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G90-987 Colostrum Quality and Absorption in Baby Calves

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Colostrum Quality and Absorption in Baby Calves

This NebGuide explains the importance of early feeding of high quality colostrum to the newborn calf.

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The intake and absorption of colostral immunoglobulins, which include antibodies against disease, are essential to the health of the newborn calf. The newborn calf is virtually devoid of circulating antibodies and thus relies on antibodies acquired from colostrum for protection against common disease-causing organisms (pathogens). Significant amounts of the antibodies obtained from good quality colostrum, if fed early enough, are transferred across the small intestine and into the blood during the first few hours of life (passive transfer). Antibodies entering the blood are further distributed to various parts of the animal's body. The absorbed antibodies protect against systemic invasion by pathogens while antibodies that are not absorbed play an important role in protection against intestinal disease.

During absorption, the proportion of antibodies entering the blood depends on the colostral quality (total concentration of antibodies), and the volume that actually reaches the calf's intestine during the early hours of life.

Monitoring the Effects of Passive Transfer

A calf is born with minimal or no resistance (immunity) to disease. The newborn must absorb the antibodies from colostrum during the first 24-36 hours of life. As mentioned, this is called passive transfer (immunity). The level of immunity transferred from the colostrum to the blood can be determined by measuring the concentration of immunoglobulins (antibodies) in the calf's serum. IgG is the predominant antibody-containing immunoglobulin in colostrum and thus it is commonly used as the reference immunoglobulin to determine transfer. The IgG levels in the calf's serum at 48 hours of age

are commonly used as the reference point to determine passive transfer efficacy.

Many methods can be used to measure blood serum antibody-containing immunoglobulins, but the zinc sulfate turbidity test (ZST) is easily and rapidly performed. This is a useful laboratory test frequently used by practicing veterinarians.

Herd-to-herd variation in the concentrations of serum immunoglobulins is common, and thus it specifically cannot be stated that the serum antibody concentrations will assure protection against baby calf diseases. Weather, dams that leak colostrum, differences in the management of dams, calves, stocking rate, sanitation, and the presence of specific pathogens may vary protection.

In general, serum IgG concentrations of less than 10 mg/ml are evidence of poor passive transfer. In most herds these concentrations are associated with increased disease problems. Serum concentrations of less than 5 mg/ml IgG are evidence of passive transfer failure. Calves with this level tend to have higher mortality. Using the zinc sulfate turbidity test, values of 20 and 10 ZST units are evidence of moderate to severe passive transfer failure. Seek veterinary assistance in high problem herds.

Factors that Influence the Passive Transfer

Blood antibody levels are influenced by the concentration of colostrum ingested, interval after birth before colostrum is ingested, feeding method, and genetic, physiological, and/or environmental factors. Of these, the antibody mass ingested and the interval after birth before colostrum is ingested are the most important factors.

Antibody concentration is highest in first milking colostrum. The rapid fall in colostral antibody concentration after calving and during subsequent milking is well recognized (*Table I*). Only first milking colostrum should be used for the initial feeding. Furthermore, there is considerable cow to cow variation in the antibody concentration of first milking colostrum; generally, concentrations are lowest in first lactation heifers.

Table I. Approximate composition of colostrum and whole milk[1]

Item	*1st Milking Colostrum*	*11th Milking Whole Milk*
Total Solids, %	23.0	13.0
Total Protein, %	14.0	4.0
Casein, %	4.8	2.5
Immunoglobulins, %	6.0	0.09
Fat, %	6.7	4.0
Lactose, %	2.7	4.9
Minerals, %	1.0	0.74
Specific Gravity	1.056	1.032

[1]University of Minnesota.

Studies have suggested that ingestion of 200-300 grams of IgG within 24-36 hours after birth is important to assure successful passive transfer. With good quality colostrum from adult cows, feeding approximately two quarts of colostrum will provide these concentrations. However, the average colostral antibody concentration is such that three to four quarts are required. Even at this feeding level, some

calves will have inadequate passive transfer because some cows are unable to produce colostrum with high antibody concentration.

An estimation of the antibody concentration (colostrum quality) can be obtained by measuring its specific gravity with a commercial instrument called the colostrometer. Perform this measurement on colostrum at room temperature (70°F). Use this test to select colostrum with high antibody concentration (specific gravity 1.056) for first feeding of calves in artificial feeding situations (*Table I*).

In most situations, the volume of colostrum available to the calf at nursing or during artificial feeding is not a limiting factor for successful passive transfer. Other important factors that affect passive transfer include:

1. **Age at first feeding.** This is very important because colostral antibodies are absorbed through the calf's intestine during the first 24 to 36 hours after birth; thus, early feeding of colostrum is mandatory (preferably during the first hour after birth).

2. **The method of feeding colostrum.** Allowing the calf to suckle the dam appears to be most efficient; however, this feeding method can be associated with passive transfer failure. Maternal factors such as sickness, poor mothering instinct, large pendulous udders with poor teat accessibility, and large crusted teats can delay the intake of colostrum by the calf, and thus limit the amount of colostrum consumed.

   Suckling drive is another cause of passive transfer failure. A significant number of calves show a considerable delay between birth and the first sucking and thus volume consumed may be low. Positive intake must be assured and not estimated.

   Artificial feeding systems can markedly reduce or increase passive transfer efficacy. In artificial feeding systems, the calf may be fed colostrum from its own dam or colostrum that has been stored from previous calvings. When the calf is fed colostrum from its own dam there generally is a delay in feeding because of the extra effort required to milk the dam. These feeding delays can be a significant factor in the success or failure of passive transfer.The lack of vigor and suckling drive can be a problem for all calves. For this reason nipple bottle feeding can be associated with inadequate intakes of colostrum.

3. **Volume of good quality colostrum.** At least 5 percent of the calf's body weight (about four pounds) should be consumed as soon as possible after birth. Approximately 12 hours later, another three to four pounds should be consumed.

4. **Colostrum administration.** Colostrum can be fed positively, rapidly, and in a large volume using an esophageal feeder. Consult your veterinarian to learn proper use of this device. Field trials suggest that adequate serum concentrations of antibodies can be achieved when correct volumes of good quality colostrum are fed using this method.

5. **Seasonal stress.** Heat or cold stress may adversely affect passive transfer.

Summary

Age at first feeding and the antibody concentration ingested are important determinants for successful passive transfer of colostral antibodies in calves.

Field studies and feeding trials have shown that failure of passive transfer is reduced in calves that have been fed a colostral volume equivalent to 7.5 to 10 percent of their body weight within the first 12 hours of life (two feedings).

Colostrum should be fed by nipple bottle where managerial expertise, time, and patience can ensure adequate and timely intakes. Calves that do not ingest the full amount should be fed the remainder by esophageal feeder; however, do not overload with more than the aforementioned total.

Acquire colostrum by milking the dam as soon as possible after calving. Heifer colostrum should be used only for second day and subsequent feeding in problem herds.

Colostrum used on first day feedings should be tested with a colostrometer. This device measures the specific gravity that relates to the quantity of colostral antibodies (immunoglobulins) (*Table I*).

In natural suckling herds with baby calf health problems, the antibody (immunoglobulin) status of calves should be monitored to ensure adequate colostral intake. Alternative feeding methods should be used if failure of passive transfer is determined.

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