THE EFFECT OF PRENATAL STRESS ON THE STRESS PHYSIOLOGY AND LIVEWEIGHT OF LAMBS

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Studies predominantly in rats and humans indicate that prenatal stress can impair the ability of animals to cope with stress. While farm animals may frequently encounter prenatal stress, this topic has received little research attention. Based on these studies in other species, prenatal stress may have substantial implication for the productivity and welfare of young and adult farm animals by reducing the animal’s ability to adapt to environmental changes (Braastad, 1998). For example, prenatal stress can have short adverse effects on embryonic mortality and birth-weight of rats and long term adverse effects on fear and learning ability. We recently conducted a major project to examine the effects of prenatal stress in lambs and this paper reports on the effects on the stress physiology and live weight of lambs.

Experiments have been conducted in Australia and France on the effect of prenatal stress on small ruminants. In Australia, a group of 24 ewes were stressed by isolation for 1 h on each of 10 occasions during the last third of gestation while another group of 24 ewes remained undisturbed. Habituation to the stressor was assessed at the 1st, 5th and 9th stress bout. Blood samples were taken before isolation, 15 minutes after the beginning of isolation and at the end of isolation. The plasma cortisol concentrations of lambs were measured at 1 month and 8 months of age from blood samples collected at 30-minute intervals from 1530 to 1630 h. A stimulation of the hypothalamo-pituitary axis (HPA) was performed at 1 month by injecting ACTH at 1 UI / kg body weight. Lambs were weighted at birth, 1 month and 8 months of age.

For the ewes, the integrated cortisol response measured during isolation decreased by 64 % from the 1st bout of isolation to the 9th bout of isolation suggesting habituation to this stressor. The average plasma cortisol concentration was higher in prenatally stressed lambs than control lambs at 1 month of age but not at 8 months of age (19.1 v. 14.7 nM, P<0.04 and 29.3 v. 25.4 nM, P>0.39, respectively). No difference was found between the treatments in plasma cortisol concentration after stimulation by ACTH. The prenatally stressed lambs were heavier at birth and had a tendency to be heavier at 1 month of age than the control lambs (Table 1).

Table 1. The effect of prenatal stress on live weight (kg) of lambs

<table>
<thead>
<tr>
<th>Weight (kg) at:</th>
<th>Prenatally stressed</th>
<th>Control</th>
<th>LSD (P = 0.05)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>4.56</td>
<td>4.06</td>
<td>0.490</td>
<td>0.041</td>
</tr>
<tr>
<td>1 month of age</td>
<td>11.4</td>
<td>10.4</td>
<td>1.11</td>
<td>0.058</td>
</tr>
<tr>
<td>8 months of age</td>
<td>37.2</td>
<td>35.7</td>
<td>2.60</td>
<td>0.256</td>
</tr>
</tbody>
</table>

The higher basal cortisol concentration for prenatally stressed lambs compared to control lambs shows a modification of the hypothalamic-pituitary adrenal axis existing at least during the first month after birth. This result is within the range of results found in France on goats (Roussel et al. 2000). The effects on early live weight are surprising. These effects suggest that mild prenatal stress has no adverse effect on live weight. In fact, mild prenatal stress may increase birth-weight of lambs with possible implications for survival. There is some limited support for this finding from studies on cattle (Lay et al. 1995), but clearly these results require confirmation.


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