A Replacement Report

Milk Replacer Research

Variation in daily delivery of nutrients and calf growth

Variation exists in mixing milk replacer and distributing milk replacer and milk to calves. On some farms implementation and execution of standard operating procedures lead to limited mistakes and consistency in daily tasks including feeding milk or milk replacer to calves. On other farms, mistakes are all too frequent and can be quite large. We measured this variation and its effect on calf performance.

A simple demonstration was set up using four experienced farm personnel to measure variation in mixing and distributing milk replacer. These were persons experienced in feeding calves whose tasks were being monitored; so they were paying attention to detail. Each repeated a task 10 times and another person weighed the milk replacer powder or reconstituted liquid that was distributed to calculate the variation of the task (Table 1). The variation (coefficient of variation, CV, %) associated with distributing milk replacer powder by a cup level to the cup brim is half that associated with using a mark on the cup below the cup brim. The variation associated with distributing reconstituted milk replacer liquid into bottles with a mark graduated to a desired volume was one-half to one-fifth that of distributing the powder. Distributing reconstituted milk replacer liquid with a nozzle that was graduated to the pail volume was also associated with low variation. However, distributing milk replacer liquid into a pail that had been graduated with line on its side resulted in about three times the variation of the previous methods. Now, recall that these people were experienced and knew their tasks were being measured. So this may represent less than average variation that takes place on commercial farms.

Table 1. Coefficients of variation (CV) measured for distributing milk replacer (milk replacer) powder and liquid by four experienced farm personnel.

Method	Overall CV of four persons, %	Range of CV among the four persons, %
Distributing powder with a graduated cup		
Filled to cup brim	2.3	1.2 to 3.3
Filled to a line below the cup brim	5.3	3.4 to 6.0
Distributing reconstituted liquid		
Into graduated bottles	1.0	0.5 to 1.3
Into pails with a graduated nozzle	1.1	1.0 to 1.3
Into pails graduated with a line	3.6	1.5 to 5.9

Variation can be reduced by weighing the total powder needed for the total number of calves to be fed. Weighing the water will also reduce the variation. If the calves are to be fed from a pail, set the pail on a level surface and then fill the pail using a nozzle or nozzle extension placed on the bottom of the pail. Small diameter pails should yield less variation than large diameter pails. Dispensing liquid to a graduated mark on the nozzle or extension gives more control than pouring liquid from a large bucket or ladle. Taking time to mix and dispense milk replacer carefully is critical to reduce variation.

It is common practice to feed calves waste milk that is a combination of transition milk, mastitic milk, and other non-saleable milk and its composition will often vary from day to day. On a dry basis, milk from Holsteins can be approximately 26% crude protein and 30% fat. Colostrum and transition milk will have greater concentrations of crude protein and fat. Variation in nutrient concentration will obviously lead to variable nutrient intake. Distribution of milk to individual calves will have the same variability as distributing milk replacer liquid to calves.

So what effect will a variable amount of nutrient intake have on calf performance? We set up a research trial to evaluate the effect of fixed or variable amount of milk replacer powder provided to calves, initially 2 to 3 days old. We made two milk replacers, one that was 26% crude protein and 17% fat and one that was 26% crude protein and 30% fat (similar to whole milk). The concentration of fat, as well as, fatty acid profile differed between the two milk replacers. There were 24 calves fed each milk replacer. Half of the calves on each treatment were fed a fixed amount of 1.5 lb of milk replacer every day. The other half of the calves on each treatment were fed a variable amount of milk replacer (1.50, 1.50, 1.20, 1.66, 1.50, 1.80, and 1.34 lb of milk replacer from day 1 to 7 of each weekly period, respectively, to average 1.5 lb daily). Calves were weaned at 28 days.

Forty-eight calves (12 per treatment) were housed in individual pens and had access to clean fresh water and dry textured starter feed (18% crude protein, 0.003% decoquinate) at all times. The nursery was naturally ventilated with no added heat. Starter feed offered and refused was weighed daily. Feces were scored daily using a 1 to 5 scale with 1 being normal and 5 being watery. Medical treatments were recorded daily. Calves were weighed initially and weekly thereafter. Body condition score (1 being thin and 5 being obese) and hip widths were measured initially and every 2 weeks thereafter. Data were analyzed as a randomized block design as a 2 by 2 factorial arrangement of treatments with their interaction.

Initial calf body weight and serum protein averaged 92 lb and 4.9 mg/dl, respectively, and did not differ ($P > 0.1$) among treatments. The trial was conducted during the summer of 2005 and the mean temperature from 0 to 56 days was 82 ºF. The average high, low, and mean temperatures for days 0 to 21 were 93, 72, and 86 ºF, respectively. The hot temperatures combined with the low serum protein levels likely led to the lower than normal calf performance on all treatments. Results are shown in Table 2.

Calves fed the 30% fat milk replacer gained slower and were less efficient from 0 to 28 days than calves fed the 17% fat milk replacer ($P < 0.05$). Calves fed the 30% fat milk replacer had less hip width gain from 0 to 28 days and 0 to 56 days than calves fed the 17% fat milk replacer ($P < 0.05$). This is likely attributable to the better fatty acid profile formulated into the 17% fat milk replacer, as well as, energy not being first limiting to gain.

Calves fed the variable amount of milk replacer gained 18% and 8% slower from 0 to 28 days and 0 to 56 days, respectively, consumed less starter throughout the trial, and were 17% less efficient from 0 to 28 days than calves fed a fixed amount of milk replacer ($P < 0.05$). The effect of feeding regime (fixed vs. variable) was similar on calves fed the low fat milk replacer and the high fat milk replacer. Other measurements did not differ ($P > 0.1$) among treatments.

Table 2. Performance of calves fed an average of 1.5 lb daily of 26% crude protein milk replacers with different fat concentrations at fixed or variable feeding amounts[1].

Measurement	30% Fat Variable	30% Fat Fixed	17% Fat Variable	17% Fat Fixed	Main effect P value[2] Fat	Amount
Gain, lb/day						
0-28 days	0.59	0.79	0.71	0.81	0.048	0.037
28-56 days	1.53	1.56	1.60	1.75	0.075	0.076
0-56 days	1.06	1.18	1.16	1.28	0.090	0.027
Starter intake, lb/day						
0-28 days	0.22	0.24	0.23	0.28	ns	0.045
28-56 days	3.55	3.67	3.53	3.80	ns	0.017
0-56 days	1.89	1.95	1.88	2.04	ns	0.015
Gain to feed efficiency						
0-28 days	0.359	0.480	0.428	0.474	0.046	0.044
28-56 days	0.430	0.446	0.468	0.468	ns	ns
0-56 days	0.407	0.450	0.450	0.468	0.095	ns

[1] Calves fed a variable amount of milk replacer received 1.50, 1.50, 1.20, 1.66, 1.50, 1.80, and 1.34 lb of milk replacer powder from days 1 to 7 of each weekly period, respectively, to average 1.50 lb daily. Calves fed a fixed amount of milk replacer received 1.5 lb of milk replacer powder each day.

[2] P values of less than 0.05 indicate statistically different main effects of fat concentration and feeding amount. P vales of greater than 0.05 indicated trends for difference in main effects. ns indicated the main effects were not statistically different (P > 0.1).

The performance of calves fed the variable amount of milk replacer in this research trial demonstrates that a lack of care in reconstituting and distributing milk replacer can reduce calf performance. It also implies that producers who feed a combination of various milk sources that alter the amount of solids consumed on a daily basis could be sacrificing calf performance.