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Effect of Force Molting Programs on Egg Production and Quality of Laying Hens

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ABSTRACT

This study was aimed to evaluate the effect of force molting programs on egg production and quality of laying hens. Total of 165 white Bovines laying hens at 72 weeks of age were divided into four groups. Birds in-group 1 (control), birds in group 2, 3 and 4 were fasted for 10, 12 and 15 days, respectively. After fasting days in each group, birds were divided into three sub groups (birds fed on a crushed yellow corn, crushed yellow corn supplemented with minerals and vitamins and birds fed on control diet) for three weeks and then birds fed on control diet until the end of the experimental period. Birds attained the peak of egg production at 138, 150 and 158 days after 10, 12 and 15 days fasting periods, respectively. The hen day egg production and egg mass for all treated groups recorded higher ($p<0.01$) values than those of control, while the egg weight for control group were higher ($p<0.01$) than those of all treated groups. On the other hand, feed conversion for all fasting groups improved ($p<0.01$) more than those of control group. During recovery feeding the feed consumption for birds fed layer ration increased ($p<0.01$) more than those of the birds fed crushed yellow corn and crushed yellow corn with minerals and vitamins. The same trend was followed for eggshell strength. From the present results it can be concluded that fasting white Bovines laying hens for 10, 12 or 15 days to induce moulting improved performance and egg quality as compared with the natural moulting, but recovery feeding after fasting did not have significant effect on hens performance.

Key words: Laying hens performance, force moulting, fasting period, egg quality

INTRODUCTION

The requirements of the human to animal protein are increasing day by day. Thus more researches are needed to increase production and egg quality. Force moulting employed commercially to stop egg production in laying and breeding hens in order to recycle them for another season of egg production. After a molt, the hen's production rate usually peaks slightly below the previous peak rate and egg quality is improved. The point of molting is thus to increase the production, egg quality and profitability of flocks in their second or third laying seasons. Feed withdrawal is the most popular and effective method in molt induction. It has generated several concerns regarding the animal welfare and food safety issues, eventually leading to investigation for alternative approaches (Keshavarz and Quimby, 2002; Webster, 2003; Holt, 2003). Most commercial forced-moulting programmes entail food withdrawal for different periods (Narahari, 2001). McCovan *et al*. (2006) suggest that non-fast induced moulting treatments provide

an effective method for inducing moulting in hens and improving their well-being by minimizing discomfort due to food deprivation. The influence of non-feed removal moulting methods on the weight of ovary, oviduct and skeletal quality of hens was examined too (Yildiz and Alpay, 2008). For a complete recovery of the reproductive tract the hen's body weight must drop 30 to 35 percent during the molt. This is achieved by withdrawing the hen's feed completely for as long as two weeks until they go into molt, which means they lose their feathers and cease to lay eggs in addition to losing weight (El-Azim and Ibrahim, 2005). As well as Alodan and Mashaly (1999) reported that the body weight of the moulted hens decreased significantly to 74.5% of their initial body weight and that the hens were returned to a full feed layer ration *ad libitum* and 16 h of light per day (California method) lost 25% of their initial body weight by day 10 of the experiment.

Research is needed to explore the possibility of utilizing locally available protein resources, especially the greens from plants, to replace the conventional protein-rich concentrate meals. It is common practice by farmers in tropical countries to use small amounts of green feed to protect against possible vitamin deficiencies and to provide unidentified growth factors. Further researches are needed to investigate the withdrawing the hen's feed and recovery feeding on different type of diets. Thus the aim of this study was to evaluate the effect of fasting period and recovery feed on different diets as force molting programs on egg production and egg quality traits of laying hens.

MATERIALS AND METHODS

The present study was carried out at the Poultry Farm in the Department of Animal Production, Faculty of Agriculture, South Valley University (Egypt) 2008. Total of one hundred and sixty five 72 week-old white Bovans hens were used in the experiment. All birds divided into four groups (three fasting treatments and control). The first group (control) had thirty hens divided into six replicates of 5 birds each. While, forty-five hens were in each (the second, third and fourth fasting groups). The birds in groups second, third and fourth were fasted for 10, 12 and 15 days, respectively. After fasting periods the groups included three treatments (a crushed yellow corn, crushed yellow corn supplemented with minerals and vitamins and feed layer ration ad libitum) each treatment divided into 3 replicates and every replicate included 5 birds (30 birds in control group +45 birds 10 days fasting +45 birds in 12 days fasting +45 bird in 15 days fasting = 160 birds) 5 birds in each replicate were kept in wire cage of 61×55×45 cm in a closed system using controlled system. The indoor temperature was 20±2°C during the experimental period. The control group (natural molting) received 17 h of light/day from 72 weeks of age to the end of the experimental period. The fasting groups received 8 h of light/day during the fasting period and this continued until the end of the three weeks after fasting then increased by half an hour for the first week. After that it was increased one hour per week till the lighting reached 17 h per day and this was continued till the end of the experiment. The composition and calculated analysis of the experimental diet are shown in Table 1. Body weight was recorded before the fasting, the end of the fasting period and end of three weeks after fasting period and after the egg production reached 10% production.

Egg production was recorded daily per hen in each cage during the experimental period and hen day egg production for each group was calculated every week. For each hen, after force molting period feed consumption was recorded and calculated weekly. Feed conversion ratio as g feed/g egg mass was calculated weekly. Egg quality measurements were determined monthly using 9 eggs per group till the end of the experiment. The Haugh unit was measured for the internal quality of the eggs. The height, correlated with the weight, determines the Haugh unit. The higher the number,

Table 1: Composition and calculated analysis of the experimental diets

Ingredients	%
Yellow corn	60.90
Soybean meal (44% Cp)	21.60
Corn gluten meal (60%Cp)	6.00
Vit and Min. premix*	0.30
Wheat bran	0.45
Dicalcium phosphate	1.36
Calcium carbonate	8.95
Salt	0.40
DL-methionine	0.04
Total	100.00
Calculated analysis:	
ME (MJ Kg^{-1})	11.58
Crude protein (%)	18.45
Crude fiber (%)	2.68
Crude fat (%)	2.78
Ca (%)	3.87
P (Available, %)	0.38
Lysine (%)	0.85
Methionine (%)	0.40

*Vitamins and minerals premix provided per kilogram of the diet: Vit A, 1000 IU; D3 2000 ICU; Vit E, 10 mg; Vit K, 1 mg; B1, 10 mg; B2, 5 mg; B6, 1500 mg; B12, 10 mg Pantothenic acid, 10 mg; Nicotinic acid, 30 mg; Folic acid, 1mg; Biotin, 50 mcg; Chloride, 500 mg; copper, 10 mg; iron, 50 mg; Manganese, 60 mg; Zinc, 50 mg and Selenium, 0.1 mg

the better the quality of the egg (fresher, higher quality eggs have thicker whites). The test was introduced by Haugh (1937) and is considered the most significant measure of egg quality.

Data were analyzed using a two way Analysis of Variance (ANOVA) to analyze the differences between treatment groups using SAS (1985) General Linear Models procedures. Means were compared using Duncan's multiple range tests. Level of significance used in all results was $p<0.05$ (Duncan, 1955). The statistical model used for analyzing data obtained was:

$$Yijk = U + Fi + Dj + (FD)ij + eijk$$

Where:

Yijk = Observed value of the concerned trait
U = Observed mean for the concerned trait
Fi = The fixed effect due fasting period
Dj = The fixed effect due to the type of diet
(FD)ij = The fixed effect due to the interaction. (Fasting period x type diet)
eijk = Random error

RESULTS AND DISCUSSION

Egg production: Effect of fasting periods on egg production values is presented in Table 2. When feed was withheld to induce a force molt, some eggs were laid for several days before egg production dropped to zero. Egg production was reduced to zero by 5th, 4th and 5th days for hens subjected

Table 2: Egg production affected by force molting

	Fasting days		
Parameter	10	12	15
Zero egg production (day)	5	4	5
Beginning of 2nd cycle (first egg) (day)	20	21	25
50% egg production (day)	43	45	57
Peak of egg production (day)	138	150	158

to 10, 12 and 15 days fasting periods, while the number of days out of egg production were 15, 17 and 20 days for hens subjected 10, 12 and 15 days of fasting, respectively. The present results showed that bird reached to 50% egg production at 43, 45 and 57 days after the fasting phase with 10, 12 and 15 days of fasting, respectively. These results means that the 10 days fasting group reached to 50% egg production at 2 and 14 days earlier than the 12 and 15 days group, while the 12 days fasting group reached to 50% egg production at 12 days earlier than the 15 days group. These results are in agreement with the findings of Carey and Brake (1983) who reported that peak of egg production was attained at 138, 150 and 158 days, while the egg production percentage was peaked at 73, 78 and 76%, respectively after deprivation periods in all 10, 12 and 15 days fasting periods in that order. The differences of peak production was 5% between the 10 and 12 days fasting group in favour of 12 days fasting group, while it was found to be 3% between the 10 and 15 days fasting group, in favour of 15 days. The difference obtained for peak of egg production percentage was 2% between the 12 and 15 days fasting group in favour of 12 days fasting group.

Hen Day Egg Production (HDP): There is insufficient information conducted to evaluate force molting on hen day egg production. The hen day of egg production as affected by the interaction between the recovery feeding and fasting period values are presented in Table 3. The HDP of all fasting groups increased ($p<0.05$) by about 49, 48 and 46% in groups 2, 3 and 4, respectively as compared with control group. However, no significant differences due to recovery feeding or interaction between fasting period lengths were detected among the four groups. These results are in agreement with the findings of Hassanabadi and Kermanshahi (2007) who found that there were no differences observed between feed removal treatment and nonfeed removal treatment for postmoult hen day production

Egg Weight (EW) and Egg Mass (EM): The Egg Weight (EW) and Egg Mass (EM) as affected by the fasting period and recovery feeding are presented in Table 3. The birds of control group had higher ($p<0.01$) Egg Weight (EW) by about 2 to 3% than those of all fasting groups but there were no significant differences among fasting treatments. Similar results were obtained by Christmas *et al.* (1985) who indicated that there was no significant difference in egg weight due to fasting treatments of 4 and 10 days. Birds in fasting groups 2, 3 and 4 had higher ($p<0.01$) egg mass (51, 50 and 48%, respectively) than those of control group. While, non-significant differences were observed in EW and EM due to recovery feeding or interaction between fasting period lengths of the four groups. Hassanabadi and Kermanshahi (2007) who found that there were no differences observed between feed removal treatment and nonfeed removal treatment for postmoult egg weight.

Table 3: Effect of fasting periods and recovery feeding on hen day egg production (HDP)(%), egg weight (gm), Egg Mass (EM), Feed Consumption (FC)and Feed Conversion Ratio (FCR) in white Bovans layer

Items	Hen day egg production (HDP) (%)	Egg weight (gm)	Egg mass (EM)	Feed consumption (FC)	Feed conversion ratio (FCR)
Fasting groups					
Control	32.6±0.74b	61.1±0.4	20.4±0.45b	114.5±0.82a	5.6±0.44a
10 days	48.5±0.87a	59.9±0.80	30.8±0.56a	114.4±0.98b	3.7±0.23b
12 days	47.9±0.08a	59.9±0.67	30.6±0.56a	115.7±0.78a	3.7±0.35b
15 days	47.5±0.80a	59.5±0.81	30.3±0.56a	113.8b±0.66a	3.7±0.20b
Probability	0.001	0.817	0.048	0.001	0.005
Recovery feeding					
YC	47.1±0.81	58.8±0.71	30.1±0.53	115.0±0.75	4.1±0.27
YCM	48.0±0.87	59.4±0.80	30.5±0.52	113.3±0.79	3.9±0.26
LR	48.8±0.90	60.3±0.86	31.1±0.58	112.2±0.99	3.9±0.28
Probability	0.403	0.389	0.402	0.142	0.947
Interaction					
10-YC	47.3±1.46	58.0±1.51	29.8±1.05	111.9±2.38	4.3±0.62
10-YC M	48.5±1.52	58.9±1.45	30.8±0.99	108.9±1.20	3.4±0.21
10-LR	49.3±1.35	60.5±1.21	31.8±0.89	113.5±1.20	3.6±0.22
12-YC	47.1±1.55	58.9±1.53	30.2±1.00	118.8±1.24	4.2±0.53
12-YC M	47.8±1.46	60.4±1.22	30.5±0.95	116.8±1.56	4.8±0.74
12-LR	48.7±1.45	60.4±1.20	31.0±0.95	111.6±1.61	4.1±0.55
15-YC	47.0±1.52	59.5±1.45	30.1±0.99	114.2±1.21	3.6±0.20
15-YC M	47.6±1.52	58.9±1.46	30.2±1.01	114.2±1.25	3.5±0.16
15-LR	47.8±1.40	60.1±1.29	30.5±0.92	113.0±1.52	4.1±0.53
Probability	0.987	0.905	0.948	0.5	0.402

a-c Means with different supper scripts in the same column are significantly different (YC) = Crushed yellow corn. (YCM) = Crushed yellow corn with minerals and vitamins, (LR) = Layer Ration

Feed Consumption (FC) and Feed Conversion Ratio (FCR): The FC and FCR as affected by recovery feeding and fasting periods are presented in Table 3. Differences observed in feed consumption due to fasting periods were not significant. The present results indicated that the feed conversion of birds in fasting groups had significant ($p<0.01$) differences as compared with control group. These results are in agreement with that of Mohamed (1990) who observed no significant differences in feed consumption between 7 and 10 days fasting treatment groups. Hassanabadi and Kermanshahi (2007) who found that there were no differences observed between feed removal treatment and nonfeed removal treatment for feed intake, feed efficiency.

Egg quality: There were no significant differences in egg component percentages due to fasting period length or recovery feeding or fasting period length (Table 4). No significant differences were observed in values of Yolk Percentage (YP) between the eggs of birds fed crushed Yellow Corn (YC), Yellow Corn with Minerals and vitamins (YCM) and Layer Ration (LR) groups. No significant differences were observed for albumen percentage, shell percentage. Also, there were no significant different on the egg quality indices such as egg shape index, shell strength, shell thickness, Haugh units and egg yolk index among treatments. These results due to length of fasting or recovery feeding are presented in Table 5 and 6. The eggshell strength produced by birds fed (LR) was higher ($p<0.05$) by about 7 and 9% than those eggs produced by hens fed YC and YCM, respectively. Christmas *et al.* (1985) found that forced molting by fasting for 4 and 10 days improved the egg quality. Non-feed removal molting programme based particularly on grain barley

Table 4: Effect of fasting periods and recovery feeding on yolk, shell and albumin percentage in white Bovans layer

Items	Yolk (%)	Shell (%)	Albumin (%)
Fasting groups			
Control	28.0±0.2	12.8±0.1	59.1±0.2
10 days	27.8±0.2	13.6±0.1	59.1±0.3
12 days	28.3±0.3	13.0±0.1	58.6±0.3
15 days	28.7±0.2	13.2±0.1	58.0±0.3
Probability	0.0584	0.6855	0.0776
Recovery feeding			
YC	27.8±0.2	13.2±0.1	58.8±0.3
YC M	28.5±0.2	12.9±0.1	58.4±0.3
LR	28.5±0.2	12.9±0.1	58.5±0.3
Probability	0.1969	0.1871	0.5386
Interaction			
10-YC	27.5±0.4	13.2±0.2	59.2±0.5
10-YC M	27.9±0.5	13.1±0.3	58.8±0.4
10-LR	28.1±0.4	12.5±0.1	59.3±0.5
12-YC	27.5±0.5	12.0±0.2	59.5±0.5
12-YC M	28.9±0.4	13.0±0.3	58.0±0.5
12-LR	27.5±0.5	12.9±0.2	59.5±0.5
15-YC	28.6±0.4	13.9±0.3	57.7±0.7
15-YCM	28.7±0.3	12.7±0.3	58.5±0.5
15-LR	28.8±0.5	13.2±0.2	57.8±0.7
Probability	0.7017	0.032	0.2721

(YC) = Crushed Yellow corn, (YCM) = Crushed yellow corn with minerals and vitamins, (LR) = Layer Ration, Significance level = p>0.05

Table 5: Effect of fasting periods and recovery feeding on shape index, shell strength (Newtan) and shell thickness (Micron) in white Bovans layer

Items	Shape index	Shell strength	Shell thickness
Fasting groups			
Control	74.00±0.6	2.6±0.1	380±0.03
10 days fasting	75.00±1.0	2.7±0.9	380±0.03
12 days fasting	73.00±0.9	2.5±0.1	380±0.03
15 days fasting	75.00±0.9	2.5±0.1	380±0.03
Probability	0.146	0.481	0.972
Recovery feeding			
YC	74.00±1.0	2.57±0.1	390±0.03
YCM	75.00±1.0	2.52±0.1	380±0.03
LR	75.00±1.0	2.76±0.1	380±0.03
Probability	0.825	0.331	0.537
Interaction			
10-YC	75.4±1.1	2.6±0.1	390±0.01
10-YCM	75.6±0.7	2.6±0.1	380±0.01
10-LR	74.8±1.0	2.7±0.2	390±0.00
12-YC	71.7±3.2	2.7±0.2	380±0.00
12-YCM	73.8±0.7	2.4±0.2	380±0.01
12-LR	71.7±3.2	2.7±0.2	380±0.00
15-YC	74.7±0.8	2.3±0.1	390±0.01
15-YCM	74.8±0.7	2.4±0.2	390±0.01
15-LR	74.8±1.2	2.8±0.2	380±0.00
Probability	0.797	0.291	0.959

Significance level = p>0.05, (YC) = Crushed yellow corn, (YC) = Crushed yellow corn, (MYC) = Crushed yellow corn with minerals and vitamins, (LR) = layer ration

Table 6: Effect of fasting periods and recovery feeding on yolk index, Haugh unit in white Bovans layer

Items	Yolk index	Haugh unit
Fasting groups		
Control	41.2±0.3	71.2±0.8
10 days fasting	40.9±0.4	71.6±0.9
12 days fasting	40.7±0.4	71.8±0.9
15 days fasting	40.8±0.4	71.0±0.9
Probability	0.906	0.781
Recovery feeding		
YC	40.6±0.4	70.9±0.9
YCM	40.5±0.4	70.6±0.8
L.R	41.3±0.4	72.4±0.9
Probability	0.35	0.332
Interaction		
10-YC	41.4±0.6	71.1±1.7
10-YCM	40.9±0.6	71.9±1.3
10-LR	40.5±0.8	70.3±1.7
12-YC	40.2±0.7	72.2±1.5
12-YCM	40.0±0.7	71.8±1.5
12-LR	40.2±0.7	72.2±1.5
15-YC	40.3±0.7	69.4±1.8
15-YC M	40.7±0.7	68.3±1.2
15-LR	44.5±0.6	75.3±1.1
Probability	0.343	0.384

(YC) = Crushed yellow corn, (YC) = Crushed yellow corn, (MYC) = Crushed yellow corn with minerals and vitamins

had positive effect on egg quality traits in laying hens (Petek *et al*., 2008). From the present result it can be concluded that fasting white Bovans laying hens for 10, 12 or 15 days to induce molting improved performance and egg quality as compared with the natural molting, but recovery feeding after fasting did not have significant effect on hens performance.

CONCLUSION

From the present result it can be concluded that fasting white Bovans laying hens for 10, 12 or 15 days to induce molting improved performance and egg quality as compared with the natural molting, but recovery feeding after fasting did not have significant effect on hens performance.

In this study, fasting groups were the best between control groups. These fasting groups of hens had significantly higher egg production and egg mass when compared with other group. More studies still needed to improve egg production and egg quality in laying hens.

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