J. Agr. Sci. Tech. (2017) Vol. 19: 581-589

Effects of Culban Seed (*Vicia Peregrina* L.) on Performance and Egg Characteristics of Laying Hens

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ABSTRACT

In this study, the effects of Culban seed (*Vicia peregrine* L.) on live body weight, feed intake, feed efficiency, egg production, egg quality characteristics, egg yolk fatty acid profiles and yolk cholesterol content in laying hens were investigated. The experiment consists of seven treatment groups with ten replications containing one laying hen in each and for 32 weeks old seventy laying hen were used in the study. The hens were fed the experimental diets containing 10 and 20% Culban seed meal in raw and autoclaved form. In addition, the autoclaved form was supplemented with enzyme (Bacozymex). There was also a control group which was fed a Culban meal free-diet. The lighting regime was 16.5 hours light and 7.5 hours darkness. The experiment lasted sixty three days. The supplementation with Culban seed had significant effects on feed intake, feed conversion ratio, egg production, albumen index, egg weight, eggshell weight, shell strength, haugh unit, yolk lipid, yolk cholesterol ratio and yolk total poly unsaturated fatty acids. The presence of culban seed in feed has negative effects on the overall performance of laying hens, mortality, internal and external quality of eggs. Therefore, in alternative protein sources Culban seed. Therefore Culban seed could be recommended as a protein source (up to 20%) for laying hen diets.

Keywords: Culban seed (*Vicia peregrina*), Egg characteristics, Egg cholesterol, Egg fatty acids, Laying hen performance.

[DOR: 20.1001.1.16807073.2017.19.3.2.1]

INTRODUCTION

Feed ingredients such as soybean meal increases the cost of poultry feed. In order to reduce high costs, it is necessary to find out locally available alternative protein sources. The culban seed contains approximately 25.31% crude protein, 1.08% methionine, 1.63% lysine and 0.64% tyrosine on a dry matter basis (Buyukcapar, 2012). Besides their feed costs, feedstuffs used in laying hen diets should not have any detrimental effects.

Culban grows in arid climates and seeds are rich in protein and energy. However, culban seed contains condensed tannin that may have negative effects on poultry performance. Condensed tannins are non-water-soluble compounds found in various plants (Jansman, 1993). It forms complex structures with proteins and carbohydrates, therefore decreasing enzyme activity (Dixon and Hosking, 1992; Sharma and Sehgal, 1992; Chi-Fai *et al*., 1997). In order to neutralize anti-nutritional factors, there have been various methods applied such as treatments with water, chemical substances, fermentation and heat (roasting, poaching, steaming etc) (Van Der Poel, 1990). Although autoclaving is very expensive and requires equipment, it is used to eliminate the anti-nutritive factors in seeds (Abeke and Otu, 2008; Kessler *et al.,* 1990). For example, the concentration of condensed tannin in culban seed was reduced from 15.3 to 7.8 g kg^{-1} through autoclaving at 121°C for 10 minutes (Buyukcapar, 2012). Recently large efforts have been directed to

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improve the nutritional quality of cereal grains, particularly to improve the level of essential amino acids as well as protein digestibility (Abdelseed *et al.,* 2011).

The aim of the current study was to determine inclusion rate and effect of raw, heat treated and enzyme added culban seed (*Vicia peregrina*) as protein source on the hens performance along with egg quality characteristics, yolk lipid content, total fatty acids and cholesterol contents in egg.

MATERIAL AND METHODS

Birds Design and Diet

This research was carried out in the Poultry House of Experimental Animals of Kahramanmaraş Sutcu Imam University, Turkey. Seventy Lohmann brown laying hens (32 weeks age) were used with 10 replications in each treatment group. The hens were accommodated one per cage in a 520 cm^2 cage in an environmentally controlled house, illuminated with a 16.5:7.5 light-dark cycle and were provided with feed and water ad-libitum. The experiment lasted sixty three days.

Experiments were planned according to randomized design model. Animals belonging to the control group were fed culban and enzyme free diet. Treatment groups were distributed according to culban seed content (10 or 20%), heat treatment (raw or autoclaved) and enzyme supplementation (supplemented or no enzyme) therefore six different treatment groups and one control group were generated. The seven groups were as follows: Group I is control; Group II fed 10% culban seed containing diet; Group III fed 10% autoclaved culban seed containing diet; Group IV fed 20% culban seed containing diet; Group V fed autoclaved 20% culban seed containing diet; Group VI fed 10% autoclaved culban seed and enzyme supplementation containing diet and, Group VII 20% autoclaved culban seed and enzyme supplementation containing diet. The experimental diet arrangement included the diet supplemented with 1 g kg^{-1} of enzyme preparation (Bacozymex Full Layer, Agrifood Products Co, Ankara, Turkey, contained: Endo-1,4-beta-xylanase (xylanase), endo-1,4-beta-glucanase (cellulase), endo-1,3(4)-beta-glucanase (beta-glucanase), phytase (Natuphos 10.000 G), bacillolysin (protease), alpha-amylase). The culban seed was ground to pass in a mill with a hole diameter of 2 mm screen and then subjected to autoclave at 121ºC for 10 minutes and at 15 lb pressure.

Ingredient of diets (corn grain, soybean meal, sunflower meal and culban seed) were subjected to wet chemistry analyses of dry matter, crude protein, crude fat, crude cellulose, ash, total sugar and starch (Table 1). The metabolic energy contents of ingredients of diets were estimated using formula *[ME (Kcal kg^{-1})= 38 × [(1×crude protein, g kg^{-1})+(2.25×crude fat, g kg^{-1})+(1.1×starch, g kg^{-1})+(1.05×sugar, g kg^{-1})+53]* suggested by Carpenter and Clegg, (1956). The crude protein, sugar, crude fat

Table 1. The chemical composition and metabolisable energy contents of the feedstuffs.[a]

Ingredients	DM[a] (%)	CP [b] (%)	EE[c] (%)	CC[d] (%)	Ash (%)	Sugar (%)	Starch (%)	ME [e]
Corn	88.04	8.32	3.62	1.72	1.40	1.60	55.12	3046.52
Soybean meal	88.90	49.36	2.43	2.85	7.10	8.50	0.12	2480.61
Sunflower meal	90.00	34.60	2.45	19.35	7.00	5.70	0.12	1809.72
Culban seed	91.42	22.47	1.02	7.86	3.76	4.60	33.78	2589.60
Crude soy oil	ND[f]	ND	99,88	ND	ND	ND	ND	8990.00

[a] Dry Matter (%); [b]Crude Protein(%);[c]Ether Extract (%);[d] Crude Cellulose(%);[e] Metabolisable Energy (kcal kg^{-1}), [f] Not Detected.

[DOR: 20.1001.1.16807073.2017.19.3.2.1]

and starch contents of the feedstuffs were analyzed according to the methods of AOAC 960.52, 923.09, 920.39 and 969.11, respectively (AOAC, 2005). The crude cellulose contents were analyzed according to the Gerhardt Fibrebag system. Corn, soybean, sunflower, culban seed and crude soy oil were used in different rations.

Feedstuffs used in this study were analyzed at the beginning of the experiment. Metabolize energy contents and some feeding criteria of feed ingredients are shown in Table 1. The culban seeds contain 22.47% crude protein, 1.02% crude fat, 7.86% crude cellulose, 3.76% crude ash, 4.6% sugar, 33.78% starch and 2589.6 kcal apparent metabolic energy kg^{-1} (Table 1).

Experiments were designed to understand heat and enzyme treated culban seed addition on ration. Seven different rations were prepared using chemical features, determined feedstuffs and their contents are given in Table 2. Crude protein and metabolisable energy content of rations were

Table 2. Ingredients and analyzed chemical composition of the experimental diets (g kg^{-1}).

	Feedstuffs[a]	Control	Raw culban seed		Autoclaved culban seed		Enzyme supplemented autoclaved culban seed	
		Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII
a)	Corn	544.02	488.48	417.77	488.48	417.77	487.48	416.77
	Soybean meal	191.93	153.82	121.71	153.82	121.71	153.82	121.71
	Sunflower meal	110.00	110.00	110.00	110.00	110.00	110.00	110.00
	Culban seed	0.00	100.00	200.00	100.00	200.00	100.00	200.00
	Crude soy oil	50.64	52.32	56.88	52.32	56.88	52.32	56.88
	Enzyme	0.00	0.00	0.00	0.00	0.00	1.00	1.00
	DCP	15.03	7.47	6.31	7.47	6.31	7.47	6.31
	Limestone	81.06	82.0	82.33	82.00	82.33	82.00	82.33
	Lysine	1.80	0.76	0.00	0.76	0.00	0.76	0.00
	Methionine	0.52	0.15	0.00	0.15	0.00	0.15	0.00
	Salt	2.50	2.50	2.50	2.50	2.50	2.50	2.50
	V+M premix	2.50	2.50	2.50	2.50	2.50	2.50	2.50
	Total	1000	1000	1000	1000	1000	1000	1000
b)	Dry matter (%)	89.50	89.72	90.06	89.72	90.06	89.63	89.97
	Crude protein (%)	17.90	17.80	17.80	17.80	17.80	17.90	17.90
	Metabolisable Energy	2802.0	2802.9	2803.0	2802.9	2803.0	2802.0	2802.0
	Crude fat (%)	7.76	7.74	7.96	7.74	7.96	7.74	7.96
	Crude ash (%)	11.88	11.35	11.34	11.42	11.34	11.42	11.40
	Crude cellulose (%)	3.61	4.19	4.76	4.19	4.76	4.19	4.76
					calculated			
c)	Calcium (%)	3.50	3.38	3.38	3.38	3.38	3.46	3.48
	Total P (%)	0.62	0.58	0,58	0.58	0.58	0,62	0.63
	Lysine (%)	0.97	0.97	0.98	0.97	0.98	0.98	0.98
	Methionine (%)	0.37	0.36	0.36	0.36	0.37	0.37	0.38

[a] Enzyme: Bacozymex Full Layer; DCP: Dicalcium Phosphate; V+M: Vitamin+Mineral Premix; (group I; control), %10 Raw Culban Seed (group II), %20 Raw Culban Seed (group III), %10 Autoclaved Culban Seed (group IV), %20 Autoclaved Culban Seed (group V), %10 Autoclaved Culban Seed +Enzyme (group V1), %20 Autoclaved Culban Seed +Enzyme (group VI), ME: Metabolisable Energy (Kcal kg^{-1}); P: Phosphorus.

Contains per 2.5 kg. Powder vitamin+Mineral premix= Vitamin A 12000000 IU; Vitamin D3 2000000 IU; Vitamin E 35000 mg; Vitamin K_3 5000 IU; Vitamin B_1 3000 mg; Vitamin B_2 6000 mg; Vitamin B_6 5000 mg; Vitamin B_{12} 15 mg; Vitamin C 50000 mg; D-Biotin 45 mg; Niacin 20000 mg; Calcium D Pantothenate 6000 mg; Folic Acid 750 mg; Choline Chloride 125000 mg; Manganese 80000mg; Iron 60000 mg; Zinc 60000 mg; Copper 5000 mg; Iodine 1000 mg; Cobalt 200 mg; Selenium 150 mg; Canthaxanthin 20000 mg, ß-apo-8'-carotenoic acid ethyl ester 5000 mg.

adjusted to equal level in different rations. Also methionine and lysine content of rations were equalized when rations were prepared (Table 2).

Data Collection and Analysis

The hens were weighed at 32 and 41 weeks of age. Feed consumption, feed efficiency and egg weight were recorded weekly. Feed conversion ratio was calculated as kg feed: kg egg. The hen-day egg production was recorded daily. The laying rate (egg number hen^{-1} d^{-1}), egg weight (g), egg mass and feed intake (g hen^{-1} d^{-1}) were measured for each replicate. The survival rate (%) was calculated by the number of live hens at the end of the experiment divided by the number of hens at the initiation of the experiment.

Egg quality characteristics (shelled egg weight, shell weight, shell thickness, shell breaking strength, egg shape index, yolk index, albumen index, haugh unit, yolk color fan value) were assessed four times along treatment. Egg yolk index and albumen index were measured using digital compass and tripod micrometer. The yolk color measurements were determined by DSM Yolk Colour Fan. The egg quality measurements were carried out as cited by Al-Harti and Attia (2015).

Egg yolk cholesterol contents were analyzed according to the method (Boehringer Manheim Gmbh Biochemica, 1989) and yolk fatty acids profile method Folch *et al.,* (1957) at 42nd day of study.

One-way analysis of variance was carried out to determine the effect of raw and heat treated culban seed on the performance along with egg internal and external characteristics. Significant differences between individual means at $P< 0.05$ were identified using the Duncan multiple range tests.

RESULTS AND DISCUSSION

The effect of raw and heat treated culban on the hens performance is given in Table 3. Hens fed with different rations were in health and there was no mortality during the experiment period. Thus ration supplementations with culban seed have detrimental effects on survival rate of the laying hens.

The raw and heat treated culban had no significant effects on the final body weight (P> 0.05). This result is not in agreement with findings of Karaman *et al.* (2009) who found that supplementation culban seed had a significant effect on the final live weight and weight gain of Japanese quails. Treatment had a significant effect on the feed intake (P< 0.05). Raw culban seed addition to diets decreased feed intake (Table 3) due to anti nutritive factors in raw culban seed such as condensed tannin.

Heat treated (autoclaving) culban seed improved the feed intake of hens. When

Table 3. The effect of raw and heat treated culban seed on the performance of laying hens (n= 10).

Groups	In W, [a] (g)	Fi W [b] (g)	FI [c] (g hen^{-1})	FCR [d]	EPR [e] (%)
Control	1822.7± 29.63	1762.3± 31.38	104.32± 2.98[a]	1.63±0.05[bc]	86.51± 3.01[a]
10% RCSM [f]	1809.1± 33.25	1646.9± 47.93	88.25± 4.79[cd]	1.38±0.06[c]	77.14± 3.84[ab]
20% RCSM	1815.9±33.14	1671.6±36.98	85.33± 4.04[d]	1.47±0.05[a]	67.78± 4.15[b]
10% ACSM [g]	1900.8±40.98	1748.8±38.06	100.64 ±2.25[ab]	1.58±0.05[bc]	84.92± 2.58[a]
20% ACSM	1818.1± 25.91	1735.0±44.58	100.22±3.79[ab]	1.68±0.07[b]	82.22± 3.07[a]
10% ESACSM [h]	1822.3± 23.25	1740.3± 54.99	99.40± 4.99[abc]	1.53±0.06[bc]	81.74± 4.29[a]
20% ESACSM	1784.0± 47.79	1663.7 ±63.89	92.01± 3.36[bcd]	1.55±0.07[bc]	76.67± 3.70[ab]

[abcd] Column means with common superscript do not differ (P> 0.05).
[a] Initial body Weight (g); [b] Final body Weight (g); [c] Feed Intake (g); [d] Feed Conversion Ratio; [e] Egg Production Rate (%); [f] Raw Culban Seed Meal; [g] Autoclaved Culban Seed Meal, [h] Enzyme Supplemented Autoclaved Culban Seed Meal.

control diet group was compared with heat treated culban seed added group, no significant differences were observed. Enzyme supplementation had also no significant effect on feed intake of laying hens when compared to the same groups without enzyme supplementations (P> 0.05). The supplementation of raw culban seed significantly decreased the average egg productivity (P< 0.01).

Average egg production from the beginning to end of the trial was 86.5% for control group whereas egg productivity for raw culban containing group (group 3) was 67.7%. Egg productivity changes were statistical differences between the groups (P< 0.01). Reduction level of egg production could be explained with decrease in feed intake. On the other hand, heat treatment of culban seed improved egg production. When results presented in Table 3 were analyzed feed consumptions were reduced between 12 and 15 g daily in 10 and 20% raw culban contained group. Raw culban addition to rations decreased feed intake possibly due to anti-nutritive factors in raw culban seed such as condensed tannin. Alternatively heat treatment of culban seeds improved the feed intake of hens. Enzyme supplementation had also no substantial effect on feed intake parameter of laying hens compared to the same groups without enzyme supplementations (P> 0.05). Feed conversion ratio was significantly different (P< 0.01) when control group was compared with 20% culban seed added group. These differences could be explained with high feed consumption and egg weight in the control group.

The effect of raw and heat treated culban addition on the egg quality parameters are given in Tables 4 and 5. Treatment had no significant (P> 0.05) effect on the shell thickness, egg shape index, yolk index, yolk color fan value and yolk weight of the laying hens. On the other hand treatment had a significant (P< 0.05) effect on the shelled egg weight, shell weight, shell breaking strength, albumen index, haugh unit, yolk lipid, yolk total polyunsaturated fatty acids and yolk cholesterol amounts. The albumen index value is a crucial parameter and this analysis indicates freshness of eggs. Depending on feedstuffs, albumen index was higher when culban seed was the added ration. This could be explained with tannin content of culban seed.

When shelled egg weight was analyzed according to different treatments, significant differences were detected between groups (P< 0.01). It is thought that this may be related to live weight and feed consumption. The heavier laying hens consume more feed and eggs of these laying hens which might be heavier (Pérez-Bonilla *et al.,* 2012). Eggshell weight differences between treatment groups were significant (P< 0.01). Feed consumption was lower in the groups with high level culban seed meal (20% raw and autoclaved). The reduction of the thickness of the shell is believed to be associated with feed intake level. A balanced

Table 4. The effect of raw and heat treated culban on the egg quality characteristics (n= 10).

Groups	SEW [a]	SW [b]	ST [c]	ES [d]	ESI [e]
Control	64.19±1.09 [a]	8.70±0.26 [a]	0.42±0.01	2.03±0.19 [a]	78.50± 0.58
10% RCSM [f]	64.14± 1.85 [a]	8.29±0.25 [ab]	0.39±0.01	1.45±0.17 [b]	78.60± 0.64
20% RCSM	57.84± 1.40 [b]	7.56±0.21 [c]	0.37±0.01	1.54±0.13 [ab]	79.50± 0.58
10% ACSM [g]	63.67± 1.15 [a]	8.39±0.14 [ab]	0.39±0.01	1.87±0.14 [ab]	79.40± 0.48
20% ACSM	59.62± 1.18 [b]	7.93±0.15 [bc]	0.39±0.00	2.02±0.15 [a]	79.70± 0.45
10% ESACSM [h]	64.78± 1.38 [a]	8.25±0.20 [ab]	0.38±0.01	1.68±0.15 [ab]	79.60± 0.50
20% ESACSM	59.65± 1.31 [b]	8.28±0.24 [ab]	0.46±1.02	1.95±0.16 [a]	78.70± 0.68

[abc] Row means with common superscript do not differ (P> 0.05). [a] Shelled Egg Eeight (g); [b] Shell Weight (g); [c] Shell Thickness (mm); [d] Eggshell Strength (kg cm^{-2}); [e] Egg Shape Index (%); [f] Raw Culban Seed Meal; [g] Autoclaved Culban Seed Meal; [h] Enzyme Supplemented Autoclaved Culban Seed Meal.

Table 5. The effect of raw and heat treated culban on the other egg quality characteristics (n= 10).[a]

Groups	AI [a]	YI [b]	HU [c]	CFV [d]	EYW [e]
Control	11.26± 0.76[ab]	47.54± 0.69	89.85± 2.30[ab]	10.80± 0.13	14.63± 0.42
10% RCSM [f]	13.06± 0.64[a]	48.88± 1.05	94.86± 1.91[a]	10.70± 0.15	14.27± 0.27
20% RCSM	12.92± 0.53[a]	48.07± 0.46	94.40± 1.31[a]	10.90± 0.23	14.05± 0.27
10% ACSM [g]	10.76± 0.37[b]	47.82± 0.65	88.38± 1.08[b]	10.60± 0.16	15.22± 0.29
20% ACSM	11.27± 0.63[ab]	50.61± 2.24	89.93± 1.84[ab]	10.90± 0.10	14.35± 0.15
10% ESACSM [h]	12.05± 0.40[ab]	48.79± 0.71	91.81± 0.86[ab]	11.00± 0.15	14.27± 0.37
20% ESACSM	10.89± 0.67[b]	47.70± 0.58	88.85± 1.97[b]	10.90± 0.10	14.42± 0.34

[ab] Row means with common superscript do not differ (P> 0.05). [a] Albumen Index (%);[b] Yolk Index (%); [c] Haugh Unit; [d] Color Fan Value (DSM); [e] Egg Yolk Weight (g); [f] Raw Culban Seed Meal; [g] Autoclaved Culban Seed Meal, [h] Enzyme Supplemented Autoclaved Culban Seed Meal.

organic and inorganic mineral is important for eggshell strength. The reduction in feed consumption was accompanied by a decrease in eggshell strength. Depending on Culban seed proportion, yolk color value (DSM Color Fan) ranged from 10.6 to 11.0 (Table 5) but this difference was not statistically significant (P> 0.05).

The effect of raw and heat treated culban on yolk fat content, total fatty acids and cholesterol contents were given in Table 6. Treatment had no significant effect on the yolk weight, yolk total saturated fatty acids, total unsaturated fatty acids and total mono-unsaturated fatty acids (P> 0.05). On the other hand treatment had a significant effect on yolk raw oil, PUFA and yolk cholesterol contents (P< 0.05). It is well known that the amount of saturated-unsaturated fat in rations reflect the egg composition. Thus, diet composition has a critical effect on fatty acid composition.

Polyunsaturated and total unsaturated fatty acid level of culban seed was analyzed and found 39.47 and 70.07% respectively (Results are not shown in the Tables). The egg yolk of hens fed rations including culban seed had more polyunsaturated fatty acids than the control group. The unsaturated fatty acid composition of the eggs from culban seed fed was insignificantly higher than egg collected from the control group. The unsaturated fatty acid content of the eggs was higher

Table 6. The effect of raw and heat treated culban on the crude fat, fatty acids and cholesterol content of the egg (n= 3).

Groups	Yolk lipid (%)	SFA [a]	UFA [b]	MUFA [c]	PUFA [d]	SECA [e]
Control	28.75± 0.15[a]	32.36±1.13	64.85 ±1.00	38.73±1.29	26.12±0.52[b]	277.74±10.32[a]
10% RCSM [f]	27.50±0.43[bc]	31.46±0.28	65.38 ± 0.28	37.22±0.09	28.16±0.21[a]	259.11±14.21[ab]
20% RCSM	27.95±0.18[abc]	30.68±0.13	65.53 ± 0.14	36.30±0.93	29.23±0.82[a]	239.95±6.87[bc]
10% ACSM [g]	28.50±0.40[ab]	31.63±0.34	65.52 ± 0.48	37.95±0.04	27.57±0.48[ab]	210.74±12.64[cd]
20% ACSM	28.23±0.39[abc]	31.48±0.54	65.55 ± 0.32	37.85±0.19	27.70±0.46[ab]	220.48±2.80[cd]
10% ESACSM [h]	28.63±0.44[a]	31.91±0.33	65.19 ± 0.37	37.41±0.05	27.78±0.40[ab]	208.30±8.88[d]
20% ESACSM	27.19±0.16[c]	29.85±1.23	67.27 ± 1.05	37.98±1.60	29.29±0.57[a]	218.47±4.10[cd]

[abcd] Row means with common superscript do not differ (P> 0.05). [a] Total Saturated Fatty Acids (%); [b] Total Unsaturated Fatty Acid (%); [c] Total Mono Unsaturated Fatty Acids (%); [d] Total Poly Unsaturated Fatty Acids (%); [e] Shelled Egg Cholesterol Amount (mg); [f] Raw Culban Seed Meal; [g] Autoclaved Culban Seed Meal, [h] Enzyme Supplemented Autoclaved Culban Seed Meal.

[DOR: 20.1001.1.16807073.2017.19.3.2.1]

than the total unsaturated fatty acid content of the control group egg. It was believed that the individuals with cardiovascular diseases might prefer eggs rich in unsaturated fatty acids. Culban seed may enhance functional egg production due to its fat composition. Egg yolk polyunsaturated fatty acid content in culban seed added group was higher than control group (Table 6). High polyunsaturated fatty acid containing functional egg production could be suggested for people suffering from cardiovascular disorders**.** Consumption of polyunsaturated fatty acid has been reported to reduce the risk of arteriosclerosis and stroke (Lada and Rudel, 2003).

The cholesterol and fatty acid contents of eggs varied depending on the ration composition. The egg yolk amount in the culban seed groups had lower cholesterol (208.30 mg) content than that of the control group (277.74 mg). This result is similar with previous studies (Guenter *et al.,* 1971; Leeson *et al.,* 1998). This decrease in cholesterol amount is remarkable, being more obvious in groups fed autoclaved culban seed in particular (Table 6). It is reported that the phenolic compounds and PUFA of the culban seed cause the decrease in yolk cholesterol (Laudadio *et al.,* 2015).

CONCLUSIONS

Our experimental results conclude that diets containing raw Culban seed decreased the feed consumption and egg production in laying hens. Whereas the diets containing autoclaved Culban seed meal increased the feed consumption and egg production of laying hens. Heat treated culban seeds could be compensated as expensive protein sources in laying hens. Heat treated Culban seed could be used up to 20% of diet as an alternative protein source for laying hens without any adverse effects. This locally available protein source culban is an alternative to soybean and it will reduce feeding costs considerably. Enzyme addition to ratio did not have positive effects on egg productivity. Also further studies must be applied to culban use with enzyme addition.

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[DOR: 20.1001.1.16807073.2017.19.3.2.1]

اثر دانه ماشک (*Vicia Peregrina* L.) بر عملکرد و ویژگی های تخم مرغ در مرغ های تخمگذار

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چکیده

در این مطالعه اثر دانه ماشک (*Vicia peregrina*) بر وزن بدن، مصرف خوراک، بازه خوارک، تولید تخم مرغ، ویژگی های کیفی تخم مرغ، سطح اسید چرب و میزان کلسترول در زرده در مرغ های تخم گذار بررسی شد. آزمایش شامل ۷ گروه تیمار با ۱۰ تکرار شامل یک مرغ تخم گذار در هر هفته و ۳۲ هفته بود و با ۷۰ مرغ انجام شد. جیره غذایی مرغ ها حاوی ۱۰ و ۲۰٪ کنجاله دانه ماشک به صورت خام و اتوکلاو شده بود. همچنین فرم اتوکلاو شده با آنزیم (Bacozymex) غنی شد. یک گروه هم به عنوان شاهد با رژیم غذایی بدون کنجاله دانه ماشک در نظر گرفته شد. آزمایش ۶ روز و با ۱۶.۵ ساعت رو شنایی و ۷.۵ ساعت تاریکی انجام شد. مکمل با دانه ماشک اثر قابل توجهی بر مصرف خوراک، ضریب تبدیل غذایی، تولید تخم مرغ، شاخص سفیده تخم مرغ، وزن تخم مرغ، وزن و

مقاومت پوسته، واحد haugh، میزان چربی زرده، نسبت کلسترول زرده و پلی اسیدهای چرب غیر اشباع زرده کل داشت. حضور دانه ماشک در خوراک هیچ گونه اثر منفی بر روی عملکرد کلی مرغ تخمگذار، مرگ و میر، کیفیت داخلی و خارجی تخم مرغ نداشت. از این رو منابع پروتئینی جایگزین دانه ماشک در رژیم غذایی مرغ می تواند بالاتر از ۲۰ درصد باشد.

[DOR: 20.1001.1.16807073.2017.19.3.2.1]