Table 2. Summary of Oklahoma reimplant trials.

Trial	Implant	Days since last implant	Reimplant			
			Days of study	Steer weight	ADG	F/G
1976-1	Synovex-S	113	58	864	+9.6%	+5.7%
1976-2	Synovex-S	77	65	892	+8.5%	-----
1979	Synovex-S	56	62	986	+7.0%	-----

Literature Cited

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Wagner, D.G. 1976. Oklahoma State Animal Science Research Report. MP-96, p. 65.

Postruminal Protein for Growing Steers

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Story in Brief

Three experiments studied the effect of an increased protein supply to the small intestine on feed intake and protein retention of 500- to 600-lb growing steers fed a corn grain-urea ration. Milk protein (casein) was infused into the abomasum at levels from 0 to 120 g daily. Infusions failed to increase protein retention or feed intake. Results suggest that the performance response to higher protein rations seen with feedlot steers may be due to factors other than postruminal protein supply. Results cast doubt on the need for high-bypass protein supplements for feedlot cattle over 500 lb.

Introduction

For feedlot steers under 600 lb fed high energy, highly digestible rations, protein is the nutrient often considered to limit performance. The work supporting this idea comes largely from 1) increased rate and efficiency of gain by feedlot steers receiving supplemental ration protein and 2) increased protein retention of lambs or steers

receiving post-ruminal infusion of protein. The infusion trials have generally used animals which were limit-fed high fiber, low protein rations (Johnson *et al.*, 1979) and may not apply to steers fed high concentrate rations *ad libitum*. These trials were designed to examine the effects of post-ruminal protein infusion on protein retention and feed intake of growing steers *ad libitum*-fed a high concentrate ration.

Materials and Methods

Experiment 1

In the first trial, five growing Hereford steers (497 lb) fitted with permanent T-type abomasal cannulas were infused with 0 to 120 g casein daily. Steers were allowed free choice access to an 11 percent crude protein corn-urea diet (Table 1). Not counting the urea, the ration provided 8.9 percent protein. Feed intake and nitrogen retention were measured for the last 5 days of 14-day periods, and steers were rotated among rations. Infusion mixtures (Table 2) provided similar amounts of energy and nitrogen from added glucose and urea. All infusions were continuous and provided a total of 2 quarts of liquid per day. Feces and urine were collected the last 5 days of each 14-day period and analyzed for nitrogen.

The second and third trials used similar infusion and collection schemes, except that four steers were used and the ration contained 1 percent urea (Table 3). In trial two, the ration was either limit-fed at a level of 6.6 lb per day or fed *ad libitum*, and only the 0 and 120 g casein levels were infused (Table 2). In trial three, the diet was fed *ad libitum* and the infusates provided either dextrose or dextrose plus urea (Table 4). This last trial consisted of only two periods.

Table 1. Diet composition, trial 1.

Item	% DM
Corn, ground	77.80
Alfalfa dehy	5.98
Cottonseed hulls	13.96
TM-salt	.49
$CaCO_3$	.49
Dical	.49
Urea	.75

Analyzed 11.0% CP.

Table 2. Abomasal infusion treatments, trials 1 and 2.

	Abomasal infusion (g of DM)		
Treatments	Casein	Dextrose	Urea
0	--	120	42.6
20	20	100	35.5
40	40	80	28.4
80	80	40	14.2
120	120	--	--

Table 3. Diet composition for trials 2 and 3.

Item	%DM
Corn, rolled	77.23
Alfalfa dehy	5.98
Cottonseed hulls	13.96
Sodium sulfate	.11
Salt	.49
Trace mineral mix	.25
$CaCO_3$	.49
Dical	.49
Urea	1.00
Vitamin A	.001
Vitamin D	.001

Analyzed 12.3% CP.

Table 4. Abomasal infusion treatments, trial 3.

Treatments	Intake	Abomasal infusion
No additional N	*Ad libitum*	120g Dextrose
Additional non-specific N	*Ad libitum*	120g Dextrose + 42.6g Urea

Results and Discussion

Steers gained an average of 2 pounds per day during trial one. Feed intake and nitrogen retention (Table 5) were not increased by protein infusion in trial one. Digestibility of dry matter and nitrogen seemed to peak at the 20 g per day infusion level. Failure of postruminal protein infusion to increase protein retention suggests that, under the test conditions, the supply of protein reaching the small intestine as undigested feed plus bacterial protein from the rumen was sufficient to meet the protein needs of these growing steers. Thereby, supplemental postruminal protein did not prove beneficial. To double-check this finding, the second trial was conducted with steers limit-fed (6.6 lb per day) or consuming feed *ad libitum* (10 lb per day). Infusion of casein increased nitrogen retention only slightly with either feeding method, but the percentage increase was much greater with the limit-fed ration. With higher feed intake (Table 6), bypass of feed protein should be greater, decreasing the need for supplemental protein.

The third trial was conducted to check whether postruminal supply of nitrogen limits performance. When urea was infused, nitrogen retention increased (Table 7). This suggests that, under *ad libitum* feeding conditions, post-ruminal non-specific nitrogen may limit performance.

Combining all three experiments, we can conclude that growth and performance of 500 to 600 lb feedlot steers *ad libitum*-fed urea-supplemented high energy rations were not restricted by the quantity of preformed protein reaching the small intestine.

Table 5. Intake and digestibilities, trial 1.

Item	Casein infusion, g/day				
	0	20	40	80	120
Dry matter intake (kd/day)	5.61	5.31	5.65	5.26	4.99
Total nitrogen intake (g/day)	117.8	112.6	112.5	111.1	107.1
Dry matter digestibility, %	71.5[a]	75.2[b]	72.6[a]	71.1[a]	70.4[a]
Nitrogen digestibility, %	69.5[ab]	71.7[a]	69.7[ab]	67.6[bc]	66.8[c]
Nitrogen retention (g/day)	40.5	35.5	42.8	35.1	32.7

[abc]Means within a row with different superscripts differ significantly (P< .025).

Table 6. Intake and digestibilities, trial 2.

Feed intake	Limited		*Ad lib*	
Casein infusion (g/day)	0	120	0	120
Dry matter intake (kg/day)	2.52[a]	2.57[a]	4.56[b]	4.75[b]
Total nitrogen intake	65.5[a]	66.2[a]	105.6[b]	109.3[b]
Digestibility, %				
Dry matter	82.3	79.6	77.1	76.3
Nitrogen	78.0	75.4	73.4	69.3
Nitrogen retention				
g/day	9.9	14.2	20.6	24.8
% N intake	15.09	21.16	19.43	21.19

[ab]Means within a row with different superscripts differ significantly (P < .005).

Table 7. Intake and digestibility, trial 3.

Treatment	120 g Dextrose	120 g Dextrose 42 g urea
Dry matter intake (kg/day)	4.52	4.80
Total nitrogen intake (g/day)	89.2[a]	110.7[b]
Digestibility, %		
Dry matter	74.1	75.6
Nitrogen	67.7	71.8
Nitrogen retention (g/day)	20.9	29.7

[ab]Means within a row differ significantly (P<.1).

Nevertheless, adding soybean meal to feedlot rations to a level of 13 percent protein generally increases rate and efficiency of weight gain for steers under 700 lb. Possible reasons for this discrepancy are that: 1) growth rate of feedlot steers may be twice that obtained during this trial, thereby the protein requirement of feedlot steers is much greater; 2) higher feed intake of feedlot steers than steers in this trial reduces bacterial protein synthesis and flow of bacterial protein to the intestines; 3) supplemental soybean meal provides additional non-protein factors (potassium, sulfur, phosphorus, buffer capacity, amino acids) which may stimulate bacterial growth in the rumen, alter the rate of passage and site of digestion in the intestines, or influence hormonal secretions. Added protein usually increases starch and protein digestibility of feedlot rations (Rust *et al.*, 1979). Results suggest that selection of proteins having high bypass to supplement corn rations may not improve rate or efficiency of gain of growing steers. In this experiment (as often occurs with steers fed high-concentrate rations *ad libitum* in protein studies) protein retention was closely related to digestible energy intake. This would suggest that energy supply, not protein supply, limited lean tissue deposition under our conditions.

Increased protein retention with postruminal infusion of urea has been observed in several trials with other non-specific nitrogen sources including glutamic acid, urea and ribonucleic acids. Some coated urea compounds may prove useful for this reason as well. Since ammonia absorption should meet the needs for synthesis of non-essential amino acids, non-specific nitrogen may have some other action. Studies with cannulated steers suggest that flow rate through the small intestine is proportional to protein content of the digesta. (R.A. Zinn, personal communication). Consequently, added non-specific nitrogen may reduce small intestinal flow rate and increase time for and extent of digestion. This may improve digestibility and availability of energy from the ration.

Literature Cited

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