

Calf Notes.com

Calf Note #78 – Prestarters and rumen development

Introduction. Development of rumen function is important to good growth and health of calves. Traditionally, we have fed calves limited amounts of milk replacer or whole milk and offered calf starter for ad libitum consumption. This usually results in early dry feed intake and allows for calves to be weaned at 28 days of age or less. Occasionally, calves will begin to consume dry feed at a very early age and be ready (physiologically) for weaning at a very young age. It is important to remember that the development of the rumen, not age, is the best indicator of weaning readiness.

In other species (e.g., swine), animals are often started on a highly digestible feed specifically formulated as the first dry feed. This product is called a *prestarter* and is uniquely formulated to be highly digestible yet highly palatable, and to allow early intake of dry feed. This allows the young animal to adapt to the dry feed. Slowly, the prestarter is then replaced with a high quality starter, which is lower in cost and somewhat lower in overall nutrient content.

The concept of using a prestarter for young calves was evaluated by several researchers, but particularly researchers at Kansas State, led by Dr. Jim Morrill. This research group developed the concept of a prestarter based on dry milk in a small, high quality pellet. A small amount of the prestarter can be added to the milk pail (if calves are fed in buckets) either while the calf is drinking or as the calf finishes its meal. As the calf is licking the bottom of the bucket, it will also begin to consume some of the pellets. The pellets can enter the rumen, which would stimulate rumen development. A small amount of prestarter is also top-dressed on the top of the calf starter, enticing calves to begin eating the prestarter and then the starter. Based on Dr. Morrill's research, calves fed in this manner began consuming dry feed within a few days of birth and were ready to be weaned as early as 17 days of age.

Most of the commercial prestarter formulations are pelleted milk replacer type formulations with additives that allow pelleting. While highly palatable for calves, the carbohydrates in pelleted milk replacers are primarily lactose, which may not be optimal for rumen development. In fact, the optimal composition of a prestarter would be one that was irresistible to calves, yet would contain the types of fermentable carbohydrate that would rapidly promote rumen development. Carbohydrate sources that are fermented to butyric and propionic acids would be optimal, since these volatile fatty acids are most stimulatory to the rumen mucosa.

We evaluated the impact of prestarters formulated to contain highly digestible (and fermentable) carbohydrates (corn and barley) as a means to stimulate rumen development in calves a

Table 1. Formulation of experimental prestarter.

Ingredient, %	10% whey		20% whey		
	Corn	Barley	Corn	Barley	Comb.
Barley	0.0	28.0	0.0	23.4	16.0
Corn	42.1	20.0	33.7	15.0	15.0
Whey	10.0	10.0	20.0	20.0	20.0
SBM	33.2	31.0	31.5	29.7	31.2
Soy hulls	7.8	4.0	8.5	5.3	6.7
Vits./mins.	6.9	7.0	6.3	6.6	11.1

number of years ago. The prestarters were formulated as in table 1.

Holstein bull calves (n = 60) were purchased from area farms at 3 to 5 days of age and were assigned to one of the six experimental prestarters formulated to contain 10 or 20% whey and based primarily on corn or barley as the primary carbohydrate source. The treatment “Bicarb” was a combination of corn and barley

with 20% whey and included 3% sodium bicarbonate to potentially reduce the effects of rumen acidosis. These were compared to a

Table 2. Chemical composition of experimental prestarters and calf starter.

Nutrient, % of DM	10% whey		20% whey			Whey Prest.
	Corn	Barley	Corn	Barley	Bicarb	
Dry matter	87.6	87.7	89.9	89.7	88.4	86.7
Crude protein	24.0	23.7	24.0	24.1	23.5	27.5
Ether extract	2.4	2.1	1.7	1.6	3.4	13.0
Crude fiber	6.5	5.7	6.3	5.8	5.9	1.6
Calcium	1.9	1.9	1.8	1.8	1.9	0.9
Phosphorous	1.2	1.2	1.1	1.2	1.2	0.8

commercially available prestarter based on whey and whey protein concentrate. Our hypothesis was that the feeding of 10% vs. 20% whey would allow us to observe how the amount of lactose (the primary carbohydrate in lactose) and rate of fermentation of carbohydrate (corn is fermented more slowly than barley) would affect animal performance. Further, the inclusion of sodium bicarbonate would allow us to see if the degree of acid production in the rumen would affect performance.

The nutrient content of the grain-based prestarters was similar among treatments and averaged about 24% protein and 2-3% fat (ether extract). These varied quite markedly from the commercial product that was 27.5% protein and 13% ether extract. This was quite expected, since the commercial formulation was prepared using milk based ingredients which would result in a product with more fat and protein compared to the grain-based products that had more carbohydrate and less fat than the other products.

Calves were fed commercial milk replacer (CMR) fed at 454 g (1 lb.) per day and the prestarters was fed at an initial rate of 114 g/d, which increased to 228 g/d as intake increased. Calf starter (22% protein) was available for ad libitum consumption. Calves were weaned when they consumed 1.5 lb. of calf starter per day or at 4 weeks of age, whichever occurred first.

The calves were healthy throughout the study and growth and intakes were fairly

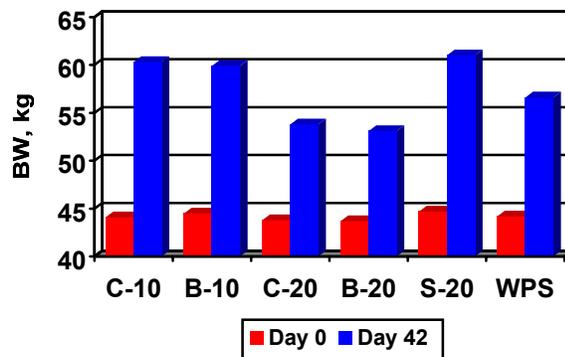


Figure 1. Body weights of calves fed prestarters containing 10 or 20% whey and based on corn (C), barley (B), or combination plus 3% sodium bicarbonate (S) or whey and whey protein concentrate (WPS).

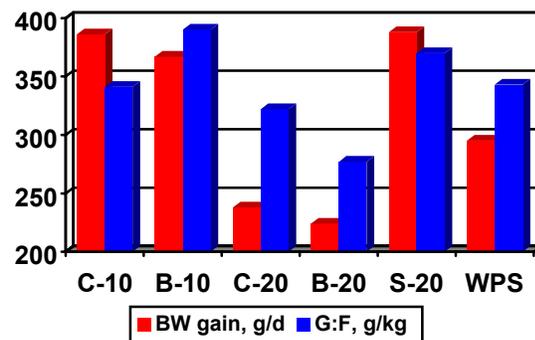


Figure 2. Body weight gains and feed efficiencies of calves fed prestarters containing 10 or 20% whey and based on corn (C), barley (B), or combination plus 3% sodium bicarbonate (S) or whey and whey protein concentrate (WPS).

typical for purchased calves during the first seven weeks of life. Body weights are shown in figure 1. Body weights at day 42 and rates of gain were greater when calves were fed prestarters containing 10% whey compared to 20% whey. Body weights at 42 days were lower when calves were fed 20% whey or when they were fed the commercial prestarter.

The greatest body weight gains and best feed efficiency occurred when calves were fed prestarters containing 10% whey or prestarter containing 20% whey plus sodium bicarbonate. Feeding prestarter containing 20% whey appeared to reduce both body weight gain and feed efficiency. Body weight gain and feed efficiency was intermediate when the calves were fed the commercial prestarter.

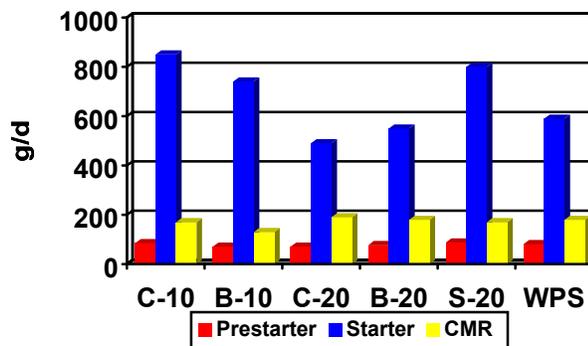


Figure 3. Intakes of calves fed prestarters containing 10 or 20% whey and based on corn (C), barley (B), or combination plus 3% sodium bicarbonate (S) or whey and whey protein concentrate (WPS).

Intakes of prestarter, starter and milk replacer are in Figure 3. The intakes of prestarter and milk replacer did not vary markedly, but intake of calf starter followed trends observed for body weight gain, which is consistent with the concept that the most important factor affecting growth is intake of calf starter. Further, since all of these calves were fed the same calf starter and managed in the same way (same facilities, management, etc.), we can conclude that the difference in formulation of the prestarter caused the observed differences in starter intake and growth.

Calves can be very sensitive to the carbohydrate composition of the diet, since the rate and extent of fermentation can influence both the degree of rumen development and the extent of acidosis that may occur. In this study, calves were fed prestarters containing 10% whey or 20% whey. The higher level of whey in the prestarter may have resulted in a greater rate of fermentation, which could have lead to greater production of lactic acid in the rumen. Production of lactic acid can cause rumen acidosis, which may reduce intake and growth. At 10% whey, inclusion of barley in the prestarter resulted in slightly lower starter intake and body weight gain. This could also be caused by the production of lactic acid, since barley is fermented in the rumen more quickly than corn. Rapid rate of fermentation can cause a very rapid drop in rumen pH, which can result in rumen acidosis.

The addition of 3% sodium bicarbonate to the prestarter resulted in better performance than the other formulations containing 20% whey. This lends further support to the idea that 20% whey resulted in acidosis, and the addition of sodium bicarbonate helped to control the acidosis to a degree sufficient to allow the calves to eat and grow normally.

Calves fed the commercial prestarter used in this study did not perform as well as calves fed 10% whey or 20% whey plus bicarbonate. The commercial product probably did not provide the profile of fermentable carbohydrates to aggressively promote rumen development, which would slow the initiation of dry feed intake and allow for early rumen development.

Rumen development is driven by the production of the volatile fatty acids in the rumen – particularly butyrate and propionate. This study suggests that the proper carbohydrate composition

of a calf prestarter can allow early weaning, good growth rates and excellent health (calves were very healthy in this study). Particularly, the treatments containing 10% whey plus corn or 20% whey plus sodium bicarbonate promoted early starter intake and good growth.

Prestarters have not been widely adapted by calf growers in the U.S., primarily because they are management and labor intensive. Furthermore, in most cases, calf growers do not attempt to “push” the rumen development of their calves to get maximum rumen development and early weaning. Although most calves, when properly managed, will be ready for weaning by 28 to 35 days of age, most producers don’t wean their calves until about 56 days. Methods of providing a high quality and palatable calf prestarter could allow early dry feed intake and allow producers to develop new methods of managing this critical time period in an animal’s life.

Reference: Quigley, J. D., III. 1987. Effect of prestarters based on corn, barley, or milk products on intake and growth of young calves. J. Dairy Sci. 70(Suppl. 1):113 (Abstr.).

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