Comparison of Behavior of Laying Hens under Conditions of Ad Libitum and 80% Feeding

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Abstract To clarify the behavioral feature of restricted feeding hens, a comparison was made of the feeding behavior and certain other activities under conditions of restricted (80% ad libitum feeding) and non-restricted feeding. The manner in which feeding behavior changed under these conditions was unique for each hen. Pecking was observed frequently in the restricted feeding periods while preening showed the opposite tendency. The time spent for activities using the beak other than eating tended to increase when eating time was short. The total time engaged in activities using the beak under both conditions was the same for all hens. Consequently, pecking and preening as well as food tampering, to some extent, may be activities whose expressions mutually repress each other.


Key words: behavior, feeding behavior, food tampering, restricted feeding, hens

Restricting the feed intake of laying hens is now an accepted management procedure for controlling growth rate, body weight and molting and reducing feed cost1,2). This method consists essentially in offering feed only at special times of the day, reducing feed energy content and restricting ration amount for one day. For example, it has been reported that a reduction in feed intake by 10-20% as a result of making food available only 3-5 hours per day3-7) leads to the greater feed efficiency. Industrial values for restricted feeding have been reviewed7) but only a few papers deal with the behavioral response of hens under the conditions of the present research. In the previous papers, we reported the changes in feeding and other activities of hens fed pellets and mash available for restricted periods of time8,9). In the present research, an examination was made of the effects of reducing the daily amount of ration on the behavior of hens; the behavior patterns of hens under this condition were compared with those of hens not restricted in their feeding.

Materials and methods

Each of eight White Leghorn hens (Shaver Starcross 288, 15 months old, 1.6-1.8 kg B.W.) was placed in a separate cage within an environment-controlled chamber (KOITO-TRON EA-Special Type, 12 m²) exposed to light for 14 hours (06:00-20:00) each day. The temperature was maintained at 20±1°C without humidity control (60-65% of relative humidity). The hens were divided into two groups, A and B, four hens
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each. At 10:00 A.M., each hen was provided with pelleted feed (Nippon Formula Feed Manufacturing Co., CP 17%; ME 2830 kcal/kg) according to the switch-back trial\(^{10}\): group A, control period (C, ad libitum feeding and provided with 150 g of feed per day) → experimental period (E, restricted feeding and provided with 80% the amount of feed intake in the control period) → C; group B, E → C → E. The diameter and mean weight of each pellet were 3 mm and 54±4 mg, respectively. Each experimental period consisted of 4 pre-experimental days and 3 experimental days. The feed intake, number of pecks at feed, time spent pecking at feed and number of pecking bouts at feed were observed every 30 min. for one hour immediately after turning on the light, for one hour each before and after feed administration and for one hour prior to turning off the light, and at all other times, 1 hour each, using the same apparatus as in the previous report\(^{11}\). Feed intake was measured for all hens and all other items, for three hens of each group. The feed intake ratio\(^{11}\), feed intake per peck and per min., number of pecks per min. and per bout, duration of a pecking bout and proportion of food tampering to all number of pecks at feed\(^{22}\) were calculated from the data obtained. In addition, using the VTR-system\(^{8}\), the behavior patterns of each hen could be observed for all restricted and non-restricted periods during the course of a day. The marked activities were as follows: eating (pecking at feed), pecking (pecking not at feed), preening, drinking, resting and disturbed behavior (jumping, fluttering etc.).

Water was available ad libitum in each cage. Oviposition time and egg weight were recorded daily. All the hens were weighed once each week.

**Results**

The mean values for daily feed intake, number of pecks at feed, time spent pecking at feed, number of pecking bouts at feed, feed intake per peck and per min., number of pecks per min. and per bout, duration of a pecking bout and proportion of food tampering are given in Table 1 along with standard deviations. Daily feed intake

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<tr>
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<th>C(^{1})</th>
<th>E</th>
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<tr>
<td>Daily feed intake (g)</td>
<td>106.6±11.6</td>
<td>84.8±7.1</td>
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<tr>
<td>No. of pecks at feed per day</td>
<td>9276±2076</td>
<td>8061±2013</td>
</tr>
<tr>
<td>Time spent pecking at feed per day (min)</td>
<td>96.5±22.7</td>
<td>80.9±19.3</td>
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<tr>
<td>No. of pecking bouts at feed per day</td>
<td>421±60</td>
<td>396±135</td>
</tr>
<tr>
<td>Feed intake per peck (mg)</td>
<td>12.1±3.3</td>
<td>11.0±2.9</td>
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<tr>
<td>Feed intake per min. (g)</td>
<td>1.17±0.31</td>
<td>1.11±0.27</td>
</tr>
<tr>
<td>No. of pecks per min.</td>
<td>97±9</td>
<td>100±10</td>
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<tr>
<td>Duration of a pecking bout (sec)</td>
<td>14.1±4.0</td>
<td>12.8±2.9</td>
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<tr>
<td>No. of pecks per bout</td>
<td>22.7±6.4</td>
<td>21.1±3.8</td>
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<tr>
<td>Proportion of food tampering(^{23}) (%)</td>
<td>76.1±6.9</td>
<td>79.0±5.8</td>
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\(^{1}\) C, control period (ad libitum feeding); E, experimental period (80% ad libitum feeding). \(^{2}\) **, P<0.01; NS, P>0.05, \(^{3}\) TANAKA and YOSHIMOTO, 1985\(^{12}\)
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in the C and E periods was 106.6 and 84.8 g, respectively. Individual variation was noted in feeding behavior under the two conditions employed. The mean values of feed intake per peck and per min., number of pecks per min. and per bout, duration of a pecking bout and proportion of food tampering for the hens were essentially the same under both conditions.

The diurnal patterns of the feed intake ratio and proportion of food tampering are shown in Fig. 1. Under the condition of non-restricted feeding, two peaks of feed intake was noted, at the start of a day and a few hours before the light was turned off. Feed intake tended to increase slightly immediately after feed had been provided. The proportion of food tampering to all pecks at feed was relatively low just after turning on the light and providing the feed. In the restricted feeding periods, the hens ate about 30% daily ration within 30 min. after it had been provided and ate up almost all of feed by the start of the dark period. The proportion of food tampering from 6–10 o’clock was nearly 100% since there was only a little feed in the trough. It decreased markedly after feed administration, though it increased immediately to the nearly level of that of control period and then gradually with reduction in feed.

Changes in proportion of each activity in the light period (06:00–20:00) with the different feeding conditions are shown in Fig. 2. The time spent eating reflected

Fig. 1. Diurnal patterns of feed intake ratio and proportion of food tampering. Left, control period; right, experimental period. 1) The proportion of feed intake during each period to daily feed intake. —, Feeding; □ and □. Feed intake ratio during each 1 hr and 30 min.; *, P<0.05.
Fig. 2. Changes in proportion of each activity of individual hens with the different feeding conditions. 1) 1-6, Individual hen numbers. 2) C, control period; E, experimental period. 3) NS, P>0.05; *, P<0.05.

individual differences. Pecking was observed more frequently in the restricted feeding periods (P<0.05) while preening showed the opposite tendency. The time spent for activities using the beak other than eating, such as pecking, preening and drinking, tended to increase when the eating time was short. The total time engaged in activities using the beak was about 40% and was the same for all hens under both feeding conditions. Disturbed behavior was observed more frequently in the experimental periods (P<0.05).

Body weight (1.6–1.8 kg) and egg production rate (70–75%) remained essentially the same throughout the experimental period.

**Discussion**

Daily feed intake under restricted feeding was about 80% that of the control period, as expected. Individual differences in feeding behavior with reduction in feeding time were little, but notable when the amount of daily ration was lessened. In the previous report, the feed troughs were covered with plastic sheets, so that pecking would occur only at feeding time. In the present study, however, the hens could peck into the troughs at any time. Therefore, the variation in feeding behavior may possibly be due to differences in time spent pecking into the trough after the feed had been completely consumed.
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The diurnal patterns of the feed intake ratio and food tampering in the control period were in agreement with those of our previous reports. When the feeding time was less than 1 hour per day, food tampering occurred very little. However, it remained at about 40% for 30 min. following feed administration in the restricted feeding periods. This is possibly because that, in the former case, the hens feel prompted to eat as much feed as possible in a limited period while in the latter, they may feed at any time at will. But it is considered that the proportion of pecking for actual eating and food tampering may change continuously under this condition and thus some method for measuring this proportion should be developed.

The time spent pecking was relatively long when preening time was short. This may be evidence supporting the possibility that the expressions of these two activities mutually repress each other. Since the time spent pecking and preening was relatively long when the eating time, i.e., time pecking into the trough, was short, the mutual repression may also be applicable to some extent to food tampering as well. The total time engaged in activities using the beak was about 40% under both feeding conditions, as shown by the data of our previous report. Disturbed behavior was observed more frequently in the restricted feeding period and it might be caused by hunger.

Body weight and egg production rate did not change throughout the experimental period. But these values may become low in the case of a prolonged restricted feeding period and thus the present data do not clarify the effects of restricted feeding on body weight and egg production.

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References

不斷給餌および80%給餌下における産卵鶏の行動

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産卵鶏の摂食行動およびその他の行動に及ぼす制限給餌の影響を明らかにするため, 不斷給餌と量的制限給餌（不斷給餌の80%量）のそれぞれの場合における行動を比較した。制限給餌による摂食行動の変化は個体によって異なった。しかし, つつきは制限給餌によって増加し, 羽づくろいは逆に減少する傾向が見られ, それらは採取時間が短い場合に増加し, 採食, 飲水, つつき, 羽づくろいを加えた嘴を使用する行動の合計時間は, どの個体においても高頻度と約40%でほぼ一定であった。以上から, つつきと羽づくろいは互にその発現を抑制し, 遊びの採食の一部はそれらと同じ動因によるものと考えられた。日畜会報, 57(12):1029-1034, 1986