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Diet selection of grazing ruminants experiencing stress

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Editor's note: Graphics are of poor original quality.

The over or under utilization of certain rangeland plants cost livestock producers millions of dollars annually. For example, excess intake of larkspurs (*Delphinium* spp.) by cattle is a primary cause of cattle loss on summer ranges in the Rocky Mountains of North America. Conversely, avoidance of leafy spurge (*Euphorbia esula*) by cattle is allowing this introduced plant from Eurasia to rep1ace native vegetation across thousands of acres of range and pasture lands in the Northern Great Plains and western regions of North America.

While cattle and (or) sheep can develop aversions to both of these plant species, they will also graze them (Ralphs and Olsen 1992; Kronberg *et al*. 1993a & 1993b). Ideally, we would like to have cattle avoid larkspur, and have cattle and sheep graze leafy spurge – provided that leafy spurge is not harmful to them as we suspect.

Development of food aversions tends to be associated with elevations of endogenous corticosteroids. Preexposing animals to aversion – inducing treatments tends to attenuate the subsequent formation of conditioned food aversions from these treatments (Braveman 1977).

We hypothesized that: 1) dosing sheep with leafy spurge would cause elevations in their blood cortisol levels (H1), 2) in an aversion trial, sheep that were not preexposed to leafy spurge would develop an aversive response to it and would have elevated blood cortisol levels (H2), and 3) sheep that were preexposed to leafy spurge before an aversion trial would not develop an aversive response to spurge nor have elevated blood cortisol levels (H3).

For the test of H1, we dosed 10 adult sheep with wheatgrass (control) or leafy spurge (0.03% of BW) from 0845 to 0900 then collected jugular blood at one-hour intervals beginning at 1100. For tests of H2 and H3, fifteen eight-month-old weaned ram lambs were randomly divided into three treatment groups (n=5) for an aversion trial. A control group received wheatgrass at 0.15 % of BW after eating a novel feed (NF). A second group was preexposed to leafy spurge before the trial (they received spurge at 0.15 % of BW, on Monday, Wednesday and Friday mornings during the week preceding the trial) and received spurge at 0.15 % of BW on trial days 2 and 3 after eating the NF. The third group was not preexposed to spurge, but received it at 0.09 % of BW on trial days 2 and 3 after eating the NF. Jugular blood was collected from lambs at 0700, 1000, 1200, 1400, 1600, 1800 and 2200 on trial days 2 and 3. The collection at 0700 on each day was used to define a baseline cortisol level for each lamb/day. The highest cortisol level for each lamb/day was defined as its peak level. Blood cortisol levels were determined by RIA. Ground grass or spurge were galvaged intraruminally from 0900 to 1000. Lambs were tested for aversion to the NF on days 3 and 4 of the trial. Sheep and lambs were housed indoors in a ventilated barn at 40ºC. Lights were on from 0800 to 2000. Sheep (H1) and lambs (H2 and H3) were placed in individual cages one or two weeks, respectively, prior to the trial for adaptation to the cages and routine.

Cortisol data were analyzed using a repeated measures design. Data for NF intake on day 2 were analyzed with analysis of variance as a completely randomized design. Data for NF intake on days 3 and 4 were first analyzed by analysis of covariance with NF intake on day 2 as the covariate. If the covariate did not improve the significance of the model, it was excluded and analysis of variance was conducted. Data for NF inake on subsequent days were analyzed using a repeated measures design.

Results for the test of H1 are depicted in Fig. 1. Lambs that received leafy spurge had higher ($P < .01$) cortisol levels than control lambs. Results for H2 are depicted in Fig. 2. Whereas, NP intake was similar ($P = .84$) among all treatment groups before they were treated, only non-preexposed (NPREX) lambs reduced their intake of NF after receiving leafy spurge. Control (CNTL) and preexposed (PREX) lambs increased their intake of NF during the trial. Results for H3 are illustrated in Fig. 3. Whereas, lambs in both treatment groups had similar ($P \geq .30$) baseline levels of blood cortisol, after spurge dosing, it was only elevated ($P = .03$) in the lambs that were not preexposed (NPREX) to leafy spurge. Cortisol levels of lambs preexposed (PREX) to spurge remained near their baseline levels throughout the day.

These data suggests that the hypothalamic-pituitary-adrenal (HPA) axis plays a critical role in diet selection processes. Larkspur consumption by cattle and leafy spurge consumption by sheep is likely influenced by the HPA axis and these relationships will be elaborated in the presentation.

Figure 1

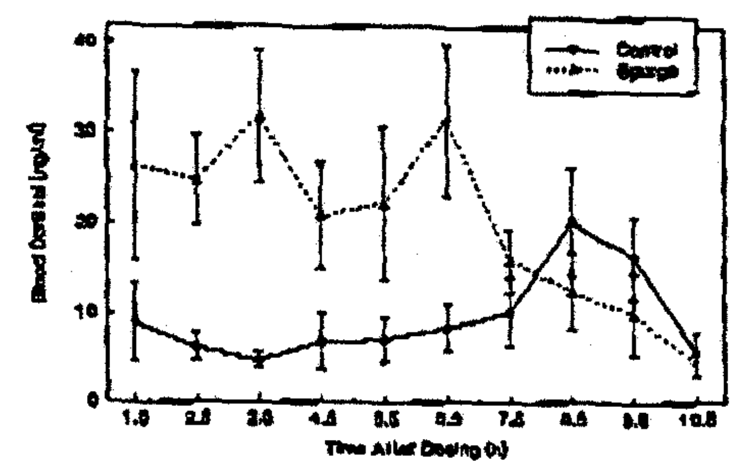


Figure 2

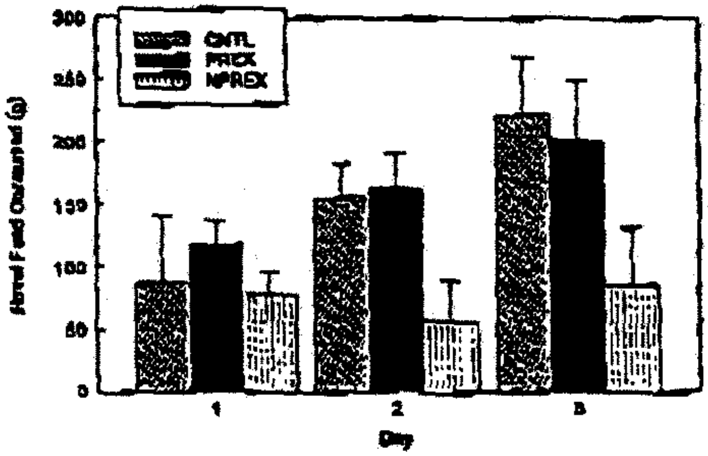
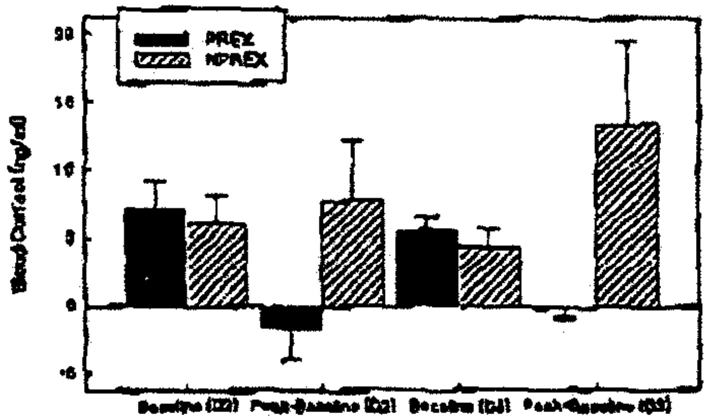


Figure 3



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