Effects of a Pre-Molt Calcium and Low-Energy Molt Program on Laying Hen Behavior During and Post-Molt

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Emily Dickey, graduate student; Anna K. Johnson, assistant professor; George Brant, professor; Rob Fitzgerald, graduate student; Ken Stalder, associate professor; Jack Dekkers, professor, Department of Animal Science; Kristjan Bregendahl, Nutritionist, Hy-Line International, Dallas Center, IA

Summary and Implications

The objectives of this study were to compare the behavior of the laying hen kept in a cage system when offered a pre-molt calcium treatment and low-energy molt diets versus a traditional feed-withdrawal during induced molt. A total of 144 Hy-Line W-36 laying hens (85 wk of age), weighing 1.7 ± 0.2 kg, were used. Laying hens were housed 3 per cage (30.5 cm wide × 40.6 cm deep × 44.5 cm high), providing 413 cm^2 per hen. Six treatments were compared in a 2 × 3 factorial design with 2 Ca (coarse and fine) pre-molt treatments and 3 molt diets: feed withdrawal (FW), soybean hulls (SH), and wheat middlings (WM). The Ca pre-molt treatment was defined as the period when the hens received either a combination of fine (0.14 mm in diameter) and coarse (2.27 mm in diameter) $CaCO_3$ or an all-fine $CaCO_3$ mixed into a commercial diet for 1 wk. Both diets were formulated to contain 4.6% Ca, such that only the particle size of the $CaCO_3$ differed between the 2 treatments. Hens had free access to feed and water and had a 24-h photoperiod. The 3 molt diets were applied (FW, SH, or WM) for a total of 28 d. The hens assigned to the FW diet were deprived of feed for 7 d with free access to water followed by 21 d of skip-a-day feeding restricted to 60 g of feed/hen per feeding day. The hens fed the WM and SH molt diets were given free access to feed and water during the entire 28 d molt period. Lighting was reduced to 8 h for the first 3 wk and was then increased to 12 h at the start of the last week of molt. Behavior was recorded by camera once before molt, twice during molt, and twice post-molt for 2 h in the morning and 2 h at night. The acquisition of 2 postures and 5 behaviors were obtained by 2 experienced observers who viewed the recordings using 24 h mode onto the Observer software using a 1 min scan sampling technique. Postures and behaviors were not different among treatments during the baseline period. The Ca pre-molt treatment had no carryover effect during or post-molt. The hens assigned to the FW molt diet spent more time in active postures and feeding and drinking behaviors during molt compared to hens fed the other 2 molt diets. Post-molt, all hens, regardless of molt diet, spent the same amount of time in each of these behaviors. The hens assigned to the FW molt diet spent more time preening during molt compared to post-molt, whereas the hens fed the WM and SH molt diets did not differ between the 2 periods (Table 1). In conclusion, these low-energy molt diets did not adversely affect the postures and behaviors of the laying hen and are therefore acceptable dietary alternatives to FW for inducing molt.

Introduction

In commercial laying hens, an induced molt is used to extend the productive life of the hen which allows for a second laying cycle. During molt, the reproductive tract regresses and egg production ceases. Traditionally, molt has been induced by feed withdrawal (FW) ranging from 4 to 14 d accompanied by light restriction. However, concern over individual hen well-being has been expressed by numerous groups who oppose this methodology of withdrawing feed to induce molt. Additionally, industry groups have recommended that producers implement only non-fasting molt programs after January 1, 2006. Few studies have compared traditional molting practices with low-energy diets on the behavior of the laying hen. Therefore, the objectives of this study were to compare the behavior of the laying hen kept in a cage system when offered a pre-molt Ca treatment and low-energy molt diets versus a traditional FW during induced molt.

Materials and Methods

Animals and Location: A total of 144 Hy-Line W-36 laying hens (85 wk of age) weighing 1.7 ± 0.2 kg were used in this study. Research was conducted over 29 wk from July 2007 to February 2008 at the Iowa State University Poultry Research Center in Ames, IA. The project was approved by the Iowa State University Animal Care and Use Committee.

Diets, Housing and Husbandry: Three laying hens were housed per cage (30.5 cm wide × 40.6 cm deep × 44.5 cm high), providing 413 cm^2/hen. Wire flooring was used in all cages and each cage was equipped with a plastic self-feeder and a nipple drinker. All cages were located in two identical, light-controlled fan-ventilated rooms.

Treatments: Six treatments were compared in a 2 × 3 factorial design with 2 Ca (coarse and fine) pre-molt treatments and 3 molt diets: feed withdrawal (FW), soybean hulls (SH), and wheat middlings (WM). The Ca pre-molt treatment was defined as the period when the hens received either a combination of fine (0.14 mm in diameter) and coarse (2.27 mm in diameter) $CaCO_3$ or an all-fine $CaCO_3$ mixed into a commercial diet for 1 wk. Both diets were formulated to contain 4.6% Ca, such that only the particle size of the $CaCO_3$ differed between the 2 treatments. Hens had free access to feed and water and had a 24-h photoperiod. The 3 molt diets were applied (FW, SH, or WM) for a total of 28 d. The hens assigned to the FW diet were deprived of feed for 7 d with free access to water followed by 21 d of skip-a-day feeding restricted to 60 g of feed/hen per feeding day. The hens fed the WM and SH molt diets were given free access to feed and water during the entire 28 d molt period. Lighting was reduced to 8 h for the first 3 wk and was then increased to 12 h at the start of the last week of molt.

Behavioral Equipment and Acquisition: Twelve cameras (12 V color CCTV camera; Model WV-CP484, Panasonic® Matsushita Co. Ltd., Kadoma, Japan) were mounted on the ceiling to record hen behaviors and postures onto a DVR at a rate of 30 frames/s. One camera recorded 4 cages. Behaviors and postures were continually recorded once during the baseline period, twice during molt, and twice post-molt for 2 h after lights came on in the morning and for 2 h before lights went out at night which resulted in a total of 960 h of recordings. The acquisition of laying hen behaviors and postures were collected by 2 experienced observers who viewed the DVDs using a 24 h mode and recorded observational data using the Observer software (The Observer, Ver. 5.0.25 Noldus® Information Technology, Wageningen, The Netherlands) using a 1 min scan sampling technique.

Behavioral Measurements: Two postures (active and sitting) and 5 behaviors (feeding, drinking, preening, non-nutritive pecking and aggression), adapted from Webster (2000), were recorded. ***Active*** postures included standing erect, standing on top of another cage mate, or engaging in a comfort movement to relieve muscular tension (e.g., wing flapping, shaking, stretching, etc.). ***Sitting*** was observed as a crouched posture with shanks or breast in contact with the cage floor. ***Feeding*** was defined as pecking behavior directed toward the feed trough or toward a neighboring feed trough. ***Drinking*** was defined as the ingestion of water from the nipple drinker at the rear of the cage. ***Preening*** behavior involved the manipulation of the plumage with the beak. ***Non-nutritive pecking*** was defined as non-aggressive pecking at anything other than feed, which included cage pecking, feather pecking, bill pecking, and air pecking. ***Aggression*** was observed as a forceful peck directed toward the head of another hen that either made contact or caused an avoidance response in the target hen. Aggression was the sum of pecks that occurred within a cage or between neighboring cages (Figure 1).

Statistical Analysis: The experimental design was a randomized complete block design with treatments in a 2 × 3 factorial arrangement with 2 Ca pre-molt treatments and 3 molt diets. The experimental unit was the cage containing 3 hens (n = 48). The behavioral data for each observational day for the 3 hens in a cage were averaged. Behavioral data were expressed as a percentage and were subjected to a square root arcsine transformation process to achieve a normal distribution. Data were analyzed using the PROC MIXED procedure of SAS (SAS® Inst. Inc., Cary, NC) software for parametric data on a cage basis. The baseline period model included treatment and room. The model used during and post-molt included molt diet (FW, SH or WM), room (one or two), and all 2 way interactions. Cage was included as a random effect and $P < 0.05$ was significant.

Results and Discussion

Behavioral Results: The percentage of time laying hens spent in postures and behaviors were not ($P > 0.05$) different among treatments during the baseline period. The Ca pre-molt treatment had no ($P > 0.05$) carryover effect during or post-molt on any hen behavior or posture. Non-nutritive pecking, aggression, and sitting were not different among molting diets during or post-molt. Hens assigned to the FW molt diet were the most active ($P < 0.001$) and spent less time feeding and drinking ($P < 0.05$) than hens fed the SH and WM molt diets (Table 1). The increased hen activity during molt may be due to behaviors and postures shifting, as the hens assigned to the FW molt diet were unable to spend as much time engaged in feeding. Post-molt, these behaviors did not differ among hens assigned to the 3 molt diets. The hens assigned to the FW molt diet spent more time preening during molt compared to post-molt ($P < 0.003$), whereas hens fed the SH and WM molt diets did not differ between the 2 periods in time spent preening.

Conclusions: In conclusion, a Ca pre-molt treatment did not affect the behaviors and postures of the laying hen during or post-molt. Low-energy diets consisting mainly of SH or WM did not adversely affect the postures and behaviors of the laying hen. The hens fed the SH and WM molt diets were able to spend less of their time being active which may help to conserve energy for a second laying cycle. Therefore, these low-energy diets are acceptable dietary alternatives to FW for inducing molt in the laying hen.

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Table 1. Effect of molt diet (FW, SH, WH) on the postures and behaviors of the laying hen during and post-molt.[1]

	Periods and Treatments							
	During Molt			Post-Molt				
Measures	**FW[2]**	**SH**	**WM**	**FW**	**SH**	**WM**	**SEM**	***P*-value[3]**
Postures, %								
Sitting	5.1	2.6	4.4	6.0	5.6	6.3	0.01	0.37
Active[4]	78.1	51.4	50.7	57.0	56.4	56.1	0.01	< 0.001
Behaviors, %								
Feeding[5]	2.2	32.7	29.9	24.9	25.5	23.2	0.01	< 0.001
Drinking	3.2	5.6	4.8	4.6	5.1	4.7	0.003	0.004
Non-nutritive pecking	0.2	0.3	0.2	0.0	0.0	0.0	0.001	0.66
Preening	11.3	7.6	10.1	7.5	7.3	9.7	0.01	0.003
Aggression	0.1	0.1	0.1	0.1	0.1	0.0	0.0003	0.48

[1]Values are least squares means ± SEM; n = 8.
[2]Three molt diets were compared: feed withdrawal (FW), soybean hulls (SH), and wheat middlings (WM).
[3]The statistical model included the fixed effects of treatment, room, and period, and $P < 0.05$ was significant.
[4]Active postures included standing, standing on a cage mate, and comfort movements.
[5]Feeding behaviors included feeding from own feed trough and attempting to feed from a neighboring feed trough.

Figure 1: Three hens housed per cage seen here engaged in feeding, sitting, and preening.