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Effects of Hen Age and Force Molting Programs on Production Performances during Postmolt Period in Laying Hens

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ABSTRACT

The aim of this study was to determine the effects of hen age and force molting programs on the production performance during postmolt period. The experiment was conducted using 320 Hy-Line W36 hens (63 and 75 week of age) randomly assigned to experimental groups (five replicates of 8 hens for each treatment). The experimental design of the study was a 2 × 4 factorial arrangement in a completely randomized block design. Eight treatments were compared in with 2 age groups (63 and 75 week of age) and 4 force molting treatments [feed withdrawal (FW), 100% alfalfa (A), 50% alfalfa and 50% oat (AO), and 100% oat (O)]). Hens molted by AO and O returned to egg production faster than hens molted by FW. The hen age had no significant effect on egg production, egg weight, feed consumption, feed efficiency and liability during postmolt period. There were no significant differences in egg production, egg weight, feed consumption, feed efficiency and livability between feed withdrawal and non-feed withdrawal methods during postmolt period. The results of this study indicated that the producer may prefer to induced molting depend on egg prices between 63 and 75 week of age. In addition, non-feed withdrawal methods can be used successfully as an alternative to feed withdrawal methods.

Key words: Laying hens, force molting, Alfalfa, oat, production performances

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INTRODUCTION

Induced molting is a process frequently used in commercial laying facilities that extend the productive life of hens. Feed withdrawal for a period of 7 to 14 days is the most common method for inducing molt. It has been shown that this period of feed withdrawal may cause a deleterious effect on hens including increased colonization of *Salmonella enteritidis* and decrease immune function (Keshavarz, 2002). For this reason, researchers have examined alternative molting methods to FW programs. These methods included high zinc concentrations (Sarica *et al*., 1996; Yilmaz and Sahan, 2003), low sodium concentrations (Berry and Brake, 1985), wheat middling (Biggs *et al*., 2003), barley (Onbasilar and Erol, 2007), cottonseed meats (Davis *et al*., 2002), Jojoba meal (Vermaut *et al*., 1997), Alfalfa (Donalson *et al*., 2005; Landers *et al*., 2005a; Aygun and Olgun, 2010; Aygun, 2013), oat (Kocak *et al*., 1980; Yetisir *et al*., 1985; Tona *et al*., 2002; Aygun and Yetisir, 2009), guar meal (Gutierrez *et al.,* 2008), fungus myceliated meal (Willis *et al*., 2009), and soybean hulls (Dickey *et al.,* 2012) which have been successfully used for induced molting. The feedstuff which used for alternative induced molting has usually insoluble plant fiber and low energy (alfalfa, cottonseed, grape pomace, and wheat middlings).

Alfalfa has very high in crude fiber (20-24%), a moderate protein level (17-20 %) and low metabolizable energy (1200-1600 kcal/kg) (NRC, 1994). The oat has got insoluble high fiber (10-11%) and moderate energy (2500 kcal/kg) (NRC, 1994), for this reason, it may be used easily for alternative induced molting.

The aim of this study was to determine the effects of hen age and force molting programs on the production performances during postmolt period.

MATERIALS AND METHODS

A total of 320 Hy-Line W36 laying hens (63 and 75 week of age) were obtained from the Research and Application Farm at the Faculty of Agriculture at Selcuk University (Konya, Turkey). Hens were placed four hens per cage (500 cm^2/hen), and 2 wk were allowed for acclimation. During this time the hens were fed a layer diet (Table 1) and the photoperiod was 16L:8D. After the acclimation, the hens were randomly assigned to experimental groups (five replicates of 8 hens for each treatment). The experimental design of the study was a 2 × 4 factorial arrangement of a completely randomized block design. Eight treatments were compared in a 2 x 4 factorial arrangement with 2 age treatment (63 and 75 week of age) and 4 force molting treatments [feed withdrawal (FW), 100% alfalfa (A), 50% alfalfa and

50%oat (AO), and 100% oat (O)]). The respective diet and water were allowed *ad-libitum*, and hens were placed on an artificial lighting program of 8L:16D during the 10 d molt period (Donalson *et al.*, 2005; Petek *et al.*, 2008; Aygun and Olgun, 2010; Aygun, 2013). At 11 d, all hens were fed a layer diet (Table 1) and the lighting program was changed to 16L:8D.

Egg production performances were measured for 36 week after molting. Egg production and mortality were recorded daily throughout during postmolt period. Egg weight was weekly measured on all eggs produced on two consecutive days. Egg weight was measured using an electronic digital balance and was recorded to the nearest 0.01 g. Egg mass (g egg/ hen per day) calculated using hen-day egg production and average egg weight. Feed consumption (g/hen per day) was measured every week from 1 to 36 week. Feed efficiency (g of feed/ g of egg) was calculated using egg weight and feed consumption.

Table 1: Composition of the diet

Item (%, unless noted)	Amount
Ingredient	
Corn, yellow	62.41
Soybean meal, 47%	18.63
Sunflower meal, 35%	2.50
Vegetable oil	2.80
Limestone	11.50
Dicalcium phosphate	1.30
Salt	0.35
Vitamin premix[1]	0.15
Mineral premix[2]	0.10
Lysine	0.08
DL-Methionine	0.18
Total	100
Calculated value	
CP	15.00
ME (kcal/kg)	2800.0
Ca	4.30
Available P	0.34
Lysine	0.80
Methionine	0.38
Methionine + cystine	0.67
Threonine	0.56
Tryptophan	0.17

[1]Vitamin premix supplied per kilogram of diet: Vitamin A, 8 000 IU; vitamin D3, 2 200 IU; vitamin E, 13 IU; vitamin K3, 3 mg; vitamin B1, 2 mg; vitamin B2, 5 mg; vitamin B6, 3 mg; vitamin C, 50 mg; calcium D-pantothenate, 7 mg; nicotine acid, 17 mg; D-biotin, 0.3 mg; folic acid, 0.67 mg; vitamin B12, 10 mg; [2]Mineral premix supplied per kilogram of diet: Copper, 5 mg; iron, 60 mg; manganese, 100 mg; zinc, 60 mg; selenium, 0.15 mg; cobalt, 0.50 mg; choline, 125 mg.

Table 2: Effects of hen age and force molting programs on onset of egg production during postmolt period

		Onset of egg production (day)
Age (week)	63	11.45
	75	11.55
SEM		***0.23***
P- value		***>0.05***
Molting Programs	FW	12.50[a]
	A	12.00[ab]
	AO	10.80[b]
	O	10.70[b]
SEM		***0.32***
P- value		***<0.01***
63 week	FW	12.40
	A	12.00
	AO	10.40
	O	11.00
75 week	FW	12.60
	A	12.00
	AO	11.20
	O	10.40
SEM		***0.46***
P- value		***>0.05***

FW: Feed withdrawal, A: Alfaalfa, AO: 50% Alfalfa + 50% Oat, O: Oat; SEM: Standard error of the mean

Statistical Analysis

All data were analyzed using the general linear model (GLM). The least significant difference (LSD) test was applied to detect statistically significant differences between groups. All analyses were carried out using Minitab Version 14 (Minitab Inc., State College, PA, USA).

RESULTS AND DISCUSSION

Onset of Egg Production

The effects of hen age and force molting programs on date of reentry into egg production are shown in Table 2. No significant differences were found between 63 week (11.45 d) and 75 week (11.55 day) age in onset of egg production. Hens molted by O (10.70 day) and AO (10.80 day) returned to egg production significantly faster than hens that were molted by FW (12.50 day) treatment. This result consistent with the finding by Landers *et al.* (2005a) who reported that hens molted by alfalfa pellet reentered production significantly faster than that molted by feed deprivation, but Donalson *et al.* (2005) stated that there were no significant differences found between alfalfa meal and feed withdrawal treatments when days to first egg. The earlier hens enter the rest period, and the sooner they will reenter to egg production (North and Bell, 1990).

Egg Production and Cracked Egg

The effects of hen age and force molting programs on egg production (hen-day, % and hen-housed, %) and cracked egg are depicted in Table 3. The age had no significant effect on egg production (hen-day, % and hen-housed, %) and cracked egg (hen-day, %) during postmolt period. There were no significant differences in hen-day (%) egg production among FW (68.85%), A (68.49%), AO (70.86%) and O (67.88) treatments. This results agree with the findings of Biggs *et al.* (2003), Yilmaz and Sahan (2003), Donalson *et al.* (2005), Aygun and Yetisir (2009), and Mazzuco *et al.* (2011) who stated that no significant difference in egg production were found between non-feed withdrawal treatments and feed withdrawal treatment during postmolt period. Also, no significant differences in hen-house percentage egg production among FW (63.80%), A (63.30%), AO (67.20%), and O (63.60%) treatments. There were no significant difference in cracked egg among FW (0.85%), A (0.93%), AO (1.00%) and O (1.09%) treatments. This finding did agree with results reported previously by Aygun and Yetisir (2009), Mazzuco *et al.* (2011) who stated that no differences were observed in cracked egg between feed withdrawal treatment and noon-feed withdrawal treatment during postmolt period. Cracked eggshells are a major economic loss to the egg industry (Stadelman, 1995).

Table 3: Effects of hen age and force molting programs on egg production and cracked egg during postmolt period

		Hen-day egg prodcution (%)	Hen-housed egg production (%)	Cracked egg (%)
Age (week)	63	69.42	65.20	0.97
	75	68.62	63.75	0.97
SEM		*1.20*	*1.56*	*0.08*
P- value		*>0.05*	*>0.05*	*>0.05*
Molting Programs	FW	68.85	63.80	0.85
	A	68.49	63.30	0.93
	AO	70.86	67.20	1.00
	O	67.88	63.60	1.09
SEM		1.69	*2.20*	0.12
P- value		*>0.05*	*>0.05*	*>0.05*
63 week	FW	70.26	65.20	0.85
	A	68.67	64.00	0.77
	AO	70.70	69.60	1.06
	O	68.05	62.00	1.19
75 week	FW	67.43	62.40	0.85
	A	68.31	62.60	1.09
	AO	71.01	64.80	0.94
	O	67.71	65.20	0.99
SEM		2.39	3.11	0.17
P- value		*>0.05*	>0.05	*>0.05*

FW: Feed withdrawal, A: Alfaalfa, AO: 50% Alfalfa + 50% Oat, O: Oat; SEM: Standard error of the mean

Table 4: Effects of hen age and force molting programs on egg weight and egg mass during postmolt period.

		Egg weight (g)	Egg mass (g egg/ hen per day)
Age (week)	63	65.47	45.45
	75	65.52	44.96
SEM		*0.23*	*0.82*
P- value		*>0.05*	*>0.05*
Molting Programs	FW	65.04	44.78
	A	65.77	45.07
	AO	65.52	46.43
	O	65.65	44.56
SEM		0.32	1.16
P- value		*>0.05*	*>0.05*
63 week	FW	65.18	45.79
	A	65.31	44.88
	AO	65.52	46.32
	O	65.87	44.82
75 week	FW	64.91	43.77
	A	66.23	45.25
	AO	65.51	46.53
	O	65.43	44.30
SEM		0.45	1.63
P- value		*>0.05*	*>0.05*

FW: Feed withdrawal, A: Alfaalfa, AO: 50% Alfalfa + 50% Oat, O: Oat; SEM: Standard error of the mean

Egg Weight and Egg Mass

The effects of hen age and force molting programs on egg weight and egg mass are illustrated in Table 4. Neither egg weight nor egg mass was affected by hen age during postmolt period. There were no significant difference in egg weight among FW (65.04 g), A (65.77 g), AO (65.52 g), and O (65.65 g) treatments during postmolt period. These findings do agree with Yilmaz and Sahan (2003), Biggs *et al.* (2004), Park *et al.* (2004), Landers *et al.* (2005a), Aygun and Yetisir (2009), Aygun and Olgun (2010), who reported that no significant differences in egg weight were found between non-feed withdrawal treatment and feed withdrawal treatment during postmolt period. Conversely, Petek (2001) and Landers *et al.* (2005b) reported that egg weight were significantly higher for non-feed withdrawal treatment when compared with feed withdrawal treatment during postmolt period. During the postmolt period, hens in the non-feed withdrawal treatments had similar egg mass as the feed withdrawal treatment. This result is consistent with other investigations on egg mass (Biggs *et al.,* 2004; Wu *et al.,* 2007; Khajali *et al.,* 2008; Aygun and Yetisir, 2009).

Table 5: Effects of hen age and force molting programs on feed consumption and feed efficiency during postmolt period

		Feed consumption (g/hen per day)	Feed efficiency (g of feed/g of egg)
Age (week)	63	118.4	1.81
	75	118.3	1.79
SEM		*1.11*	*0.02*
P- value		*>0.05*	*>0.05*
Molting Programs	FW	116.5	1.79
	A	117.8	1.76
	AO	118.8	1.81
	O	120.3	1.83
SEM		1.57	0.02
P- value		*>0.05*	*>0.05*
63 week	FW	115.7	1.78
	A	118.7	1.82
	AO	118.8	1.81
	O	120.3	1.83
75 week	FW	117.3	1.81
	A	116.9	1.71
	AO	118.9	1.82
	O	120.2	1.84
SEM		2.22	0.03
P- value		*>0.05*	*>0.05*

FW: Feed withdrawal, A: Alfaalfa, AO: 50% Alfalfa + 50% Oat, O: Oat; SEM: Standard error of the mean

Feed Consumption and Feed Efficiency

The effects of hen age and force molting programs on feed consumption and feed efficiency are shown in Table 5. The age had no significantly effect on feed consumption and feed efficiency. Feed consumption did not significantly differ among the FW (116.5 g), A (117.8 g), AO (118.8 g) and O (120.3 g) treatments during postmolt period. Similar results were found by Petek (2001), Biggs *et al.* (2003), Biggs *et al.* (2004), Hassanabadi and Kermanshahi (2007), Aygun and Yetisir (2009) in which feed consumption in hens molted with feed withdrawal were not significantly different from hens molted with non-feed withdrawal methods. No significant differences were found among FW (1.79), A (1.76), AO (1.81), and O (1.83) treatments for feed efficiency during postmolt period. Previously reports (Biggs *et al.,* 2003; Biggs *et al.,* 2004; Wu *et al.*, 2007; Aygun and Yetisir, 2009) stated that there were no significant difference between non-feed withdrawal treatments and feed withdrawal treatment for feed efficiency during postmolt period.

Livability

Neither age nor molting programs had significant effect on livability during postmolt period (data not shown). There were no significant differences in livability among FW (86.25%), A (83.75%), AO (92.50%) and O (86.25%) treatments during postmolt period. Wu et al.

(2007) reported no significant differences in mortality between feed withdrawal and non-feed withdrawal methods in second cycle of production.

Conclusion

The results of this study indicated that hen age and molting programs did not affect the production performances during the postmolt period in this experimental condition. The producer may prefer to induce molting depend on egg prices between 63 and 75 week of age. In addition, as non-feed withdrawal methods can be used successfully as an alternative to feed withdrawal methods.

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