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Calf Note 185 – Milk intake and dry feed type effects on growth

Introduction

Interest in preweaning levels of milk feeding and subsequent performance of calves has led to a reexamination of the dry feed component of the diet prior to and immediately after weaning. High rates of body weight gain (often >1 kg/d) are often not maintained after weaning due to a lack of gastrointestinal development and poor digestibility immediately after weaning.

Further, interest in the value of feeding forage prior to and immediately after weaning has been spurred by several studies that suggest that forage may promote rumen development rather than hinder it.

Finally, a common question from calf raisers is when to introduce fermented feeds to calves. A common suggestion is to wait until calves are about 4 months of age, due to the general lack of ruminal size, higher moisture content of silage and subsequent lower nutrient intake. However, availability of high quality lactation TMR is an appealing alternative – when should we offer a TMR to calves? These questions were addressed in a recent article by Overest et al., in the January 2016 Issue of the Journal of Dairy Science. Let's take a look at the research and some of their practical findings.

The Research

In this study, 48 newborn Holstein calves were fed acidified milk replacer (26% protein, 16% fat, 150 g/L, pH = 4.0-4.5 with formic acid) up to 12 L/d from d about 1 d of age to day 38. From d 39 to 50, the amount of liquid was reduced so that calves were weaned by d 50. This provided a 12-d transition period prior to weaning.

Calves were offered 1 of 4 treatments: a **TMR**, concentrate only (**CON**), concentrate mixed 85:15 with 2nd cut chopped grass hay (**MIX**) or concentrate + hay fed separately (**SEP**). Nutrient content of each ingredient and the MIX diet is in Table 1.

Calves had access to feed ad libitum and intake was measured daily. Water was available at all times.

Calves were weighed weekly and blood was sampled for measurement of blood β -hydroxybutyrate. In addition, behavior was measured.

	CON	MIX	Hay	TMR
DM, %	90.3	89.8	88.3	51.5
NDF, %DM	14.7	21.6	61.1	31.7
NFC, %DM	48.5	46.1	18.6	40.4
CP, %DM	20.9	18.0	8.3	15.2
ME, Mcal/kg DM	2.9	2.7	2.0	2.5

Table 1. Nutrient content of feeds used in the study.

Some Results

We'll take a look at some of the more practical aspects of the study summarized by topic.

Observation #1: Lots of milk = little starter. Prior to weaning, calves on all treatments at very little dry feed but gained an average of 1.1 kg of BW/d. Lots of milk also translates to greater BW gain. Average dry feed intake was 0.08 to 0.1 kg/d for all treatments. If we calculate the average intake over the entire 38-d preweaning period, this comes to 3.0 to 3.8 kg. Growth rates were 1.0-1.1 kg/d, which is excellent BW gain for calves during the first two months of life. Typical ADG for calves in the first 60 d are typically similar to 0.5 to 0.7 kg/d when fed less milk or milk replacer.

Observation #2: Weaning can be tough. During the weaning transition (d 39-50), calves gained an average of 0.4, 0.5, 0.5, and 0.2 kg BW/d for CON, MIX, SEP, and TMR treatments, respectively. Prior to this time, calves gained 1.0-1.1 kg/d; after weaning (d 50-84) calves gained an average of 1.2 (CON, MIX, SEP) or 0.7 (TMR) kg/d. Lower growth during weeks 6-7 were likely due to the lack of dry feed intake prior to weaning and lack of ruminal development. Previous research (Terre et al., 2006, 2007; Hill et al., 2010) has shown that post-weaning nutrient digestibility is impaired when calves drink larger amounts of milk and consume little dry feed prior to weaning. It's essential that calves "build" sufficient rumination capacity in the rumen (both physical size and metabolic activity) and intestine to be able to utilize nutrients from dry feed. It's possible that reduced growth during the 6-7 wk period could contribute to increased stress on the calves, possibly from increased large intestinal fermentation of starch and production of endotoxin from the lower gastrointestinal tract.

Observation #3: What effect forage? Data are somewhat conflicting regarding the value of offering forage prior to and immediately after weaning. Some research indicates that forage (containing lower energy and higher indigestible fiber) reduced growth by reducing ME intake, slowing the rate of rumen development and increasing gut fill. Other data suggest that calves fed even a small amount of forage preweaning will eat more DM and grow faster compared to calves fed only concentrate.

In this study, calves fed forage, either separately (**SEP**) or mixed with concentrate in a ratio of 85% concentrate and 15% forage (**MIX**) consumed the same amounts of DM and grew at the same rate as calves fed only concentrate during weaning (wk 6-7; Table 2). From 8-12 wk, all calves on CON, MIX and Hay diets were fed the MIX diet; therefore, the comparison post-weaning is only between MIX vs. TMR. These data suggest that, at least in calves fed higher amounts of liquid prior to weaning, the effect of offering forage had little effect on intake or growth.

Observation #4 – TMR can be offered too early. Lower intake of solid feed throughout the trial and slower growth from wk 6 to the end of the study indicates clearly that the TMR offered in the trial supported slower growth compared to concentrate without or with forage (Table 2).

Observation #5 – Forage affects rumination. The authors monitored rumination time (minutes per hour) beginning on wk 3. During the weaning period (wk 6-7) rumination times were

6.3, 17.8, 11.1, and 11.9 minutes per hour for calves fed CON, MIX, SEP and TMR treatments, respectively. Calves fed CON (fed no forage) ruminated for fewer minutes per hour ($P < 0.05$) compared to all other calves and calves fed MIX tended ($P < 0.10$) to ruminate more than calves

	CON	MIX	SEP	TMR
Weaning (6-7 wk)				
Solid feed, kg/d	0.46 ^a	0.50 ^a	0.52 ^a	0.19 ^b
ADG, kg/d	0.4 ^a	0.5 ^a	0.5 ^a	0.2 ^b
Post-wean (8-12 wk)				
Solid feed, kg/d	2.68 ^a	2.67 ^a	2.87 ^a	1.78 ^b
ADG, kg/d	1.2 ^a	1.2 ^a	1.2 ^a	0.7 ^b

Table 2. Intake of dry feed (concentrate + forage) and average daily gain in calves.

fed SEP. This observation is consistent with the onset of ruminal contractions and physical development of the rumen. Rumination increases production of saliva, maturation of salivary bicarbonate concentration and increase in salivary pH and improved ruminal environment.

Summary

Several conclusions can be made from this interesting study:

1. It is possible to feed TMR containing fermented feeds too early. In this study, feeding a high quality TMR (15% CP and 2.5 Mcal ME/kg DM) reduced intake and ADG. It's likely that a combination of reduced nutrient concentration (the TMR contained 15% of DM as CP compared to 21% CP in CON and 18% CP in the MIX) and content of fiber and fermentation products reduced intake and growth. However, it is unclear whether a TMR containing similar nutrients to the MIX diet would show similar effects.
2. Feeding large amounts of milk replacer preweaning slows dry feed intake and subsequent rumen development. In this study, reducing milk intake by 1 L/d over a 12-d period did not eliminate the reduced ADG during the transition. However, after weaning (after 50 d), calves gain >1 kg/d to the end of the 12-wk study.
3. Calves fed large amounts of milk replacer preweaning were efficient during this period (average G:F ratio = 0.74 kg gain per kg DMI) and the small amount of dry feed consumed had little effect on efficiency of milk replacer use for growth.

References

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