Sodium Chloride Levels for Finishing Feedlot Heifers

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Summary

A trial was conducted to establish a NaCl level that maximizes intake and performance while minimizing excretion of Na to the environment. Fifty-nine individually fed yearling heifers (803 lb) were fed 113 days. NaCl was added to a corn-based feedlot diet at levels of 0, 0.125, 0.25, 0.375 and 0.5 % of diet DM. No difference in ADG, DMI or F/G were observed with different levels of NaCl. Results suggest NaCl inclusion in the diet likely is not necessary to maintain acceptable feedlot performance.

Introduction

Sodium chloride is commonly supplemented in feedlot diets at .3 to .5% of diet DM. This level of supplementation has been assumed to aid in improving DMI and performance. With NaCl addition to the diet the level of Na excretion in feces and urine also is increased. The increase in Na in animal waste may cause long term problems in manure or compost applications and runoff application areas. Sodium accumulation in the soil profile will inhibit water infiltration and inhibit the absorption of nutrients in cropping systems. Determining the optimal amount of NaCl to be included in feedlot rations will be vital to long term environmental sustainablility. The objective of this trial was to evaluate NaCl levels to obtain a level that maximizes intake and performance while minimizing excretion of Na to the environment.

Procedure

Fifty-nine spayed yearling heifers (803 lb) were individually fed for 113 days. Heifers were assigned randomly to treatment and weighed on three consecutive days. Revalor-H® implants were administered at the beginning of the trial. Heifers were individually fed once daily using Calan electronic gates. Adaptation to concentrate was attained by increasing intake (0.5 lb/day) from 1.5 % of BW on the treatment diet until ad libitum consumption was attained, approximately 21 days. The basal diet was initially formulated to produce a sodium deficiency. The diet included 42.5% high moisture corn, 42.5% dry rolled corn, 7.5% grass hay, 3% tallow and 5% supplement. Iodine was added to the diet at 1.5 ppm. Five treatments (12 heifers/treatment) were formulated to provide increasing levels of NaCl; 0, 0.125, 0.25, 0.375 and 0.5 % of diet DM. Treatments bracketed 1996 NRC minimum Na requirements (0.08% of DM or 0.20% NaCl). Sodium chloride level in the supplement was increased by replacing fine ground corn (Table 1). Treatments then were mixed before feeding by combining low and high NaCl supplements to attain proper treatment levels. Water intake was measured using water meters on a group basis to evaluate average Na intake from water. Feeds and supplements were sampled weekly and composited for Na analysis. Feces and urine were sampled every 28 days and composited to evaluate Na excretion. Fecal output was determined by multiplying DMI by the estimated dry matter indigestibility of the diet (14.7%, 85.3% DMD). Urine volume was estimated assuming creatinine excretion is 12.7 mg/lb of BW and dividing by the creatinine concentration in the urine. Urine creatinine concentration was determined using laboratory analysis (Sigma Procedure No. 558, Sigma Diagnostics, St. Louis, MO.). Na analysis was performed on all samples by a commercial laboratory using atomic absorption spectroscopy. Results were analyzed using the mixed procedure of SAS.

Results

Ingredient and water analysis showed increasing levels of Na

Table 1. Supplement composition.

Ingredients (DM%)	Low Supplement[a]	High Supplement[a]
Limestone	27.6	27.5
Fine Ground Corn	24.3	13.8
Urea	24.2	24.6
Potassium Chloride	11.5	11.5
Calcium Sulfate	5.2	5.2
Salt	0.0	10.0
Tallow	3.0	3.0
Dicalcium Phosphate	2.4	2.5
Trace mineral[b]	1.0	1.0
Vitamin A-D-E[c]	.2	.2
Rumensin-80[d]	.35	.35
Tylan-40[e]	.25	.25

[a]Low represents no NaCl in the diet DM, High represents 0.5% NaCl in the diet DM.
[b]Trace mineral composition;10% Mg, 6% Zn, 4.5% Fe, 2% Mn, .5% Cu, .3% I, and .05% Co.
[c]Vitamin A-D-E; 15,000 IU of vitamin A, 3,000 IU of vitamin D, and 3.75 IU of vitamin E/g of premix.
[d]Rumensin-80; 27.1 g/ton of diet DM.
[e]Tylan-40; 9.7 g/ton of diet DM.

Table 2. Performance of heifers fed finishing diets with different levels of NaCl inclusion.

Level	0%	0.125%	0.25%	0.375%	0.5%	SEM	P-value[a]
Initial BW, lb	801	808	802	800	805	23	0.99
Final BW[b], lb	1150	1171	1164	1155	1180	30	0.95
ADG lb/day	3.09	3.21	3.28	3.14	3.31	0.13	0.71
DMI lb/day	21.1	21.4	21.9	20.7	21.5	0.6	0.71
F/G	6.87	6.69	6.73	6.67	6.56	0.19	0.83
Marbling[c]	517	521	521	507	532	14	0.77
Fat thickness (in)[d]	0.46	0.64	0.55	0.53	0.47	0.04	0.03
Ribeye Area (in^2)	14.1	13.3	13.6	13.8	13.6	0.4	0.63

[a]F-test statistic P-value.
[b]Final BW based on dressing percentage of 62.
[c]Marbling score: 400 = Traces; 500 = Small 0; 600 = Modest.
[d]Significant quadratic response to Na (P = 0.01).

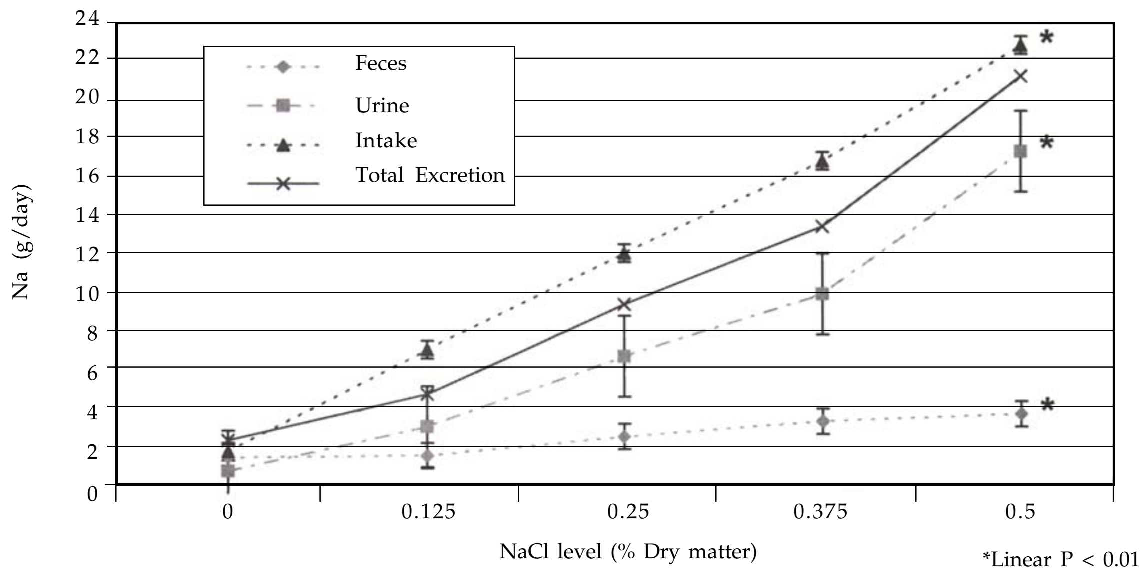

Figure 1. Na intake and excretion in feces and urine with different levels of NaCl inclusion.

intake from 1.9, 7.2, 12.2, 17.0 and 22.9 ± 0.46 g/heifer/day with an average of .65 g/day from water. Analyzed Na levels in the diet were 0.01, 0.07, 0.12, 0.18 and 0.23 % of DM. This provides NaCl levels of 0.03, 0.18, 0.31, 0.46 and 0.59 % of diet DM. Analysis of performance data showed no significant difference in ADG, DMI or F/G with different levels of NaCl (Table 2). Overall, NaCl supplementation was not effective in increasing ADG, F/G or DMI. Heifer performance averaged 3.21 ± 0.13 lb ADG with F/G averaging 6.7 ± 0.19. No significant effects were detected for marbling, yield grade or ribeye area (P > 0.10) across all treatments (Table 2). A significant quadratic effect for fat thickness was detected (P = 0.01). The quadratic response was a result of higher fat thickness in the 0.125% and 0.25% NaCl levels compared to lower fat thickness in the 0% and 0.5% NaCl levels. Fecal and urine analysis showed increasing levels of Na in waste with increased feeding levels (Figure 1).

These results suggest that NaCl inclusion in diets at current NRC recommendations or less would be adequate. In an attempt to produce a sodium deficiency, feedstuffs with low sodium contents were used in this trial. In commercial cattle feeding situations some ingredients would contain more sodium than those used here. Alfalfa contains about 0.12 % Na, beet molasses contains 1.48 % Na, corn gluten feed 0.26 % Na and distillers grains 0.30 %Na. Because most commercial diets in Nebraska contain alfalfa and a byproduct or molasses, most diets likely contain 0.05 to 0.07% Na or more and NaCl is likely not needed. Reducing NaCl supplementation in feedlot operations would reduce the excretion of Na to the environment and minimize Na buildup on acres receiving manure and runoff water.

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