Beef Cow Milk Composition and Calf Scours

Karen L. Krieger, R.B. Danielson and I.A. Schipper

Millions of dollars are lost each year in the ranching industry to calf diarrhea (scours). Calf scours kill more calves in North Dakota than any other calfhood disease (2).

Diarrhea has been defined as water and electrolyte malabsorption. The type of food ingested has been found to be a major determinant of the direction and rate of water and electrolyte movement in the proximal small intestine (1). Increases in "pathogenic" *Escherichia coli* in the feces have followed dietary changes, with associated diarrhea and mortality. One study (5) found that changes of diet appeared to have more influence on the incidentce of calf scours than did environmental conditions.

Nutritional causes of calf scours have been studied using dairy calves on a milk replacer diet, but little is known about nutritional factors affecting scouring in the suckling beef calf. It has been found that the wrong amount, proportion or source of a dietary nutrient in a milk replacer can cause severe scouring. One could suspect that a suckling beef calf receiving substandard milk could be prone to scouring.

Information on milk composition and factors influencing milk nutrient concentrations in beef cows is very limited. This research studied colostrum, since scouring in beef calves often occurs the first few days after birth. The objectives of this reesearch were:

- To determine protein, milkfat and lactose composition of beef cow colostrum.
- To compare these factors in colostral samples drawn from cows fed hay and cows fed silage.
- To determine the relationship between beef cow diet, beef cow colostral composition and the incidence of calf scours.

Krieger is a former graduate student and Danielson is assistant professor, Department of Animal Science; Schipper is professor, Department of Veterinary Science.

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A preliminary study was made in the spring of 1981 (Phase I) to obtain information on milk composition levels in beef cows. Two diets were offered to bred beef cows of varying ages and breeds at two locations. Forty cows located at the NDSU Beef Barn each received approximately 40 pounds of corn silage, millet and chopped alfalfa hay in a 6:3:1 ratio. Twenty-four cows housed at the NDSU Poultry Center each received approximately 21 pounds of chopped prairie hay and two pounds of 20 percent protein cubes daily. All cows received dicalcium phosphate and trace mineral salt free choice. Colostrum samples were collected postpartum and the time interval between parturition and sampling was recorded. Samples were frozen at $-20°C$ until analyzed for protein, milkfat and lactose.

A second trial (Phase II) was designed utilizing the results of Phase I. Thirty-eight mature bred Hereford cows, purchased from a ranch that had a history of calf scours, were divided into two groups and housed in adjacent open drylot pens. All cows received the same maintenance diet of corn silage, alfalfa and straw in a 5:1:1 ratio from December 1981 to February 1982. Cows averaged a visual condition score of 3 on a 1 to 5 scale and gained weight through the maintenance period. From February through May, one group was offered 20 lb crested wheat hay and 9 lb oat straw per head per day while the second group received 38 lb corn silage and 12 lb oat straw per head per day. All diets met or exceeded National Research Council (NRC) TDN and crude protein requirements. The calving season commenced in late March and continued to mid-May. Following parturition and prior to calf suckling, a representative colostrum sample was taken from as many quarters as possible from each cow. The second and third samples were taken at 24 and 48 hours postpartum (PP). All samples were frozen until analyzed. Incidence of scoring was determined by visual observation of the herdsman.

RESULTS AND DISCUSSION

Phase I

Percent protein, milkfat and lactose of colostrum drawn from cows fed hay in Phase I averaged 13.27 ± 9.34, 5.37 ± 13.13, and 2.95 ± 1.42, respectively. Averages of those components of colostrum drawn from cows fed silage were 15.68 ± 10.02, 4.91 ± 8.19, and 2.53 ± 2.37, respectively.

Feed cost per cwt of gain (table 2) was calculated using December 1985 local prices. All diets were assessed a grinding feed of $10 per ton, while an additional $20 per ton feed was charged for pelleting.

By feeding barley in the meal form, feed costs per cwt of gain were about $1.24 lower than feeding pelleted barley or corn. However, pigs fed the barley-meal diet weighed about 18 pounds less than pigs fed the other two diets. An additional 12 days would be required for the pigs to obtain the same weight as those fed the pelleted barley or corn diets. Thus, the feed and labor costs required to finish the pigs should be added to the price reported in table 2.

The results of the first experiment indicate that the feeding value of pelleted barley is equal to corn and that meal-fed barley has about 90 percent the feeding value of corn.

Results of the second experiment are presented in table 3. Performance criteria were not statistically different among the dietary treatments. However, pigs fed the Bowman or Hazen cultivars were the most efficient in converting feed to gain. Carcass criteria were not statistically different among the diets, although pigs fed the corn diet tended to have a smaller loin eye area than the barley-fed pigs.

Feed cost per cwt of gain was similar for pigs fed the corn and barley diets, with the lowest cost of gain observed for pigs fed the Hazen barley diet.

Table 4 contains the results of the third experiment. Performance criteria were not influenced by the dietary treatments. However, pigs fed corn had higher dressing percentages than the average of the pigs fed the barley diets ($P<.04$). Also, pigs fed the Robust cultivar had a lower

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Table 4. Cost of Gain and Carcass Measurements of Swine Fed Various Barley Cultivars (Exp. 3)[a].

Item	Dietary Treatment[b] Corn	Steptoe	Robust	Klages
	Performance Criterion			
No. pigs	23	24	24	24
Initial wt., lbs	76.8	76.5	76.5	76.5
Final wt., lbs	230.7	228.4	223.4	229.1
Avg. gain, lbs/day	1.90	1.88	1.82	1.88
Feed/gain ratio	2.98	2.93	3.06	2.99
	Carcass Measurements			
No. pigs	19	17	19	21
Dressing, %[c]	63.3	62.6	62.2	63.1
Backfat, inc.[d]	1.00	.92	1.05	.99
Loin eye, sq. in.	5.27	5.26	5.06	4.95
	Feed Costs			
Cost/lb of feed[e]	$ .07	$ .07	$ .07	$ .07
Cost/cwt of gain	$ 20.86	$ 20.51	$ 21.42	$ 20.93

[a]Dept. of Animal and Range Sci., NDSU exp. no. SW85-5; Appreciation is extended to the North Dakota Barley Council for providing the barley cultivars used in this experiment.

[b]Corn fed as a meal diet; barley as a pelleted diet.

[c]Treatment differences; corn vs. avg. of barley diets ($P<.04$); Robust vs. Klages ($P<.03$).

[d]Treatment differences; Steptoe vs. avg. of Robust and Klages, ($P<.08$); Robust vs. Klages, ($P<.01$).

[e]Same as footnote b, table 2.

Table 3. Performance, Carcass Measurements and Feed Costs for Swine Fed Diets Containing Various Barley Cultivars (Exp. 2)[a].

Item	Dietary Treatment[b] Corn	Azure	Hazen	Bowman	Robust	Bedford
	Performance Criterion[c]					
No. pigs	72	24	24	24	24	24
Initial wt., lbs.	89.9	89.4	89.5	89.4	89.6	89.6
Final wt., lbs.	229.9	234.3	230.6	234.8	231.5	230.5
Avg. gain, lbs/day	1.95	2.02	1.96	2.02	1.97	1.96
Feed/gain ratio	3.25	3.26	3.14	3.15	3.27	3.32
	Carcass Measurements[c]					
No. pigs	35	12	11	12	10	11
Dressing, %	73.1	73.1	73.1	73.1	73.0	73.1
Backfat, in.	1.02	1.02	1.01	.95	.94	1.11
Loin eye, sq. in.	5.06	5.25	5.50	5.11	5.37	5.23
	Feed Costs[d]					
Cost/lb of feed	$ .07	$ .07	$ .07	$ .07	$ .07	$ .07
Cost/cwt of gain	$ 22.75	$ 22.82	$ 21.98	$ 22.05	$ 22.89	$ 23.24

[a]Dept. of Animal and Range Sci., NDSU exp. no SW84-4; Appreciation is extended to the North Dakota Barley Council for providing the barley cultivars used in this experiment.

[b]Corn fed as a meal diet; barley as a pelleted diet.

[c]No significant ($P>.10$) treatment differences.

[d]Same as footnote b, table 2.

There were a higher number of samples drawn from Hereford cows in the silage-fed group than from other breeds. The hay-fed group contained a majority of Angus cows. However, the largest discrepancy among cows in both groups was the time interval between parturition and sampling, some as large as 12 hours. For these reasons, statistical analyses were not done on this data and no conclusions were drawn.

Phase II

No significant difference between milk from cows fed hay and milk from cows fed silage was found for any of the three compositional factors in any of the three time periods of Phase II. Table 1 indicates the incidence of scouring in the two groups. No significant difference was found in the number of scouring calves in the hay group vs the number of scouring calves in the silage group (P = 75).

Table 1

	Hay	Silage
Total calves	19	19
Number of scouring calves	6	3

Milk consumed by non-scouring calves appeared to be higher in percent milkfat at 0 hours PP (P<.25) than milk consumed by scouring calves. Higher concentrations of milkfat consumed by the non-scouring calves could be causing a decrease in bacterial counts of the ingesta (4).

Milk consumed by the scouring calves appeared to be higher in percent lactose at 0 hours PP (P<.25) than milk consumed by non-scouring calves. Young ruminants are know to have a low lactose tolerance level. Sugars reach the large intestine when the lactose tolerance level is exceeded, where they are a desirable food source for bacteria. Scours could be a potential result of this bacterial growth (3).

Gross analysis of milk consumed by calves that later scoured appeared to be lower in protein the first 48 hours PP than milk consumed by non-scouring calves. However, these results were not significant. It could be postulated that the lower protein milk contained lower immunoglobulin levels, resulting in poorer immunity to calfhood diseases, especially scours.

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dressing percentage than pigs fed the Klages cultivar (P<.03). Backfat measurements were lowest for pigs fed the Steptoe cultivar. Loin eye area measurements favored pigs fed the corn or Steptoe cultivar. Feed cost per cwt of gain was most favorable for pigs fed the Steptoe diet.

Discrepancies were noted between dressing percentages of the pigs used in the second and third experiment. These variations can be attributed to differences in slaughter locations, the differences in the amount of shrinkage and the methods used to calculate dressing percentages.

Current feed prices may favor feeding barley in the meal form compared to pelleted barley or corn in the meal form. Pelleted barley or corn diets cost about the same at present. However, if the price of soybean meal increased, economics would favor the use of barley, since less soybean meal is required in the barley diets (table 1).

Only minor discrepancies in performance and carcass criteria were observed among the various barley cultivars. These results indicate that the genetic changes involved in the development of barley cultivars for malting purposes has had no effect on the nutritional quality of these cultivars for swine. The decision of which barley cultivar to produce should be based on expected yields and potential prices per bushel.