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Calf Note #150 – Consistency of milk feeding

Introduction

Recent research has shown that waste milk can vary significantly markedly in solids content, depending primarily on the amount of water that contaminates the product. This reduces the solids in the milk, reducing overall nutrient intake. Variation in reconstituted calf milk replacer (**CMR**) can occur when different amounts of powder are mixed. Whether mixing individual feedings or whole bags at a time, variation in the ratio of powder to water can affect the nutrients a calf is fed.

We know that the variation in the nutrient intake can affect growth. However, another important question is whether the variation *per se* affects their growth or health. Changes in the amount or concentration of nutrients presented to the intestine could potentially affect many aspects of the intestinal environment, thereby affecting digestion and health.

Some interesting research

The question of variation was addressed in two studies by Hill et al. (2008). The researchers used two studies to evaluate the question of variability and its effect on performance of milk-fed calves.

Study 1. The first study compared feeding a set amount of dry matter (**DM**) from either CMR or whole milk or a combination of the two. The treatments are in Table 1. Calves in the CMR treatment were fed 454 g/d of CMR (1 lb as fed; 432 g/d on a DM basis) reconstituted into 3.8 L (1 gallon) of water. This was divided into two equal treatments fed in the a.m. and p.m. The second treatment (**MIX**) was a mix of DM from CMR (½ lb. of powder) and whole milk from a local dairy farm. The third treatment (**MILK**) was whole milk fed at the same DM as the other treatments. Water was added to MIX and MILK treatments so that all calves were fed 3.8 L (1 gallon) of liquid daily. Calves were fed the 3.8 L of liquid per day to d 39, then the amount offered was reduced by 50% until weaning at d 42. Calves were all offered a commercial calf starter and free choice water for the entire 56-day experiment.

Item	CMR	MIX	MILK
g fed/day	454	454	454
g from milk	0%	50%	100%
Liters fed	3.8	3.8	3.8

Table 1. Treatments used in Study 1.

So, what did the researchers learn? Results are in Table 2. Calves fed the CMR in this study grew faster prior to weaning, consumed more calf starter (**CS**) and were more efficient in using nutrients for growth (**FE**). Calves fed the CMR grew better even though they consumed slightly less protein and fat – the milk used in the study increased the amount of CP and fat consumed by MIX and MILK calves. Thus, the results are particularly interesting, as calves fed CMR grew better and more efficiently *even though they consumed less CP and fat.* So, what caused this difference?

Item	CMR	MIX	MILK	*P**
ADG, g/d	437	380	375	0.03
CS DMI, g/d	418	373	378	0.05
FE, g/kg	514	471	460	0.04
Scours**	1.5	1.5	1.4	0.29

Table 2. Performance of calves in Study 1 from days 0-42.

**P* for CMR vs. MIX and MILK.

Scours** = scours score on scale = 1 (normal) to 5 (severe scours).

One difference among treatments was the concentration of bacteria fed to calves. The milk used in this study was not pasteurized. The average standard plate count for the CMR, MIX and MILK treatments were 2,226, 67,571, and 126,905 cfu/ml, respectively. The researchers suggested that increasing numbers of bacteria in milk used in MIX and MILK treatments could have impaired animal performance. The number of total bacteria were greater than some have recommended (James and Scott, 2007) for feeding to calves without pasteurization. However, scours scores or number of days the calves scoured did not differ, so bacteria probably didn't cause intestinal disease.

After weaning (on d 42) to the end of the study (d 56) there were no differences in growth or intake among treatments, so the differences in intake, growth and efficiency observed prior to weaning did not appear to have long lasting effects.

Item	CMR1 Fixed	CMR1 VAR	CMR2 Fixed	CMR2 VAR
CMR	27/17	27/17	27/31	27/31
g/d	681	VAR*	681	VAR*
Solids %	14.8	14.8	14.8	14.8

Table 3. Treatments used in Study 2. CMR1 = 27% CP and 17% fat; CMR 2 = 27% CP and 31% fat (as fed basis).

VAR*: calves fed 545, 754, 681, 817, 608, 681, 681 g/d during each day of the week of the study. The average amount fed = 681 g/d over each 7 d period.

It's noteworthy that the milk used in Study 1 was whole, saleable milk. Even though the milk was fit for human consumption, the amount of solids, protein and fat varied considerably. The range in solids was 10.5 to 15.0% (SD = 0.7). We would normally expect that whole milk would be approximately 12.5% solids with minimal variation. This study suggests that our assumptions regarding whole milk may need to

change. Of course, several research studies have shown that waste milk varies in solids, protein and fat content even more than whole, saleable milk.

Study 2. The second study was designed to evaluate effects of daily changes in amount of CMR fed daily. This study used two CMR formulas – one a 27/17 (CP/fat) formula similar to commercial CMR formulas fed in the U.S. and the second a 27/31 formula designed to be similar to whole milk on a DM basis. These two CMR were fed at either a fixed amount (681 grams/day; 1.5 lb/day) or a rate that varied from day to day, but averaged 681 grams/day over the week. The amount offered varied from 545 to 817 grams/day (1.2 to 1.8 lb/day) depending on the day of the week. Calves were fed a fixed DM percentage – 14.8%, so the amount of liquid calves received daily varied. However, each calf received the same amount of nutrients at the end of each 7-day period. Calves were weaned from milk on this study on day 28.

Item	CMR1 Fixed	CMR1 VAR	CMR2 Fixed	CMR2 VAR	*P**
ADG, g/d					
0-28 d	367	323	361	269	0.04
29-56 d	795	726	709	696	0.08
CS, g/d					
0-28 d	110	91	95	88	0.05
29-56 d	1506	1396	1452	1407	0.02
FE, g/kg					
0-28 d	501	453	503	379	0.04
29-56 d	528	520	488	495	0.33

Table 4. Performance of calves fed Fixed or variable amounts of CMR. CMR1 = 27/17; CMR2 = 27/31.

*Probability of Fixed differing from VAR treatments.

Results of the trial are shown in Table 4. Calves fed the Fixed rate of CMR (same amount of powder every day) grew faster, ate more calf starter and were more efficient prior to weaning. The effects on starter intake and ADG were maintained even after weaning.

Results in this study are striking. Calves fed either CMR on a consistent basis (681 g/d) grew faster, ate more calf starter and were more efficient than calves fed different amounts of CMR on different days – even though nutrient intake was the same by the end of each week. This study gets to a key point – calves grow better when they're exposed to less variation in nutrient intake. This appears to affect calves not only during the milk feeding period but also carries over after weaning.

The implications of this study are important. When we control variation, animals perform better. When we don't, we pay the price in terms of reduced performance. It's incumbent on us as managers of our animals to implement management strategies to minimize variation in our feeding programs.

On a side note, calves fed the high fat CMR (31%) in Study 2 generally grew slower, ate less calf starter and were less efficient than calves fed the lower fat CMR (17%). It's important to note that the 17% CMR was supplemented with lysine, methionine and specific fatty acids, whereas the 31% CMR was not. Thus, the amount of essential amino acids and fatty acids varied between the CMR. Thus, it's likely that at least some of the difference between the two CMR formulas was due to differences in these nutrients. Though we normally think of milk protein as providing high quality protein, the addition of essential amino acids can improve performance when other nutrients are available to support increased growth.

Summary

Consistency is king. Variation in the nutrients we provide calves can and does affect performance. Whether we feed whole milk, waste milk or CMR, there's variation in nutrients delivered to the calf. When that variation is too great, performance suffers. We can improve calf growth and efficiency when we take steps to reduce variation. Strategies such as using a refractometer to measure total solids and adding solids can reduce variation in the nutrient intake. These two studies suggest that monitoring variation with saleable milk, waste milk and even reconstituted CMR would be useful.

References

Hill, T. M., H. G. Bateman, II, J. M. Aldrich, and R. L. Schlotterbeck. 2008. Effect of consistency of nutrient intake from milk and milk replacer on dairy calf performance. Prof. Anim. Sci. 24:85-92.

James, R. E., and M. C. Scott. 2007. On farm pasteurizer management for waste milk quality control. p. 49 in Proc. 11th Calf and Heifer Conf., Burlington, VT.

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