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Calf Note #138 – Prolonged colostrum feeding and calf health

Introduction

Colostrum is well known as the source of immunoglobulins (**IgG**) for newborn calves. Most of the focus on colostrum feeding (and rightly so) is on delivering sufficient mass of IgG from colostrum during the first 24 hours of the calf's life. This is the period in which the IgG (and other proteins) can be absorbed without digestion into the calf's bloodstream.

But what happens after 24 hours of age? Are IgG still absorbed into the bloodstream? If not, are they digested? What value is the traditional recommendation to feed colostrum for the first three days of life?

Well, after 24 hours of life, there are a number of changes that occur within the gastrointestinal system of the calf that digest the IgG, thereby destroying their immunological value. These changes (caused by a multitude of factors) are collectively termed "intestinal closure" and it generally occurs at about 24 hours of age. Thereafter, the IgG are no longer absorbed into the bloodstream and cannot contribute to the calf's systemic immunity.

But, there is still value to feeding colostrum for longer than just 24 hours of life. That's because all types of immunoglobulins – IgG, IgM and IgA are at least partially resistant to digestion in the intestinal tract. It has been shown that IgA (also called secretory IgA) is particularly resistant to digestion; however, IgG (the main immunoglobulin in colostrum) is also partially resistant to digestion. In a research trial, human subjects consumed bovine IgG derived from colostrum. Feces collected from the subjects indicated that a substantial amount of the bovine IgG was not digested but passed into the feces and was still immunologically active.

Other research with calves showed that IgG from the bloodstream moved into the intestine, where they contribute to protecting the calf against intestinal infections from organisms such as salmonella, rotavirus and others. For more information, see Calf Note #92 - Antibodies & passive transfer (<http://www.calfnotes.com/pdf/CN092.pdf>).

A recent research trial reported in the January 2009 issue of the Journal of Dairy Science showed that calves supplemented with colostrum powder during the first 14 days after arrival at a commercial calf ranch had improved health and growth compared to calves fed a nutritional similar supplement (without supplemental IgG) or unsupplemented calves.

The research

Calves on three California calf ranches were used in the study. The calves (n = 90 to 92) arrived at the ranch at 1 to 3 days of age and were managed according to the normal management of the farm, except that 30 calves per farm were fed 140 grams/day of a colostrum supplement (**CS**); a second 30 calves were fed 70 grams of a nutritional supplement (**NS**) with a similar nutrient profile to CS

except without IgG; and the third group of 30 calves was unsupplemented (**Control**). The colostrum supplement provided 10 grams of IgG per 70 grams fed at each feeding in the a.m. and p.m.

Most calves arrived on the farms with either total or partial failure of passive transfer (i.e., serum IgG concentration <10 g/L) and weighed an average of 41 kg (90 lb). Calves were purchased from local dairy farms and transported to the calf ranches by truck.

Mortality rates from arrival to day 28 averaged 7.7, 7.8 and 26.1% for each of the three calf ranches. The high mortality on ranch #3 was due to an outbreak of *Salmonella enterica* serovar Newport during the study and during a heat stress period. There was no effect of CS or NS on the risk of dying during the first 28 days of the study; however, calves with partial FPT (3.5 to 9.9 g of IgG/L of serum) were 6 times more likely to die and calves with FPT (<3.5 g of IgG/L of serum) were 26 times more likely to die than calves with successful passive transfer.

Table 1. Description of calves on arrival at all farms.

Item	Con	CS	NS
No. of calves	90	92	91
Serum IgG, g/L	13.5	11.5	12.1
% with FPT	60.0	63.0	62.6
BW, kg	42	41	42

There was an effect of the supplemental IgG in terms of disease incidence and body weight gain (Table 2). Calves fed the supplemental IgG had fewer days treated for diarrhea, days treated for respiratory disease and total treatment days.

These data show that an IgG supplement can improve calf health (respiratory and diarrhea days) although there was no effect on overall mortality. The biggest factor affecting mortality on these three ranches was incoming serum IgG concentration. Calves that didn't receive enough colostrum during the first day of life were much more likely to die than other calves.

Table 2. Effect of treatments on health parameters of calves on all farms.

Item	Con	CS	NS
ADG to 28 d, kg	0.22	0.28	0.23
Diarrhea days, %	9.7	6.1	10.7
Respiratory days, %	0.74	1.00	1.46
Treatment days, %	10.6	8.2	12.3

Maternal colostrum is a good source of supplemental IgG if it is available.

Previous research showed that maternal colostrum from cows vaccinated with rotavirus vaccine during the dry period protected calves against a rotavirus challenge when fed to calves for 14 days. Addition of 100-200 ml of colostrum to milk or milk replacer can provide 5 to 10 grams of IgG/day depending on the IgG concentration in the colostrum.

Producers that don't have access to maternal colostrum have three potential sources of IgG – dried colostrum supplements, egg antibody and plasma and serum proteins. Colostrum supplements generally contain 10-15% IgG and are “poly-clonal” IgG sources. A poly-clonal source of IgG is one that contains a wide variety of antibodies and is not specifically targeted to one specific viral or bacterial antigen. Plasma and serum proteins are generally higher in IgG and contain 12 to 20% IgG. Again, these IgG are poly-clonal. Plasma proteins are particularly easy to use since they may be added to commercial milk replacer formulations, making the addition of functional IgG automatic. Egg antibodies are obtained from chickens that are hyper-immunized against specific pathogens and thus are more targeted to a pathogen of interest.

Summary

Adding a source of functional immunoglobulins to milk replacer can improve health of calves and potential reduce the use of antibiotics on the farm. Of course, the amount of response that each producer will observe in response to the use of supplemental IgG during the first two weeks depends on level of management and endemic on the farm. The cost to using an IgG source – whether obtained from colostrum, egg powder or plasma protein – should be weighed against the improvements in calf health. It will be important not only to include the cost of medicines used, but also the labor involved in administration as well as improvements in average daily gain which can result in better quality calves.

References

Berge, A. C. B., T. E. Besser, D. A. Moore, and W. M. Sischo. 2009. Evaluation of the effects of oral colostrum supplementation during the first fourteen days on the health and performance of preweaned calves. *J. Dairy Sci.* 92:286–295.

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