EFFECT OF CALCIUM PRESENTATION AND FEEDING METHOD ON EXCRETA CONSISTENCY OF LAYING HENS

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Summary

Two strains of commercial laying hens were subjected to complete feed or whole-wheat feeding regimes with calcium provided as limestone, either ground and included in the feed, or as grit (4.0-4.76 mm diameter) provided daily or every second day. Moisture content of excreta was measured by a total collection method at 12, 19/20, 28/29, 34 and 38 weeks of age and an excreta scoring method was introduced once weekly from 22-38 weeks of age. No relationship was found between excreta moisture score or moisture content with the level of total feed or grit intake. A significant (P<0.05) Time x Strain x Feed effect was found for excreta score. Regression analysis indicated that the scoring method and actual excreta moisture content were poorly correlated (R^2 0.16, P < 0.05). Consistency, as determined by scoring method, was firmer in excreta produced by the whole grain feeding method.

I. INTRODUCTION

General concern has been raised about wet excreta from layer production causing odour, water pollution and dirty egg problems. Little data is available on the effects of nutrition on moisture content of excreta produced by laying hens. In a review of feeding programs for layers, Leeson (1993) suggested that lower calcium diets would reduce excreta moisture by lowering water consumption. Leeson and Summers (1991) reported higher excreta moisture in pre-lay hens on laying hen (hence high calcium) rations. In the present trial, various methods of calcium presentation, in association with two feeding methods, were investigated and the effects on excreta moisture were monitored.

II. METHODS

One hundred and forty four commercial layers, half an imported strain (Strain 1) and half an Australian strain (Strain 2), were introduced to two feeding methods from eight weeks of age. Both feeding methods were based on the same wheat-based feed formulation with method one provided as a complete pelleted feed (C) and method two as whole wheat and the meals/premix in mash form (W). Within each feeding method calcium was provided by the following alternatives: (1) ground limestone included in the ration, (2) limestone grit 4.0-4.76 mm diameter available daily in a separate feed trough, and (3) the limestone grit available every second day in a separate feed trough. A rearing diet formulation was used from 8-18 weeks of age and a laying diet formulation after 18 weeks. At 12 weeks of age three replicate pairs of birds per treatment were selected at random from eight-bird rearing cages and placed in laying cages. Excreta were collected daily for eight days using an aluminium foil tray, shaped to fit the edges of the cage floors and held under the floor by wire. Moisture contents of excreta were determined after samples were oven-dried at 75\(^\circ\) C for 48 h.
Pullets were transferred to single-bird cages in laying accommodation at 16 weeks of age. Laying commenced in earnest from 21 weeks of age. At 21 weeks of age, photographs were taken of excreta in varying condition under the cages. Scores were assigned from 1, apparently "dry" separate excreta, through to 5, a wet amorphous mass. From 22 weeks of age a score was applied once weekly to the condition of the excreta on the concrete floor under all 144 experimental birds. The photographs were studied prior to scoring the excreta each week. The starting position for scoring each week was chosen randomly. At 19/20 and 28/29 weeks of age, 14-day excreta collections were made under three birds per treatment using the aluminium trays as described above. Moisture content of the excreta was determined as described above. For the final five days of the 28/29 week collection and for two consecutive days at 34 and 38 weeks of age, excreta collections were scored and the moisture content determined.

The statistical evaluations of the data were performed by repeated measures analysis using the Greenhouse-Geisser correction factor (where necessary) within the General Linear Models (GLM) procedure of SAS (SAS Institute, 1989). Where no Time by Strain or Treatment interactions were found, data were pooled and means evaluated using the GLM procedure. Where appropriate, significant Least Squares Means (LSMEANS) were separated using paired-sample t-tests and are presented in tables with appropriate standard errors (SE).

Regression analysis was performed on excreta score versus excreta moisture content and total feed and grit consumption versus excreta score and excreta moisture content using the regression analysis procedures of the statistical package Minitab (Version 7, copyright Minitab Inc.).

III. RESULTS

The two strains of bird produced excreta with a similar moisture content at 12 weeks of age (Strain 1, 73.6%; Strain 2, 74.9%; P > 0.05). Moisture content of excreta was significantly different (P < 0.05) across treatments at 12 weeks of age (Table 1). However, the excreta did not appear to be physically different across treatments. No relationship between excreta moisture content and total feed or grit consumption was found by regression analysis.

Table 1. Percentage moisture content of excreta from birds at 12 weeks of age as affected by complete (C) or whole-wheat (W) feeding and method of calcium provision.

<table>
<thead>
<tr>
<th>Feed/Calcium</th>
<th>C 1*</th>
<th>C 2</th>
<th>C 3</th>
<th>W 1</th>
<th>W 2</th>
<th>W 3</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>69.9a</td>
<td>73.3ab</td>
<td>70.2a</td>
<td>76.0b</td>
<td>77.8b</td>
<td>78.2b</td>
<td>1.93</td>
</tr>
</tbody>
</table>

* See text.

ab Means with similar superscripts are not significantly different (P > 0.05).

No significant differences were found in excreta moisture content across strains and treatments at 18/19 weeks, at peak egg production (28/29 weeks) or at 34 and 38 weeks of age (Table 2). No relationship between excreta moisture content and total feed or grit consumption was found at any stage. Excreta moisture content was consistent over time (P > 0.05) for each individual bird. A poor relationship between excreta moisture content and excreta score was found at each age (R^2 = 0.16; P < 0.05).
Table 2. Percentage excreta moisture content for birds of Strains 1 and 2 at 18/19 weeks, at peak production (28/29 weeks) and at 34 and 38 weeks of age.

<table>
<thead>
<tr>
<th>Week</th>
<th>18/19</th>
<th>28/29</th>
<th>34</th>
<th>38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strain 1</td>
<td>75.4</td>
<td>74.8</td>
<td>73.2</td>
<td>70.1</td>
</tr>
<tr>
<td>Strain 2</td>
<td>75.4</td>
<td>73.5</td>
<td>69.6</td>
<td>69.1</td>
</tr>
<tr>
<td>SE</td>
<td>0.75</td>
<td>1.39</td>
<td>1.46</td>
<td>1.54</td>
</tr>
</tbody>
</table>

The method of calcium presentation did not affect ($P > 0.05$) excreta moisture score within feeding methods. Pooled data for each feeding method revealed a significant ($P < 0.05$) Time x Strain x Feed effect for the excreta score. The interaction is illustrated graphically in Figures 1 and 2. Excreta moisture scores increased over the experimental period for the birds of Strain 2 as did scores for birds provided with a complete feed.

![Figure 1](image1.png)  
**Figure 1.** Excreta moisture score for Strains 1 and 2 from 22 to 38 weeks of age (Means ± SE).

![Figure 2](image2.png)  
**Figure 2.** Excreta moisture score for complete (C) and whole-wheat (W) fed birds from 22 to 38 weeks of age (Means ± SE).
IV. DISCUSSION

In the current study, excreta moisture contents were within or below the 75-80 % range which was determined as being normal by Larbier and Leclercq (1992). These authors suggested that an excreta water content greater than 80 % indicated that a bird was suffering from diarrhoea. There is concern that the various calcium presentation methods may allow, or cause, excessive calcium intakes by the birds and thus lead to wetter excreta (Leeson, 1993). However, the method of calcium presentation to the birds did not affect excreta moisture levels in the current study. No explanation is proposed for the higher moisture levels of excreta from the whole-wheat fed birds at 12 weeks of age but this difference was not carried through into the laying period. The excreta did not appear different at 12 weeks of age, but there was an obvious difference in the appearance of excreta from birds on the complete feed as the birds approached point of lay. This led to the scoring method being applied at 22 weeks. At no stage was the determined moisture content affected by the strain of bird but the excreta scoring method employed revealed a physical difference in the consistency of excreta produced by the two strains. Birds fed a complete diet produced excreta that were of a looser physical consistency than those fed on whole-wheat diets. It was apparent that feeding whole-wheat caused water to be held more effectively within the excreta.

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REFERENCES