BLOOD METABOLITES IN STEERS FED PROTEIN SUPPLEMENT DAILY OR AT 4-DAY INTERVALS

D. K. Bishop[1], R. P. Wettemann[2]
and J. A. Vizcarra[1,3]

Story in Brief

Yearling steers (n =12) were used to determine if interval of feeding of protein supplement influenced blood metabolites. Hereford and Angus X Hereford steers weighing 291 ± 6 kg had ad libitum access to low quality chopped prairie hay and were fed cottonseed meal at 0900 daily (.91 kg/day; control) or every 4th day (3.63 kg; interval). Blood samples were collected at 0900 (prior to feeding controls), 1300 and 1700 daily from day 16 through day 20 of supplementation. Steers fed protein supplement each day tended to have greater concentrations of glucose in plasma compared with interval fed steers (78.0 vs 72.6 mg %, respectively). When steers were fed a protein supplement every 4th day, plasma urea nitrogen (PUN) was increased the day after feeding and nonesterified fatty acids (NEFA) in plasma were increased, compared with steers fed 25% of the amount of supplement every day. Extended intervals between protein supplementation of cattle consuming low quality forage causes large variations in blood metabolites and may influence growth or reproduction.

(Key words: Glucose, NEFA, PUN, Protein Supplement, Cattle.)

Introduction

Protein supplements are typically supplied to cattle grazing low quality pasture. At times it is desirable to feed the supplement infrequently to reduce labor. Early studies (Pope et al., 1963) indicated that protein supplements may be fed every 2, 4 or 6 days without major effects on winter weight loss of mature beef cows. When wethers were fed a cottonseed meal supplement every day, nitrogen retention and volatile fatty acids in the rumen were greater compared with whethers fed the supplement every sixth day (Nelson and Watkins, 1967). The effects of infrequent feeding on plasma metabolites that may influence endocrine and reproductive function have not been evaluated in

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[1]Graduate Student [2]Regents Professor [3]The authors acknowledge the assistance of students in ANSI 4803 during the fall semester of 1991.

cattle. Many range cattle in Oklahoma are feed protein supplements in the winter every second, third or fourth day. The objective of this experiment was to determine if the interval of feeding of a protein supplement to beef cattle will influence blood metabolites that may alter performance of cattle.

Materials and Methods

Twelve Hereford X Angus steers, weighing 291 ± 6 kg, were blocked by weight and randomly assigned to receive cottonseed meal (CSM 41% CP) cubes daily (.91 kg/d; control) or 3.63 kg every fourth day (interval). Initially two steers were maintained in each pen. All steers received chopped low quality prairie hay free choice and had access to water ad libitum. Steers were weighed at the beginning (d 0) of the trial after 16 h without feed and water.

On d 13, after all steers were fed their protein supplements, steers were confined in metabolism stalls where they were individually fed for a three day acclimation period. Temperature was controlled at 30.5 ± 1° C. Hay intake was recorded daily for each animal. Control steers were fed CSM daily and treated steers were fed CSM on d 17 and d 21 in the metabolism stalls.

On d 15, a jugular cannula was inserted into each steer. Blood samples were collected at 0900 (prior to feeding the daily supplement), 1300 and 1700 commencing on d 16. Steers were sampled at these times each day through d 21.

Oxalic acid (1.3 mg) was added to blood samples (10 mL) and samples were centrifuged (5°C ; 3000 rpm) to recover plasma. Plasma was stored at -20°C until glucose, NEFA and PUN were quantified by enzymatic colorimetric procedures.

Results and Discussion

Body weight change was not related to frequency of protein supplementation and steers fed low quality hay lost an average of 9 ± 3 kg during the 21 d trial. Similarly, extending the supplementation interval from every 2 d to every 6 d did not influence weight loss of mature cows grazing dormant pastures during winter (Pope et al., 1963). Warm ambient temperature in the metabolism stalls may have increased weight loss during the 16 h without feed or water.

Hay intake by individual steers (Figure 1) was influenced by the interval of feeding CSM supplement. Steers fed CSM daily consumed more hay than steers fed every fourth day ($P<.001$). Day also influenced hay intake ($P<.001$). Hay intake was greatest in interval fed steers on the day after

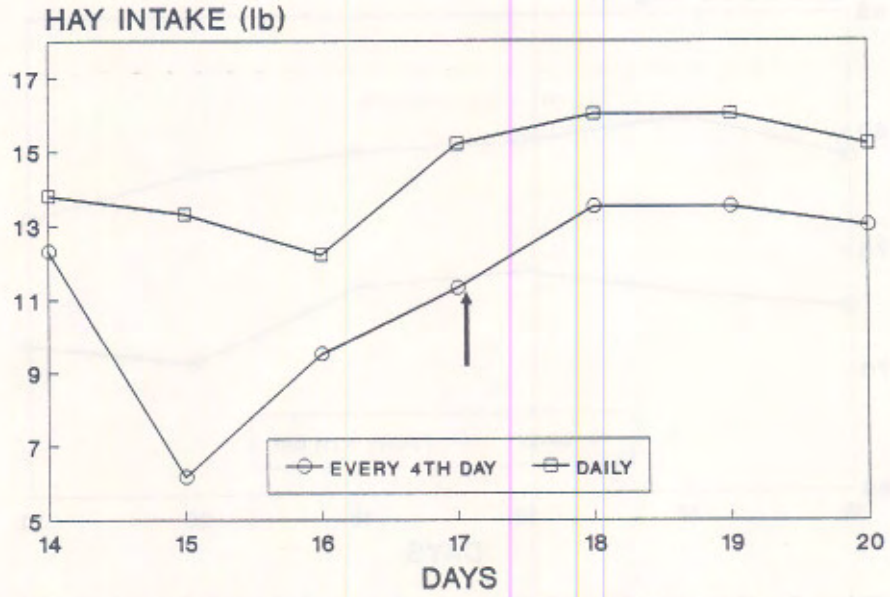

Figure 1. Intake of hay by steers fed supplemental CSM daily or every fourth day.

protein supplementation (d 18) and was similar to the intake of control steers on that day. The reason for reduced intake of steers on d 15 is not apparent. Increased intake of low quality forage on days when additional protein was available indicates, in agreement with others, that supplemental protein increases intake of low quality forage.

Concentrations of glucose in plasma were not influenced by time of day but tended ($P<.11$) to be greater in steers fed CSM every day (control) compared with every 4th day (Figure 2). Mean glucose concentrations were 78.0 mg % for daily steers compared with 72.6 mg % for interval steers. Schaefer et al. (1990) reported decreased concentrations of glucose in slaughter-weight animals after 36 h without feed or water.

Concentrations of PUN (Figure 3) and NEFA (Figure 4) were quantified in samples collected three times per day. Interval steers were fed protein supplements after the first sample of blood was collected on d 17. There were interactions between feeding interval, time of sampling and day which influenced concentrations of PUN ($P<.01$) and NEFA ($P<.05$). Concentrations of PUN were increased in interval fed steers by about 2-fold on d 18, the day after steers were fed CSM. During other times, PUN was similar in daily and interval fed steers. The ability of ruminant animals to

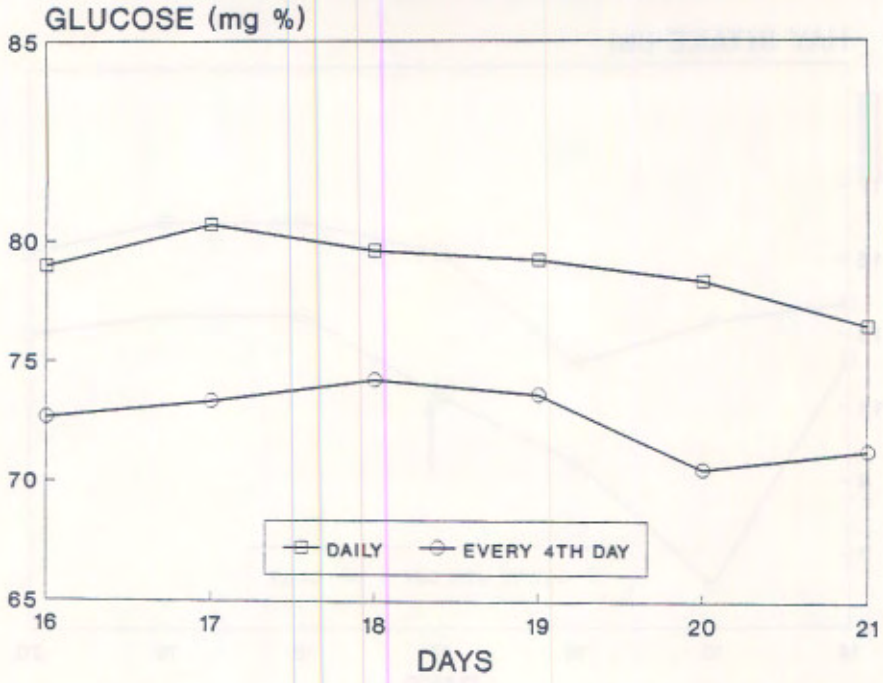

Figure 2. Concentrations of glucose in plasma of steers fed supplemental CSM daily or every fourth day.

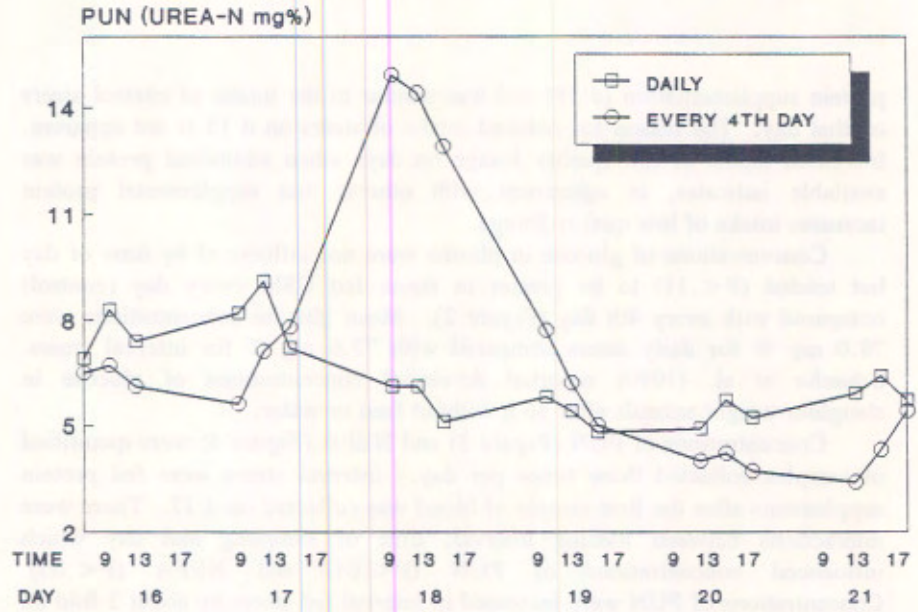

Figure 3. Concentrations of plasma urea nitrogen in plasma of steers fed supplemental CSM daily or every fourth day.

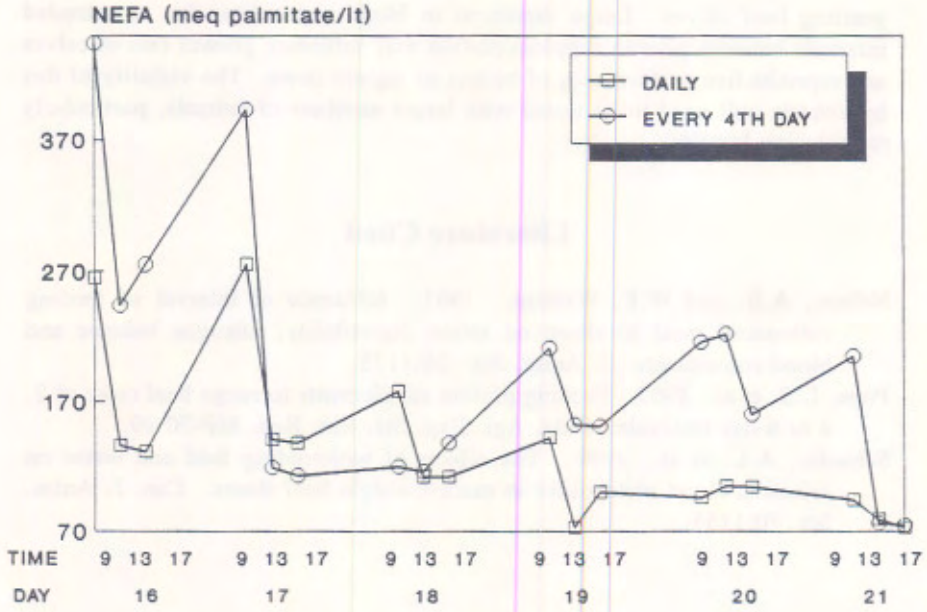

Figure 4. Concentrations of nonesterfied fatty acids in plasma of steers fed supplemental CSM daily or every fourth day.

recycle nitrogen from ingested nitrogenous feedstuffs as urea through the blood is well known. It is also well known that intake of low quality roughages is optimum only when rumen nitrogen requirements are met with supplementation and/or recycling. Wethers fed supplemental protein every 6 d (Nelson and Watkins, 1967) had increased urinary nitrogen compared to sheep fed cottonseed meal daily. Concentrations of NEFA tended to decrease during the trial in both daily and interval fed steers. Concentrations of NEFA were greater in interval fed steers, especially on the day and the morning prior to feeding CSM. Increased NEFA concentrations are associated with loss of body weight and indicate mobilization of body energy stores. Increased PUN concentrations after supplementation of 3.63 kg of CSM, and increased NEFA concentrations between feedings of protein supplement may indicate poor utilization of feed by growing steers.

Feeding protein supplements to yearling steers every 4th day resulted in decreased concentrations of glucose in plasma, increased PUN the day after feeding, and increased NEFA compared to steers fed protein on a daily schedule. Although weight changes were not influenced during the short trial by frequency of protein supplementation, changes in blood metabolites indicate that frequency of supplementation may be important to nutritional status of

yearling beef calves. Large variations in blood metabolites due to extended intervals between protein supplementation may influence growth rate of calves

and reproductive performance of heifers or mature cows. The viability of this hypothesis will need to be tested with larger numbers of animals, particularly reproducing females.

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