

# Failure of Passive Transfer (FPT): Strategies for Management

## A Guide for Beef Cattle Producers



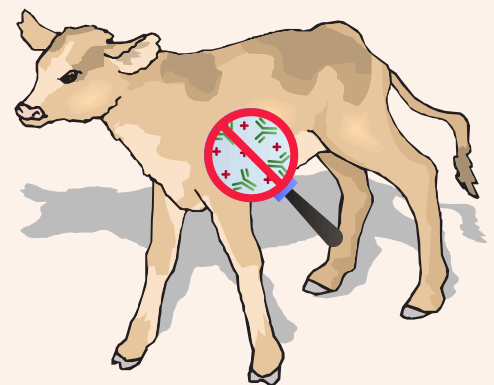
### Definitions

- **Colostrum:** The “first milk” secreted from the dam after calving. Rich in nutrients and immunoglobulins, prompt colostrum intake after birth is essential for the calf’s health and longevity.
- **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.
- **Immunoglobins (antibodies):** Important components of the immune system that help the body combat disease. Their main forms in blood serum are **IgG, IgM, and IgA**, each of which has a specific function. IgG is of particular importance in the prevention of diseases in calves, as it must be transferred from dam to calf via colostrum.
- **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):** A measurement of all the proteins in blood serum, including immunoglobulins. This value is a good indicator of successful transfer of passive immunity from calves fed maternal colostrum. Usually measured in grams per deciliter (g/dL).

### Failure of Passive Transfer (FPT)

**FPT** is a condition where 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).

- The most accurate predictor of FPT in a calf is a radial immunodiffusion assay result of  $< 800$  mg/dL. This assay directly measures IgG concentrations in serum.
- A **Serum Total Protein (STP)** concentration of  $\leq 5.2$  g/dL is a good on farm alternative to assess FPT. It can easily be measured by an optical or digital refractometer (See Page 6).



CDFA Antimicrobial Use and Stewardship | [www.cdfa.ca.gov/ahfss/aus](http://www.cdfa.ca.gov/ahfss/aus)

UC Agriculture and Natural Resources | <https://ucanr.edu/site/newborn-beef-calf-health>

## Consequences of FPT

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

Calves with FPT have:

- 1.8 times greater risk of developing respiratory disease
- 1.5 times greater risk of having diarrhea
- Twice the risk of dying 
- Increased number of antibiotics treatments for treating health problems on-farm 
- Decreased average daily weight gain



## Risk Factors

### Dam-Related Factors

#### ☐ Dam Health

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

#### ☐ Dam Body Condition

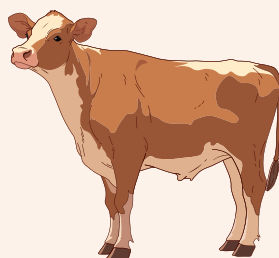
- Calves born to heifers of ideal body condition score (BCS) tend to have higher serum **IgG** levels and significantly higher **IgM** levels than calves born to underweight heifers.

#### ☐ Calving Season

- Studies 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 Intake

- 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.
  - Newborn beef calves typically range from 65-90 lbs. and require two feedings. Each feeding consists of a colostrum volume of 3.25-4.5 lb (1.5-2 liters/quarts).
  - Check colostrum replacer products for directions on recommended volume.



## □ Twins and Difficult Birth

- Twins and calves delivered through either an easy or hard pull have significantly lower serum **IgG** and **IgM** concentrations in comparison to calves born without assistance.

## Colostrum Management Factors



## □ Colostrum Quality and Measurement

- Based on the device used for measurement, **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 ( $\geq 50$  g/L) versus poor quality ( $< 50$  g/L) **colostrum**.
  - **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 **colostrum**.

## □ Colostrum Handling and Preparation

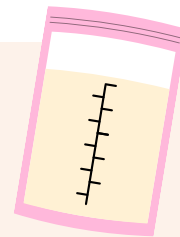
- High bacterial numbers in **colostrum** can adversely affect the health and immunity of calves.
  - This can be reduced by collecting from a teat with no visible fecal matter and wiping the teat with clean cloth prior to collection.
  - Remember, bacterial contamination cannot be determined visually. It requires laboratory testing for diagnosis.
  - **Colostrum** contaminated with even small amounts of fecal matter can be an important source of many infectious pathogens, 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 ( $>140^{\circ}\text{F}$ ) can be detrimental to colostrum quality.



**Figure 1:** Example of a Sous Vide machine.

## Risk Factors

### Colostrum Management Factors (continued)

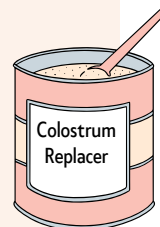


#### ☐ Considerations for Feeding Colostrum

- It is not recommended to use colostrum from dairies for biosecurity reasons. Dairies have a high prevalence of Johne's disease and Bovine Leukosis Virus infections, both of which may be transferred through colostrum to calves. Avian influenza virus, which has been infecting dairies, is also shed in colostrum.
- Fresh **colostrum** is best but can be frozen for emergencies.
  - Collect colostrum from cows with stillborn calves.
  - Evaluate the quality of the colostrum (via Colostrometer or Brix Refractometer) before freezing to ensure only good quality colostrum will be stored for later use.
  - Freeze colostrum in one-quart freezer bags.
- At the time of feeding, carefully thaw colostrum bags in a warm water bath to a temperature of approximately 105°F.
  - Ensure bags are closed and double bagged 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 suggests 200-300 g of **IgG from colostrum** is 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.





## Risk Factors

### Colostrum Management Factors (continued)



#### ☐ 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 receive colostrum via a feeding bottle.
- If calves are unable to stand and suckle the dam within 1-4 hours after birth, 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 again within 12 hours after birth, for a total of two feedings.



#### ☐ Timing of Colostrum Collection

- The quality of a dam's **colostrum** begins to decline after calving. It is essential to collect a dam's colostrum 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)**
  - A veterinarian or experienced producer can centrifuge the blood and read results with a Refractometer (see Page 6 below)
  - If possible, calves with **FPT** should be monitored more closely than other calves due to higher risk for disease.
- Submission to a laboratory for radial immunodiffusion



## Methods to assess FPT in calf serum for herd surveillance

- ☐ **STP** is a good predictor of successful immunity when calves are fed maternal **colostrum**. Low STP concentrations ( $\leq 5.2$  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 being above the STP threshold is a good benchmark to strive for.

- ☐ **Optical and Digital Refractometers**

- Inexpensive and easy to use under field conditions.
- Measure **Serum Total Protein** in g/dL (grams per deciliter)
- Look for calf **STP** of 5.3 g/dL or above for successful passive transfer.

5.3 g/dL 



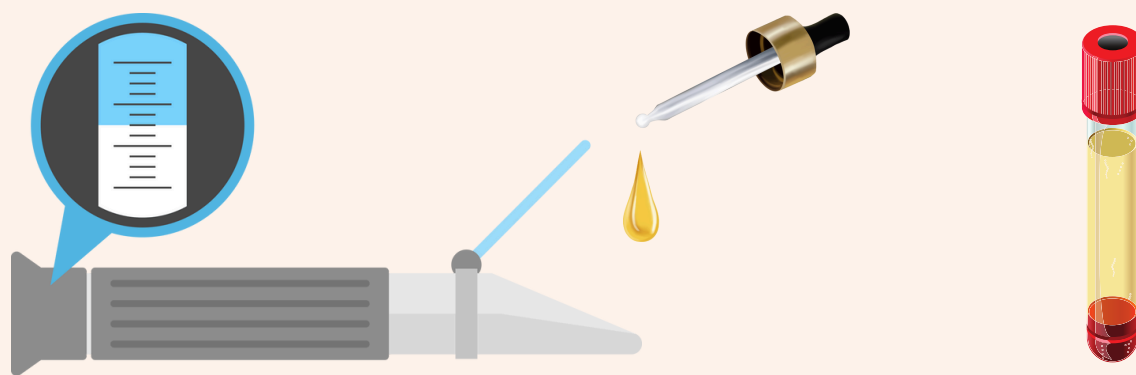
There are different models and designs available on the market. For example:

- 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 for successful passive transfer.

- ☐ 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.

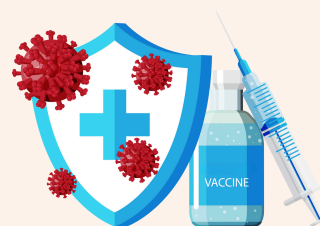


## Solutions/Management

### 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 Vaccine
  - Given in late pregnancy to dams (typically two doses for heifers, and annually for cows) to enrich colostrum with the respective antibodies.
  - Check label and/or discuss with your veterinarian.



#### ☐ Dam Nutrition

- Protein: In late pregnancy, insufficient dietary protein is a potential risk factor for **FPT** in nursing 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 calf 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 the growth, health, and transfer of passive immunity of the dam's calf.
  - Pre-parturient (pre-delivery)
    - e.g., Dried distiller's grains, soy lecithin, or protein tubs
  - Supplements
    - e.g., Trace minerals including selenium, vitamin E, copper, cobalt, and Bio-Mos® yeast-based prebiotic



## 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, reduced growth rates, and death.

### ☐ 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.

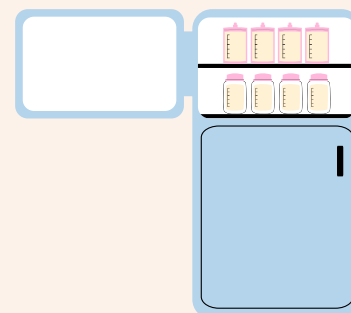


### ☐ Prevention of Dystocia Through Reproductive Management

- Select a bull with a favorable **Expected Progeny Difference (EPD)** Calving Ease (CE) value, which may mean difficulty during calving is less likely.
  - This is especially important when breeding heifers.
- EPDs** allow animals, within a breed, to be compared based on their genetic potential for specific traits, and are often available when purchasing a breeding bull.
- Heifer development involves selection of heifers with good reproductive scores, as determined by a veterinarian, and those born earlier in the calving season.

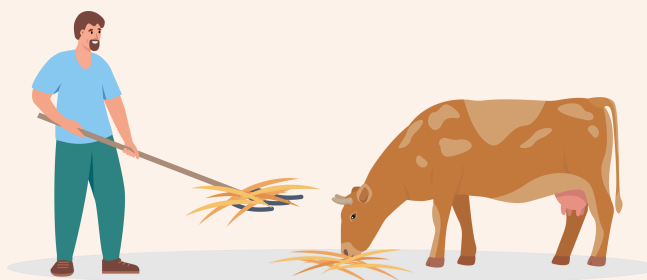
### ☐ Colostrum Management

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



### ☐ Dam Nutrition

- A dam's nutritional status can impact the quality and amount of colostrum available to the calf.
- During the last trimester of pregnancy, the National Research Council (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://tinyurl.com/VideoColostrumQuality>



- **Colostrum management for suckler calves:**
  - <https://tinyurl.com/SucklerCalves>



- **Dystocia Prevention and Intervention:**
  - <https://tinyurl.com/DystociaPrevent-Intervention>



- **Vaccine handling guidelines from CDFA:**
  - <https://tinyurl.com/AUSProducerVxHandling>



- **Understanding Expected Progeny Differences:**
  - <https://tinyurl.com/ProgenyDifferences>



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