sawdust and lignin: the effect of saponins and other plant constituents *Br.J.Nutr.* **47**: 45-52.
- 2-FLETCHER, D., and PAPA. C.M. (1985) Utilization and yolk coloring capability of dietary xanthophylls from yellow corn, corn gluten meal, alfalfa and coastal Bermuda grass *Poult Sci* **64**: 1458- 1463.
- 3- HOUSE, J. D, KHAJALI, F. and GUENTER, W. (2001) Impact of 10% alfalfa in barley-based diets with and without exogenous enzymes on egg folate content *Can. J. Anim Sci.* **81** (Abstr) 629.
- 4- MOURAO, J. L., PONTE, P. I., PRATES, J. A. M, CENTENO, M. S .J., FERREIRA, L. M. A., SOARES, M. A. C., and FONTES, C. M. (2006) Use of β -glucanases and β -1,4-xylanases to supplement diets containing alfalfa and rye for laying hens: Effects on bird performance and egg quality *J.Appl. Poult. Res.* **15**: 256-265.
- 5- SIDHU, G. S., and OAKENFULL, P.G. (1986) A mechanism for the hypocholesterolaemic activity of saponins *Br. J. Nutr.* **55**: 643-649.