



## *Milk Replacer Research* Feeding rate and weaning age affects digestion

Published research shows that as milk replacers (MR) are fed to calves at rates approaching 2 lb (or more) of powder daily, starter intake is depressed and there is a weaning and post-weaning slump in ADG. Spanish researchers (Livest. Sci. 110:82) reported that starter intake was reduced and post-weaning digestibility of the starter was reduced in the calves fed approximately 2 vs. 1 lb of MR powder daily. We have previously reported similar reductions in post-weaning digestion of starter under US conditions (Table 1). We have reinvestigated these possibilities in both pre- and post-weaned calves and under 28 and 42 day weaning programs.

Holstein calves (5/program) initially 2 to 4 days of age and averaging 94 lb body weight were fed 3 MR treatments using Pinnacle MR (26% CP, 17% fat powder). Program A was feeding 1.5 lb of MR powder daily and weaning at 28 days. Program B was feeding 1.5 lb of MR powder daily and weaning at 42 days. Program C was feeding up to 2.5 lb of MR powder daily and weaning at 42 days. All calves were fed an 18% CP starter and water free-choice from day 0 to 56. Calves were maintained in 4 by 8 feet pens in a curtain sided and naturally ventilated barn with no added heat. Calves were bedded with straw. Digestibility was estimated with chromic oxide, an indigestible marker, in the feeds during days 21 to 24, days 36 to 39, and days 53 to 56. Blood was sampled on d 21, 35, and 56 and serum was analyzed for various constituents. Differences are discussed at  $P < 0.05$  (Table 2).

Digestion was typically less in weaned calves than in pre-weaned calves, as would be expected for digestion of milk vs. non-milk ingredients. Intake and amount of nutrients digested typically increased with day, while fat was an obvious exception. Additionally, serum concentrations of amylase increased with day.

During the first measurement period for day 21 to 24 (pre-weaning), Ca digestibility was least for program C while amount of DM, organic matter (OM), CP, Fat, and P digested was greatest for program C. The amount digested was a function of the greater MR intake of calves fed program C. Serum amylase concentration was lower for calves fed program C vs. B, indicating that there is less of the starch digesting enzyme amylase produced in calves fed program C.

During the second measurement period from day 36 to 39, digestibility of DM, OM, fat, Ca, and P was greater from calves fed program B vs. A. Additionally, digestibility of DM, OM, fat, Ca, and P was greater from calves fed program B vs. C. The amount of DM and OM digested was greatest for calves fed program A and least for calves fed program C. Calves fed program C digested less CP, fat, Ca, and P than calves fed program B. Calves fed program A digested less fat than calves fed program B. The amount of nutrients digested was influenced by total intake of nutrients which ranked program A greater than B greater than C for all nutrients measured except fat (which ranked program B greater than C greater than A). Serum amylase concentration was lower for calves fed program C vs. B.

During the third measurement period from day 53 to 56, all calves were weaned. Digestibility of DM, OM, Ca, and P was lowest for calves fed program C, which was influenced by intake being lowest for calves fed program C. Serum amylase concentration was lower for calves fed program C vs. B.

Calves fed program C had lower digestibility of DM, OM, Ca, and P the week of weaning (day 36 to 39) and post-weaning (day 53 to 56). This combined with a lower intake of starter, resulted in less of these nutrients being digested. This supports the results in other trials where calves that were fed more than 1.5 lb MR powder daily had less BW gain and feed efficiency during the weeks just prior to weaning and post-weaning.

Item	MR program			
	A	B	C	D
MR CP-fat, %	20-20	26-17	26-17	28-20
Days fed MR	42	42	28	49
Total MR intake, lb/calf	40.4	60.7	39.7	108.7
ADG, lb/d				
0-56 days	1.05 <sup>a</sup>	1.33 <sup>bc</sup>	1.27 <sup>b</sup>	1.43 <sup>c</sup>
56-84 days	2.20 <sup>a</sup>	2.34 <sup>b</sup>	2.64 <sup>c</sup>	2.08 <sup>a</sup>
Starter intake, lb/day				
0-56 days	1.67 <sup>a</sup>	1.66 <sup>a</sup>	2.07 <sup>b</sup>	1.51 <sup>c</sup>
56-84 days	6.27 <sup>a</sup>	6.52 <sup>a</sup>	7.60 <sup>b</sup>	6.39 <sup>c</sup>
Post-weaning digestibility of OM, %	77.4 <sup>a</sup>	78.3 <sup>a</sup>	78.7 <sup>a</sup>	68.0 <sup>b</sup>
Serum amylase, units/liter	46.0 <sup>a</sup>	48.8 <sup>a</sup>	50.9 <sup>a</sup>	35.9 <sup>b</sup>

<sup>a,b,c</sup> Program means with different letters differ ( $P < 0.05$ ).

Item	MR program		
	A	B	C
Days fed MR	28	42	42
Total MR intake, lb as-fed/calf	38.2	58.4	87.8
Total starter intake, lb as-fed/calf <sup>a,b</sup>	102.1	86.9	74.3
Days 21 to 24			
OM intake, lb/day <sup>b</sup>	1.93	1.90	2.56
OM digestibility, %	87.4	86.9	87.6
OM digested, lb/day <sup>b</sup>	1.69	1.65	2.24
Fat digestibility, %	90.7	89.0	90.8
Ca digestibility, %	70.1	69.9	57.1
Serum amylase, units/L <sup>b</sup>	58	56	39
Days 36 to 39			
OM intake, lb/day <sup>a,b</sup>	2.78	2.31	1.84
OM digestibility, % <sup>a,b</sup>	80.8	87.9	77.7
OM digested, lb/day <sup>a,b</sup>	2.24	2.03	1.43
Fat digestibility, % <sup>a,b</sup>	86.8	94.3	79
Ca digestibility, % <sup>a,b</sup>	54.9	67.1	51.4
Serum amylase, units/L <sup>b</sup>	76	69	57
Days 53 to 56			
OM intake, lb/day <sup>a,b</sup>	4.70	4.16	3.65
OM digestibility, % <sup>b</sup>	82.9	82.9	77.8
OM digested, lb/day <sup>a,b</sup>	3.90	3.44	2.84
Fat digestibility, %	88.3	90.0	86.0
Ca digestibility, % <sup>b</sup>	55.6	54.6	54.2
Serum amylase, units/L <sup>a,b</sup>	93	81	68

<sup>a,b</sup> Programs A vs. B were different ( $P < 0.05$ ) based on contrast statement.  
<sup>a,b</sup> Programs B vs. C were different ( $P < 0.05$ ) based on contrast statement.