



Failure of Passive Transfer (FPT): Strategies for Management

A Guide for Beef Cattle Producers



Definitions:

Immunoglobulins: Also known as antibodies, primary forms are **IgG, IgM, and IgA**, which have different, specific functions and timeframes when they are produced in the body. IgG is particularly important in prevention of disease in calves, as the transfer of the dam's IgG to the calf is via colostrum.

Colostrum: The “first milk” secreted from the dam after calving. It is important for the calf's health to receive shortly after birth due to its antibody and nutrient richness.

Serum: The clear, straw-colored liquid portion of blood when separated from red and white blood cells and clotting components. The serum component of blood contains antibodies.

Serum Total Protein (STP): All the proteins in blood; a good indicator of successful transfer of passive immunity from calves fed maternal colostrum. Usually measured in grams per deciliter (g/dL).

Dystocia: A difficult birth or inability to give birth without assistance.

Expected Progeny Difference (EPD): EPDs are predictions of genetic potential expressed as the expected difference in performance between one animal's offspring when compared to another.

Failure of Passive Transfer (FPT):

A condition in which calves do not acquire enough maternal antibodies, mostly in the form called IgG, due to inadequate colostrum quality or delayed colostrum feeding. This may be prevented through appropriate management during the peripartum and neonatal periods (the time around birth and young calfhood). Failure of passive transfer in a calf is most accurately predicted by measurement of serum total protein (STP) concentrations of ≤ 5.2 g/dL, as determined by an optical or digital refractometer.

Consequences of FPT:

FPT is not a disease, but a condition that makes calves more susceptible to diseases during calfhood.

Calves with FPT have:

- Twice the risk of dying
- 1.8 times greater risk of developing respiratory disease
- 1.5 times greater risk of having diarrhea
- Increased use of antibiotics to treat health problems on-farm
- Decreased average daily weight gain

Risk Factors

DAM-RELATED FACTORS

□ Dam Pre-Calving Vaccination

- Develop a plan with your veterinarian based on your specific herd needs.
 - Remember to always check the vaccine label!
- Respiratory Viruses & *Clostridia* spp.
 - There are many options for killed or modified live vaccines, combination vaccines, and vaccination timing.
- Scours
 - Heifers: Two doses of vaccine
 - 8- and 5-Weeks before calving
 - Cows: One Annual Dose
 - 5-Weeks before calving

□ Dam Nutrition

- Protein: Insufficient dietary protein in late pregnancy is a potential risk factor for FPT in suckler calves.
- Malnutrition: Can affect colostrum secretion and milk delivery to calves if during late pregnancy.
 - This can lead to impaired transfer of passive immunity, lower birth weights, reduced calf vigor, and delayed initiation of suckling.
 - (e.g., low quality hay and low mineral supplementation)
- Supplements: May have positive effects on growth, health, and transfer of passive immunity of their calves.
 - Pre-parturient (pre-delivery)
 - e.g., dried distiller's grains and soy lecithin
 - Supplements
 - e.g., trace minerals including selenium, Vitamin E, copper, cobalt, and Bio-Mos® yeast-based prebiotic

□ Dam Health

- Dam health at time of calving affects maternal colostrum quality and, subsequently, the passive transfer of IgG to calves.

□ Dam Body Condition

- Calves born to heifers of ideal body condition tended to have higher serum IgG levels and significantly higher IgM levels than calves born to thin heifers.

❑ Calving Difficulty

- Calves delivered through both an easy or hard pull, or twins, had significantly lower serum IgG and IgM concentrations in comparison to calves born without assistance.

❑ Calving Season

- Studies have found that late-gestation heat stress can reduce colostrum IgG content, especially in heifers.
 - If calving is during hot weather, pay extra attention to colostrum management.
 - Providing shade or moving the calving season to a cooler time of the year may alleviate this problem.

❑ Dam Parity

- Heifers may have a lower volume, concentration, and/or quality of colostrum than mature cows.

CALF- RELATED FACTORS

❑ Colostrum Quality

- When calves are seen suckling their dams within the first 2 – 4 hours after birth without assistance, no intervention is necessary.
- Calves that require assistance should consume at least 5% of their body weight in colostrum twice within the first 12 hours of life.
 - Calves typically range from 65- 90 lbs., which means a required colostrum volume of 3.25-4.5 lbs (= 1.5-2 liters/quarts) twice.
 - Check colostrum replacer products for directions on recommended volume.

Colostrum should meet the standards listed below to achieve successful passive transfer of IgG:

- Colostrometer: measures the specific gravity of a fluid which can be converted to IgG concentration in colostrum.
 - Good quality (≥ 50 g/L) versus poor quality (< 50 g/L).
- Brix refractometer: measures the amount of sucrose in a fluid, which can be related to IgG in colostrum.
 - A Brix score of 22% or higher is considered good quality.
- High bacterial numbers in colostrum can adversely affect the health and immunity of calves.
 - This can be reduced by collecting from a teat with no visible fecal matter/ wiping the teat with clean cloth prior to collection.

- Remember, bacterial contamination cannot be determined visually. It requires laboratory testing for diagnosis.
- Colostrum contaminated with even small amounts of fecal matter can be an important source of many infectious diseases, like *Salmonella*, *Mycoplasma*, *Listeria*, and *E. coli*.
- If possible, heat treatment of colostrum prior to feeding is an effective way to reduce the risk of infecting newborn calves.

[Sous Vide Machines](#) can be used to achieve the required safe temperature of 140°F for 60 minutes to kill different types of pathogens in colostrum. Remember that higher temperatures (>140°F) can be detrimental to colostrum.

□ **Source of Colostrum** (Natural colostrum vs colostrum replacer)

- Fresh colostrum is best but can be frozen for emergencies.
 - Collect colostrum from cows with stillborn calves.
 - Evaluate the quality of the colostrum before freezing to ensure only good quality colostrum will be stored for later use.
- Freeze colostrum in one quart freezer bags and carefully thaw it in a water bath at the time of feeding to a temperature of approximately 105°F.
 - Ensure bags are closed and double bag to prevent leakage of water into the colostrum as it defrosts.
 - Do **not** microwave frozen bags under any circumstances.
 - Sous vide machines also work well for thawing frozen colostrum.
- Beef calves require at least 150 g of IgG from colostrum replacer for immune protection.
 - Recent research suggesting 200-300 g as ideal.
- Read the label, as product instructions might vary.
 - You should always double check to see how to mix the colostrum replacer to ensure proper absorption by the calf.

Supplement vs. Replacer:

- **Colostrum Supplement**
 - Can be used to increase the amount of IgG fed to calves when only low or medium quality colostrum is available.
 - Colostrum supplement **cannot** replace high quality colostrum
 - Intended to only provide additional nutrition to a calf that has already received some colostrum.
- **Colostrum Replacer**
 - Contains more IgG than Supplement products
 - Provides more antibodies than poor or moderate quality colostrum.

- ❑ **Deciding on Colostrum Tube Feeding**
 - Check the suckle reflex of calves within 10 minutes after birth.
 - Calves that receive colostrum through suckling the dam's teat exhibit a higher serum IgG concentration compared to calves that received colostrum via a feeding bottle.
 - If calves are unable to stand and suckle the dam within 1-4 hours, offer a bottle first; if the calf will not suckle the bottle, use an esophageal feeder.

- ❑ **Timing of Colostrum Feeding**
 - Newborn calves should receive approximately two quarts of high-quality colostrum within the first 4-6 hours after birth, and a second feeding of the same volume within 12 hours after birth.

- ❑ **Timing of Colostrum Collection**
 - Colostrum quality declines after a cow has calved. It is essential to collect colostrum from dams within the first 24 hours after calving to maintain higher antibody levels.
 - Do not store colostrum from dams that were milked past 24 hours after calving.

Methods to assess FPT in calf serum for herd surveillance

- ❑ **Blood Sample Collection**
 - Random Sample
 - Choose up to 12 calves at random (not based on vigor, sex, weight, or other factors)
 - Ideal Age: 36-60 hours after birth
 - Can range from 12 hours to 7 days after birth
 - Serum Total Protein (STP)
 - Veterinarian or experienced producer can centrifuge blood and read results with a Refractometer (see below)
 - If possible, calves with FPT could be monitored more closely than other calves due to higher risk for disease.

- ❑ STP is a good predictor of successful immunity when calves are fed maternal colostrum. Low STP concentrations (≤ 5.2 g/dL) in calves fed colostrum replacer do not correlate well with FPT, and those calves aren't good candidates to assess FPT on a herd basis.

- ❑ Not every calf will achieve adequate passive transfer but at least 80% of all calves above the threshold is a good benchmark to strive for.
- ❑ Monitor calves with FPT more closely as they are more vulnerable to disease.
- ❑ **Optical and Digital Refractometers:**
 - Inexpensive and easy to use under field conditions.
 - Measure serum total protein in g/dL
 - Look for calf STP of 5.3 g/dL or above for successful passive transfer.

There are different models and designs available in the market. For example:

- Optical refractometer: [Vee Gee Scientific](#) Handheld Refractometers (around \$100)
 - Digital refractometer: [MISCO Digital Multiscale](#) Refractometer (around \$600)
- ❑ **Brix Refractometer:**
 - Measures the percentage of total solids (% Brix) in liquids.
 - Can be used for both determination of colostrum quality and FPT.
 - Look for at least an 8.4% Brix reading in calf serum.
 - ❑ Beware of very high refractometer readings; dehydration may cause falsely elevated readings. Check for signs of calf dehydration (dry nose or mouth, sunken eyes, or skin-fold test) before collecting blood.

Prevention of FPT:

Preventing FPT in calves is crucial for beef producers because it directly impacts the overall health, growth, and productivity of calves. Calves that do not receive adequate colostrum with essential antibodies are at a higher risk of infections, diseases, and reduced growth rates.

□ **Prepartum Cow Vaccination:**

- Passive immunity in beef calves can be enhanced by vaccinating the pregnant cow against specific diseases such as neonatal calf diarrhea, bovine respiratory disease, and *Clostridial* pathogens.

□ **Prevention of Dystocia Through Proper Management:**

- Selecting a bull with a favorable calving ease expected progeny difference (EPD) means that difficulty during calving is less likely.
 - This is especially important when breeding heifers.
- EPDs allow for the comparison of animals within a breed for their genetic potential as parents for a given trait and are often available when purchasing a breeding bull.
- Heifer development and selection of heifers with good reproductive scores as determined by a veterinarian and/or born early in the calving season.

□ **Colostrum Management:**

- Regularly evaluate the quality of colostrum at your facility.
- Ensure adequate transfer of colostrum IgG in newborn calves.

□ **Dam Nutrition:**

- Dam's nutritional status can impact the colostrum available to the calf. During the last trimester of pregnancy, the NRC recommends multiparous cows receive a diet with 7.9% crude protein (CP) and 54% total digestible nutrients (TDN).

Additional Resources:

Video on testing colostrum quality.

<https://www.youtube.com/watch?v=Rdt766azjew&t=11s>

Colostrum management for suckler calves. <https://ahdb.org.uk/knowledge-library/colostrum-management-for-suckler-calves>

Dystocia Prevention and Intervention.

<https://www.iowabeefcenter.org/calving/dystocia.html#:~:text=The%20major%20cause%20of%20dystocia,prevent%20malposition%20ahead%20of%20time.>

Vaccine handling guidelines from CDFA:

https://www.cdfa.ca.gov/AHFSS/AUS/docs/AUS_BMPs_VaccineHandlingGuidelines_Producers.pdf

Understanding Expected Progeny differences:

<https://extensionpublications.unl.edu/assets/html/g1967/build/g1967.htm>

This document was made in collaboration with the following organizations:

