Substituting Dried Whey For Dried Skim Milk In Dairy Cattle Milk Replacers

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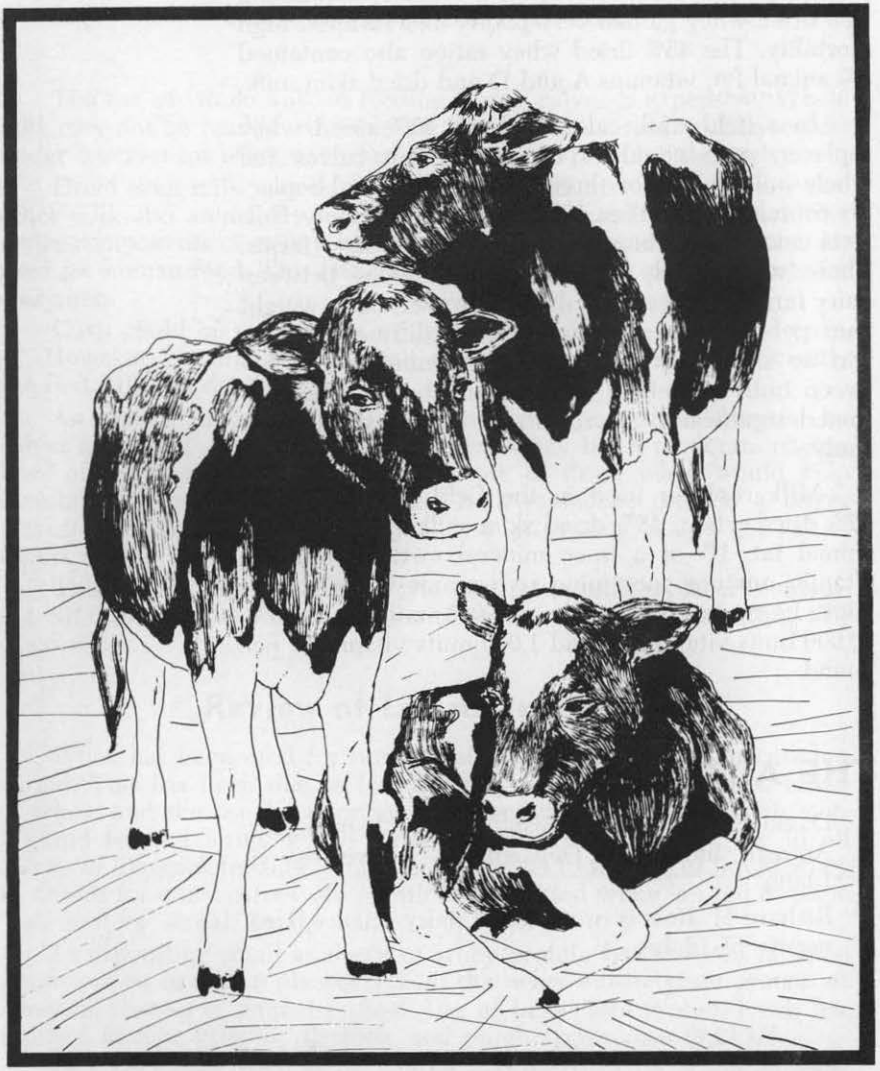

May 1973 Bulletin 534

Idaho Agricultural Experiment Station

UNIVERSITY OF IDAHO

College of Agriculture

Other studies (1,17,18) showed that 30 to 35% dried whey is the maximum that could be used in the milk replacer without diarrhea and retarded growth. Toullec (14) concluded protein in whey was 93% digestible, organic matter was 97% digestible, and whey was well utilized by the pre-ruminant calf. The milk replacer he used contained 68.8% whey protein and 29.8% dried whey.

Baker et al. (3), working with rats, concluded processing methods had no effect upon nutritive value of the protein. However, Shillam (12), working with calves, found digestibility of milk proteins was significantly reduced by high heat from roller drying or pre-heating skim milk to high temperatures for an extended period before spray drying.

Atkinson et al. (2) reviewed use of lactose in animal and human feeding with the following conclusions: (1) Lactose can be tolerated at extremely high levels by young pigs and dairy calves. This tolerance decreases with age of the animal. (2) Lactose feeding lowers acidity in the intestinal tract of all animals. (3) Lactose favorably influences absorption, retention, and use of calcium, phosphorus, and magnesium.

Thacker (13) reported use of animal fat with dried skim milk rations reduced the incidence of scours in raising veal calves.

This study was started at the Caldwell Branch Experiment Station with the cooperation of Ida Gem Dairies, Jerome, Idaho. The objective was to develop a commercial milk replacer using maximum amounts of dried whey. The ration would contain animal fat as an antidiarrhetic agent and energy source. This milk replacer should be economical and an additional way to use dried whey.

Procedure

Caldwell Branch Station

Bull calves from the Caldwell Branch Experiment Station dairy herd were randomly assigned at birth to one of three treatments. All calves were given one colostrum feeding. The following three rations were used: (1)whole blended herd's milk; (2) a milk replacer containing 45% dried whey, 5% stabilized animal fat, 49% dried skim milk, and 1% of a Vitamin A and D mixture (400,000 units of A, 50,000 units of D per pound); and (3) a milk replacer containing 94% dried whey powder, 5% stabilized animal fat, and 1% of the above vitamin mixture.

The following feeding rates were calculated to provide equal amounts of energy within one kilocalorie and enable calves to gain about 1.1 pounds of body weight per day for 6 weeks: Ration 1 – 8.6 pounds of whole milk per day; Ration 2 – 1.6 pounds of Ration 2 reconstituted in 7 pounds water; Ration 3 – 1.6 pounds of Ration 3 reconstituted in 7 pounds water.

These amounts were divided equally. Calves were fed twice a day. Rations were warmed to 90° F + 5°. Calves received coarsely ground grain mixture of equal parts barley, wheat, and dried beet pulp. The mixture was fed free choice, up to 3 pounds per day. Alfalfa hay was available free choice at all times, along with trace mineral salt and water.

Field Trial

Ten dairymen were selected in March to compare a milk replacer containing 45% dried whey with the feed they were presently using, either herd milk or a milk replacer. All calves were alternately assigned to the experimental replacer and to the program the dairyman was using to feed the calves the first 6 weeks of age. Each dairyman agreed to feed at least 10 calves on each ration.

The commercially prepared experimental ration consisted of 45% dried whey, 48% dried skim milk, 5% stabilized animal fat, 1% trace mineral mixture, and 1% vitamin mixture containing 5 grams of Chlortetracycline, 12 grams of soy lecithin, 400,000 units of Vitamin A, 50,000 units of Vitamin D, and 1,000 units of Vitamin E per pound.

Results and Discussion

Caldwell Branch Station

Thirty-five Holstein calves were used in the initial trial at the Caldwell Branch Experiment Station. Results are given in Table 1.

Calves fed whole milk (Ration 1) consumed 8.7 pounds of milk per day. Calves were slow or off feed an average of one feeding per calf. Their average daily gain for 6 weeks was 1.2 pounds. Although these calves ate slightly more milk than planned, their consumption of hay and grain remained very close to that of the calves fed Ration 2.

The 11 calves fed the 45% whey milk replacer averaged 5 pounds more at birth than the calves on Ration 1. They gained 5 pounds more than the calves fed the herd milk, making an average daily gain of 1.3 pounds. These calves had slightly more digestive troubles. In the 6-week trial they averaged two feedings per calf at which they were slow or refused to eat. No calves fed either Ration 1 or 2 received any medical treatment for scours.

Calves fed Ration 3 containing 94% whey grew very poorly. To obtain data on 12 calves for the statistical analysis, 24 calves had to be started. Twelve calves died during the first week of the trial, most during the third and fourth days. The calves would eat 5 to 7 feedings, then scour and be dead the next day. Bacteriological studies of feces from these calves revealed no consistent pathogens.

Table 1. Results of feeding 2 milk replacers containing dried whey to 35 Holstein bull calves for 6 weeks.

	No. of calves	Feed consumed per calf			Initial wt.	Final wt.	Body gain°°	Avg. feedings off feed
		Milk°	Grain	Forage				
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Whole milk	12	367.1	19.0	7.0	98	148	50a	1
45% whey	11	352.2	19.0	9.0	103	158	55a	2
94% whey	12	342.0	14.0	6.0	102	140	38b	5

°Lbs. of reconstituted milk replacer or blended herd milk.

°°Means with different letter suffixes differ significantly at the 1% level of significance.

Table 2. Comparison of average body weights by weeks of 35 Holstein calves fed milk and two milk replacers containing dried whey.

	Milk	45% Whey	94% Whey
No. of calves	12	11	12
Beginning weight (lb.)	98	103	102
Week 1	100	99	102
Week 2	104	109	103
Week 3	114	116	113
Week 4	130	127	119
Week 5	138	139	130
Week 6	148	158	140

The overall good growth by the calves fed 45% whey, compared to those on whole milk, was attributed to the 5% animal fat in that ration. However, animal fat was of little or no benefit in controlling scours with the milk replacer containing 94% dried whey.

These results indicate a milk replacer containing 45% good quality whey, when properly supplemented, can be used to raise young dairy calves following colostrum feeding. Calves made uniform body gains throughout the 6-week trial.

Morrill (7) was successful in feeding higher levels of whey (68%) to dairy calves. However, he started trials with calves 7 days of age or older. The Caldwell study showed, as did Morrill and Wallace (7,17), that milk replacers containing larger amounts of dried whey caused a higher incidence of diarrhea.

Rations in the Caldwell feeding trial were fed so they supplied equal amounts of energy. Protein content of milk (Ration 1) was calculated to be 24% on a dry matter basis; Ration 2 had 23% protein, and Ration 3, 12%. However, we believe the differences in body weight gains between Rations 2 and 3 were due more to the diarrhetic effect of the high level of dried whey than to the difference in protein level.

Calves on whole milk consumed 112 grams of protein per day. Ration 2 provided 167 grams and Ration 3, 87 grams. Calves on Ration 3 failed to grow during the first two or four weeks of the trial. During the fifth and sixth week they gained slightly more than one pound per day, as seen in Table 2. Cause of the delay or the rapid gains made during the last two weeks cannot be explained. Ration 3 provided sufficient energy but considerably less protein than is presently recommended (9).

Field Trial

Results of the field trial are shown in Table 3. Data complete enough for use in this analysis and report were obtained on 90 Holstein calves from three farms and the Caldwell Branch Experiment Station. The 45% whey milk replacer was compared with three other milk replacers or mixed herd milk.

Difference between dairy farms was highly significant. This occurred in rate of milk, grain, and hay feeding. Although there was significant difference in the amount of milk and hay consumed, there was

Table 3. Least squares means of 90 Holstein calves raised on 4 dairy farms for 6 weeks on 5 different milk replacers.°

Class	n	Total milk	Total grain	Total hay	Gain per day
		lb.°°	lb.	lb.	lb.
Overall	90	46.4	30.7	17.0	.86
Farm					
1	27	41.2c	31.0b	22.9ab	.73b
2	28	49.3b	43.7a	17.1b	.64b
3	15	38.7d	29.5b	24.7a	.68b
4	20	66.4a	18.8c	3.6c	1.40a
Ration					
1	20	46.3ab	24.6	14.3b	.93
45% whey	45	46.4a	28.2	20.7a	.95
Milk	10	46.6a	27.9	19.5a	.88
2	7	47.7a	35.4	12.1b	.69
3	8	45.0b	37.6	18.7a	.86
Sex					
Heifer	32	46.7	29.6	14.2b	.87
Bull	58	46.1	31.9	19.8a	.85

°°Pounds of dry matter.
°Means with different letter suffixes differ significantly ($P \leq .05$).

no significant difference in average daily gain for calves on the three dairy farms.

Calves raised at the Experiment Station gained significantly more than the calves on the three dairy farms. No significant differences occurred between males or females except in amount of hay eaten. Bull calves consumed 5.6 pounds more hay in the 6-week trial.

In the field trial, calves fed the 45% whey ration did not achieve the desired 1.1 pounds daily gain. Most of the dairymen were inclined to limit the amount of milk replacer as a control of scours. Thus, calves in the field trial only gained an average of 0.95 pounds per day. However, this was higher than for those fed whole milk (0.88) or either of the milk replacers (0.69 and 0.88).

A total of 500 calves was fed in the field trial. Eight of the dairymen said they could not see any difference in the way calves responded to either ration being used. The other two dairymen did not proceed far enough to form an opinion.

A problem developed with Colby cheese whey dried in a small dryer. Small hard particles formed that would not dissolve when the whey was reconstituted in water. This problem did not occur with the large dryer or with cheddar cheese whey.

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