

Impact of Modern Milk Replacer Formulations on Calf Health and Performance

Trevor Tomkins, Ph.D.
Milk Specialties Company
Dundee, IL 60118

Janusz Sowinski
Milk Specialties Company
Dundee, IL 60118

Introduction

Within the last ten years there have been major changes in the formulation of calf milk replacers in the United States. These have been brought about by changes in the world supply of milk based ingredients, milk processing technology, vegetable protein processing technology and knowledge of the calf's digestive system. Calf milk replacers manufactured in the 1950's and 1960's contained high levels of skim milk powder as the primary protein source. Skim milk protein consists of approximately 80% casein protein and 20% whey proteins. Provided that the skim milk has not been severely heat treated during the drying process, casein in the milk replacers forms a firm clot or curd in the calf's abomasum. Severely heat treated skim milk does not clot and calves fed milk replacer containing such skim milk suffer from diarrhea and poor performance.

Today's modern milk replacers, in the United States, do not contain significant levels of skim milk powder, but either whey proteins or combinations of whey proteins and vegetable proteins, including isolated soy protein, soy protein concentrate, soy flour, isolated wheat protein or potato protein. These milk replacers do not clot in the abomasum and there has been speculation that such non clotting milk replacers may have a negative impact on calf health and performance.

Milk Specialties Company has undertaken a series of studies to investigate replacement of skim milk protein in calf milk replacers with whey proteins.

Experimental Design

Three major studies involving 605 Holstein bull calves were conducted in the period from 1989 to 1991.

Holstein bull calves weighing approximately 100 lb were purchased from sale barns in Wisconsin and/or Michigan and shipped to a calf facility in southern Wisconsin. The facility contains 240 individual stalls and was filled over a 2 day period.

Calves were randomly allocated to milk replacer treatment. On arrival all calves were thoroughly inspected for health problems, including runny noses, signs of diarrhea and swollen navels. All

calves with signs of problems were promptly treated.

The calves were fed only milk replacer for the duration of the trial according to the feeding schedule shown in table 1.

AGE (WEEKS)	APPROXIMATE DRY MILK REPLACER INTAKE PER CALF PER DAY (LB)
1	0.8 - 0.9
2	1.3 - 1.5
3	1.7 - 1.9
4	2.1 - 2.5
5	2.6 - 3.0

Table 1: Feeding Schedule

In each trial the milk replacers were formulated to contain 21% crude protein and 16.5% fat. The formulations of the milk replacers are shown in Table 2. The treatments were designated SMP (Skim Milk Powder) or WPC (Whey Protein Concentrate) to signify the major source of protein. The WPC formulation was common to all 3 trials.

	WPC Diet (Common to trial 1, 2 and 3)	SMP Diet Trial 1	SMP Diet Trial 2	SMP Diet Trial 3
Dried Whey	28.4	28.5	28.4	28.5
(WPC) Whey Protein Concentrate	51.8	16.7	7.6	37.7
(SMP) Skim Milk Powder	—	35.0	44.2	14.0
Fat	16.2	16.2	16.2	16.2
Premix/Vits/Mins	3.6	3.6	3.6	3.6
% Protein from SMP	0	58	74	23
% Protein from WPC	100	42	26	77

Table 2: Formulation of Diets

Calves were weighed on arrival and then again at either 32, 35 or 38 days of age for trials 1, 2 and 3 respectively. During the course of the trials, feed consumption was recorded.

Results

Calf performance is shown in table 3.

	Trial 1		Trial 2		Trial 3	
	SMP	WPC	SMP	WPC	SMP	WPC
Number of Calves	120	125	120	120	60	60
Mortality	0	1	2	1	1	2
Days on Trial	32	32	35	35	38	38
Start Wt (lb)	101.9	102.8	103.1	102.8	105.2	104.9
End Wt (lb)	157.9	156.1	147.1	145.7	155.1	155.0
Total Gain (lb)	56.0 ^a	53.3 ^a	44.0 ^a	42.9 ^a	49.9 ^a	50.1 ^a
Average Daily Gain (lb)	1.75 ^a	1.67 ^a	1.26 ^a	1.23 ^a	1.31 ^a	1.32 ^a
Dry Milk Replacer Intake/Calf (lb)	67.0	67.4	65.0	64.9	68.1	67.9
Feed/Gain	1.20	1.26	1.51	1.55	1.37	1.35

Means compared within each trials only. Figures with same superscript not statistically significant at P<0.05.

Table 3: Summary of Calf Performance on Trials 1, 2, and 3.

Within each of the three trials calf performance was comparable on the SMP and WPC diets. In Trial 1 the average daily gain was 1.75 and 1.67 lb/day for SMP and WPC respectively. In Trial 2 the average daily gain was 1.26 and 1.23 lb/day for SMP and WPC respectively and in Trial 3 the average daily gain was 1.31 and 1.32 for treatment SMP and WPC respectively. Feed to gain was comparable on the three trials.

Conclusion

They protein concentrate can be used as a full or partial replacement of skim milk in a milk replacer diet for a young calf without any deleterious effect on health or performance of the calf.

Summary

A series of 3 trials involving 605 calves were conducted to compare the performance of calf milk replacers formulated entirely with whey protein coming from skim milk powder. In each of the three trials, performance was comparable on both the whey protein and skim milk diets.