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Calf Note 198 – Colostrum fed by tube or bottle

Introduction

For a number of years, calf advisors have recommended a standard protocol for feeding colostrum to newborn calves that includes administering the colostrum with an esophageal feeder (a nice demonstration of how to use a tube feeder from the University of Wisconsin is here). Esophageal feeders allow administration of known amount of colostrum in a short period of time. But, some calf managers prefer bottle feeding colostrum to newborns. Proper placement of the tube in a newborn calf, welfare concerns, and the desire to monitor calf intake are common when managers express concerns about using an esophageal feeder. Another common question is whether absorption of IgG from the colostrum is affected by method of feeding. It is generally accepted that colostrum fed by tube will first enter the rumen, as the esophageal groove does not close when calves are intubated. If the colostrum remains in the rumen for an extended period of time, it is possible that efficiency of IgG absorption may be depressed. However, several studies (Chigerwe et al., 2012; Godden et al., 2009) have suggested that final serum IgG is not markedly affected by feeding with a tube versus bottle.

Most previous research comparing bottles vs. tubes have evaluated whole, liquid colostrum. There are fewer studies that have evaluated powdered colostrum replacers and whether or not method of feeding might affect efficiency of IgG absorption.

The Research

An article in the 2018 Journal of Dairy Science reported on the serum IgG in calves fed a spray-dried colostrum replacer, administered either by bottle or esophageal feeder. In this study, newborn Holstein calves (n = 20, with birth BW = 44.8kg) from a commercial dairy (Millet, Alberta, Canada) were used. Within 10 minutes of birth, calves were separated from the dam, weighed and moved to individual pens bedded with straw. A spray-dried colostrum replacer based on bovine colostrum was used. The product (750 grams) was mixed with water to a final volume of 3 L. The product delivered 200 grams of IgG in the first feeding. At 12 hours and every 12 hours thereafter until 48 hours, calves were fed 3 L of pasteurized whole milk. Therefore, the only source of IgG occurred in the first feeding. The researchers monitored serum IgG concentrations and several other blood constituents. For the sake of clarity, this Calf Note will focus on serum IgG concentrations. Also, the researchers used a marker of abomasal emptying, so they could determine if differences (if any) in serum IgG concentration could be attributed to a difference in the way the colostrum left the abomasum and entered the intestine, where absorption occurred.

Results

A summary of how colostrum IgG were absorbed are in Table 1. Consumption of colostrum was faster when calves were tubed (logical, as it is faster to administer via tube rather than bottle feeding). Also, because not all calves that were fed by bottle consumed all their colostrum, intake of colostrum was greater when calves were fed by tube. These are all reasons in support of using a tube for more rapid and complete administration of colostrum.

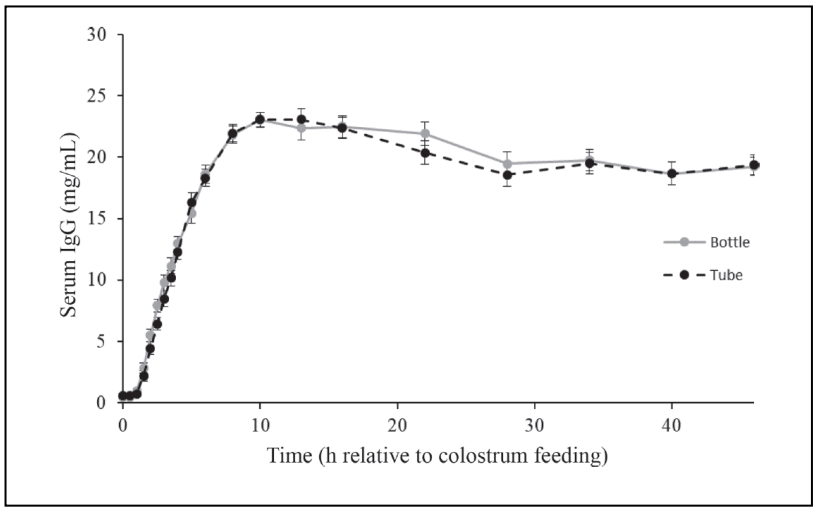
Maximum serum concentrations did not differ and were >24 g/L in both treatments. We generally consider serum IgG concentrations >10 g/L to indicate "successful passive transfer", so these values indicate that the IgG from the colostrum product were well absorbed.

An interesting observation is that peak IgG concentrations were achieved at 13 to 16 hr. Calves were all fed at approximately 2 hours after birth. So, these data suggest that it takes about 11-14 hours for peak serum IgG concentration to occur. Note that there was only 1 feeding of colostrum replacer. Had the researchers fed a second feeding of colostrum product, it is likely that peak concentration would have occurred later in life.

Table 1. Calf body weight and intake.

Item	Bottle	Tube	SE	P
Time to consume, min	17.6	5.2	1.51	0.01
Consumed, 1st meal, L	2.47	2.96	1.30	0.01
Max serum IgG, g/L	24.2	24.7	0.58	0.56
Time to peak IgG, h	13.1	16.1	2.68	0.44
Abomasal emptying, %/h	52.4	52.9	7.50	0.96

Serum IgG concentrations are in Figure 1. Clearly, there are no differences between tube feeding and bottle feeding. Further, the rate of abomasal emptying (52 to 53% per hour) were very similar between treatments. We can infer some important concepts from this observation.



If we assume that colostrum administered by tube enters the rumen, whereas colostrum consumed by bottle by-passes the rumen and goes directly to the abomasum, then we would expect a difference in abomasal emptying, since there would be little colostrum in the abomasum of tube fed calves. However, there were no differences in abomasal emptying. The reason is likely due to the size of the rumen in a newborn calf. According to work by Chapman et al. (1986), the rumen of very young calves can hold only about 400 ml. Therefore, if we administer a large amount of colostrum (>400 ml) by esophageal feeder, then there isn't enough capacity in the rumen. The excess colostrum will move out of the rumen into the omasum and abomasum. In this case, calves were tubed with 3 L of colostrum, so it is likely that at least 2.5 L of colostrum flowed into the abomasum even though the calves were tube fed. It is also possible that, as the abomasum emptied, any colostrum remaining in the rumen would move into the rumen. Therefore, there was no effect on abomasal emptying and no effect on absorption of IgG.

Summary

Calves fed by esophageal feeder absorb IgG equivalent to calves fed by nipple bottle. This appears to hold true for maternal colostrum or colostrum replacers. In addition, it appears that feeding more than about 400 ml of colostrum by tube results in "spill-over" from the rumen into other components of the calf's stomach. Consequently, it appears that there is no significant effect on abomasal emptying or absorption of IgG.

References

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