

What's New in Colostrum Management?



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How do we promote calf health & growth?

Maximize Immunity
- Colostrum
- Nutrition
- Minimize stressors
- (Vaccination)



Minimize Infectious Disease Challenge
- Housing
- Bedding management
- Ventilation
- Sanitation



HEALTH ↔ DISEASE



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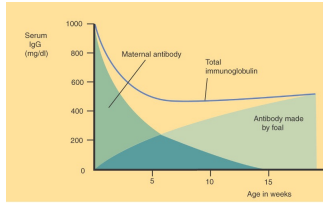


HEALTH ↔ DISEASE



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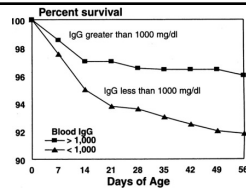
- Why is colostrum so important?
 - Passive absorption of immunoglobulins (IgG) protects calf in first weeks/months
 - Non-specific immune factors, hormones, growth factors, WBC?
 - Nutrients: 24% total solids: high levels of fat, protein, etc.



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Benefits of Successful Transfer of Passive Immunity (Serum IgG > 10 g/L)

- Reduced treatment and mortality rates (NAHMS, Wells, 1996)
- Improved growth rates and feed efficiency (Fowler, 1999; Faber et al., 2005; Nocek et al., 1984; Robison et al. 1988; Faber. 2005)
- Decreased age at first calving (Faber et al. 2005)
- Increase 1st & 2nd lactation milk: + 550 kg (DeNise, 1989; Faber, 2005)
- **Cost of FTPI: ~\$70 USD** or € 60 (€ 10-109) (Meta-analysis by Raboisson et al., 2016)

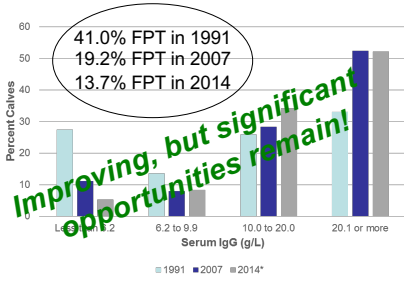


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Incidence of Failure of passive transfer (FPT) (NAHMS): Serum IgG < 10 g/L (sample 1-7 days old)

41.0% FPT in 1991
19.2% FPT in 2007
13.7% FPT in 2014

Improving, but significant opportunities remain!



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The 5 Q's of Colostrum Management

- **Q**uantifying passive transfer (monitoring)
- **Q**uality
- **Q**uantity
- **Q**uickness
- **S**Queezy clean (bacterial contamination)



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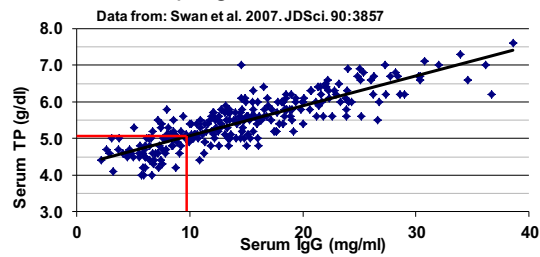
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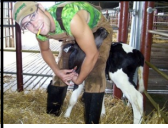
On-farm monitoring of serum total protein to evaluate the colostrum program




- 5.0 or 5.2 g/dL STP value to predict serum IgG of 10 g/L:

(Calloway, et al., 2002)

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Monitoring passive transfer rates (Using the old goal)



- Herd level:
 - Bleed 12+ clinically normal 1-7 d old calves & separate serum
- STP Refractometer:
 - Goal: 90% \geq 5.2 g/dL
or 80% \geq 5.5 g/dL
- Brix Refractometer:
 - Goal: 90% \geq 8.4%



- Is dichotomizing too simplistic?
- Is higher better?

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Creating a consensus recommendation on levels of passive immunity in dairy calves in the United States

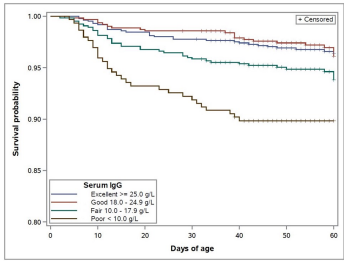
- Jason Lombard (USDA NAHMS) = leader
- Assembled panel of calf experts
- Reviewed key papers in past 10 years
- Reviewed Urie et al., 2018: NAHMS 2014 dairy study data
 - 2,360 calves from 103 farms

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Survival probability for preweaned heifer calves by days of age and serum IgG concentration categories.

Data from 2014 NAHMS Dairy Study, Lombard et al. JDSci 2020
2,360 calves from 103 farms

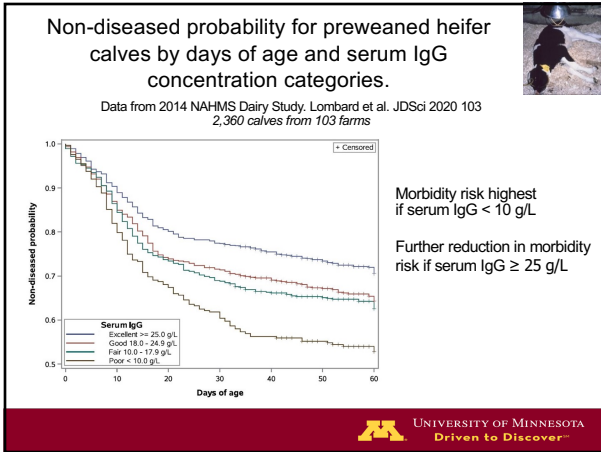


Mortality risk highest if serum IgG < 10 g/L

Further reduction in mortality risk if serum IgG \geq 18 g/L



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New Goals:

Consensus recommendations for monitoring levels of passive immunity in dairy calves in the United States

Lombard et al. JDSci 2020 103

Proposed Categories	Proposed IgG Levels	Proposed % Calves in each Category		
Excellent	> 25.0 g/L	> 40%		
Good	18.0 – 24.9 g/L	~ 30%		
Fair	10.0 – 17.9 g/L	~ 20%		
Poor	< 10.0 g/L	< 10%		

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New Goals:

Consensus recommendations for monitoring levels of passive immunity in dairy calves in the United States

Lombard et al. JDSci 2020 103

Proposed Categories	Proposed IgG Levels	Proposed % Calves in each Category	Equivalent Serum Total Protein Levels (g/dL)	
Excellent	> 25.0 g/L	> 40%	> 6.2 g/dL	
Good	18.0 – 24.9 g/L	~ 30%	5.8 – 6.1 g/dL	
Fair	10.0 – 17.9 g/L	~ 20%	5.1 – 5.7 g/dL	
Poor	< 10.0 g/L	< 10%	< 5.1 g/dL	

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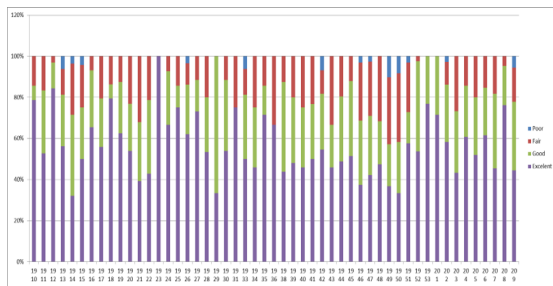
Lombard et al. JDSci 2020 103

Proposed Categories	Proposed IgG Levels	Proposed % Calves in each Category	Equivalent Serum Total Protein Levels (g/dL)	Equivalent Serum Brix Levels (%)
Excellent	> 25.0 g/L	> 40%	> 6.2 g/dL	> 9.4%
Good	18.0 – 24.9 g/L	~ 30%	5.8 – 6.1 g/dL	8.9 – 9.3%
Fair	10.0 – 17.9 g/L	~ 20%	5.1 – 5.7 g/dL	8.1 – 8.8%
Poor	< 10.0 g/L	< 10%	< 5.1 g/dL	< 8.1%



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Example Herd Report: Monitoring STP Data



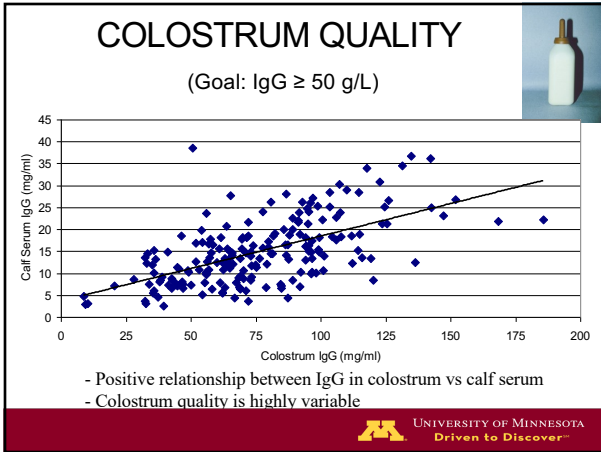
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The 5 Q's of Colostrum Management

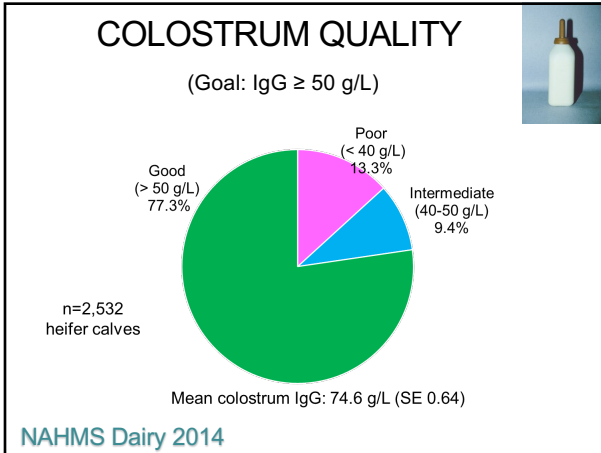
- Quantifying passive transfer (monitoring): New goals
- Quality
- Quantity
- Quickness
- SQueezy clean (bacterial contamination)



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Colostrum Quality

(Colostrum IgG > 50 g/L)


- Factors affecting quality:
 - Dry cow vaccination program
 - Feed balanced dry cow ration
 - Avoid dry cow stress (heat, crowding)
 - Avoid short dry periods (< 21 days)
 - Milk cows within 1-2 hrs (max 6 hrs)
- Monitoring tools:
 - Colostrometer
 - Brix refractometer: 19-22% = 50 g/L IgG
- Goal: \geq 90% of samples tested \geq 22% Brix

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Volume produced: Lower in fall/winter months

(Gavin et al., 2018; Soufleri, 2021; Rossi 2022)



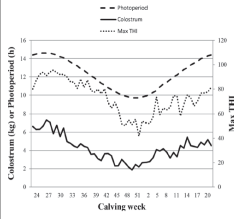



Figure 4. Photoperiod, average weekly colostrum weight, and maximum temperature humidity index (THI) by calving week for 2,988 Jersey cows on 1 farm.

- Gavin et al., JDSoci. 2018
 - Jersey herd in TX
 - Factors assoc with low yield (<2.7kg):
 - Lactation length, short days dry, twins, older dam age
 - Month preceding calving:
 - Decreased THI
 - Reduced photoperiod (↑ melatonin, ↓ prolactin)
 - Didn't evaluate nutrition:
 - Need for adequate energy and metabolizable protein in dry cow diet

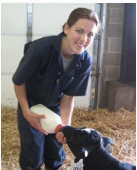
The solution? Bank colostrum +/- colostrum replacers


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Colostrum Quantity

What volume should we provide at first feeding?



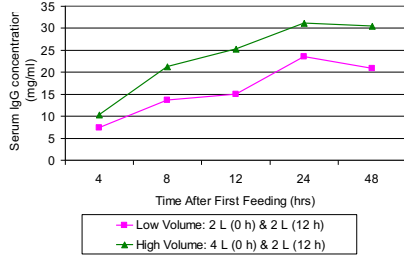
- **Goal:** Feed ≥ 300 g of IgG to the average calf
- **Recc:** Feed 10% BWt at first feeding (4 L to Holstein)
- **Bottle or esophageal tube:**
 - both work equally well if feeding a sufficient volume
 - Training and equipment cleaning/condition important
 - Don't tube calves multiple times
 - 2 times maximum (empirical)

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2. Colostrum Quantity

- Goal: Feed a minimum of 150 - 200 g of IgG (≥ 300 g ideal)
- Recommend: Feed 10% BWt at first feeding (Holstein = 4L / Jersey = 3L)



Morin et al., 1997



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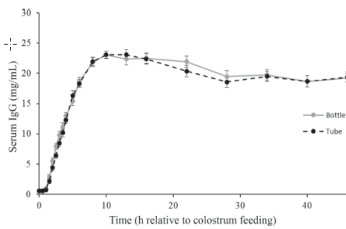
Colostrum Delivery Method: Nipple Bottle vs Esophageal tube

(Desjardins-Morrisette et al., JDSci. 2018)



- Design: 20 newborn calves assigned to bottle or tube
 - Both groups fed 3L of colostrum replacer (200 g IgG)
 - Bottle calf: If drank < 0.5 L in 30 min, tubed remainder

• Results:



- Conclusion: No effect of feeding method on serum IgG


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The 5 Q's of Colostrum Management

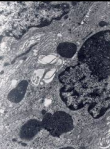
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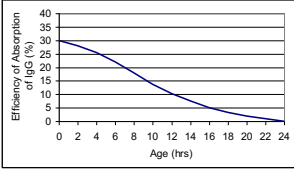



Quickness (time to first feeding)



- Gut Closure:
 - Progressive loss of ability to absorb Ig
 - Complete by 24 hrs
- Goal:
 - Feed within 1-2 hrs
 - (6 hrs max)

Ig in intestinal epithelial cell





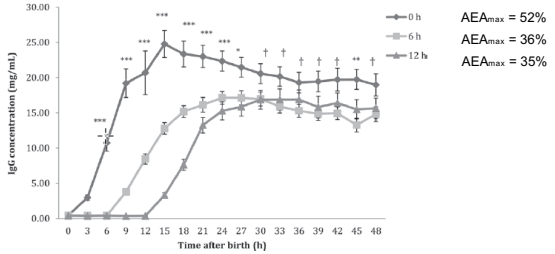
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Early Colostrum Feeding Enhances IgG Absorption

(Fischer et al. 2018. JDSci)

Male Holstein calves fed approx. 3 L (7.5% BWt) heat-treated colostrum at **45 min, 6 hr, or 12 hr of age** (n=9/grp) (estimated 186 g IgG consumed)



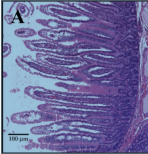
Conclusions: Delaying colostrum feeding within 12 h of life:

- Decreased the passive transfer of IgG

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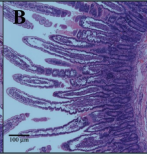
Is there value to offering a second feeding, or colostrum/IgG supplementation after gut closure?

- Yes, if it can be implemented by the farm
- Pyo et al., (JDSci, 2020)
 - All calves fed 1 feeding colostrum
 - Fed 1 of 3 different colostrum/milk diets until 72 hrs of age (2 qts BID) (n=8/tx)

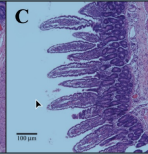


Proximal Jejunum

Pooled heat-treated colostrum



1:1 Colostrum - Whole milk mixture



Whole milk

- Conclusion:
 - Extended feeding colostrum or transition milk promoted intestinal development

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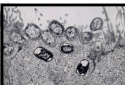
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SQueezy Clean (Bacterial Contamination)

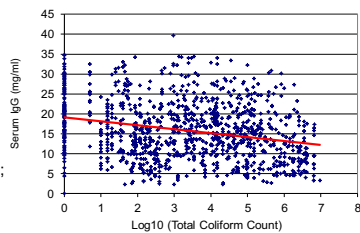


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Consequences of microbial contamination of colostrum?





- Pathogens may cause disease
(e.g. *E. coli*, *Salmonella* spp., *Mycoplasma* spp., *M. avium* subsp. *paratuberculosis*)
- Bacteria counts are associated with ↓ serum IgG levels
James et al., JDSci 1981;
Poulson et al., ACVIM 2002;
Godden et al., JDSci 2012




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How often do producers feed contaminated colostrum?

- Goal:
 - TPC < 100,000 cfu/ml
 - TCC < 10,000 cfu/ml





Sheila McGuirk
UWI-Madison



Sam Leadley
Attica Vet, NY

- National study: 43% of 827 samples from 67 herds exceeded limit (Morrill et al., 2012. JDSci 95:3997)






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Critical Control Points to Reduce Contamination













- Cow
 - Identify infected cows (MAP)
 - Don't let calf suckle dam
 - Udder prep
 - Don't pool raw colostrum
- Equipment
 - Sanitation of milking, storage & feeding equipment
- Proliferation
 - Feed ASAP (< 1-2 hrs)
 - Refrigerate (< 48 hrs)
 - Freeze
 - Preservatives
- Replacers, Heat-treating




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Colostrum Replacements

- \$30-45 USD per dose
- 100 to 175+ g IgG per dose
- Ig either lacteal or serum/plasma derived
- Includes nutrients
- To replace maternal colostrum (MC):
 - Convenient: mix & feed
 - Use if inadequate supply of MC
 - Infectious disease control (e.g. Johne's)
- Recommend reconstitute with water as per label before feeding
 - Caution: dumping powder directly into maternal colostrum may create hyperosmotic solution



Land O' Lakes CR – 100 g
Saskatoon Colostrum Co.

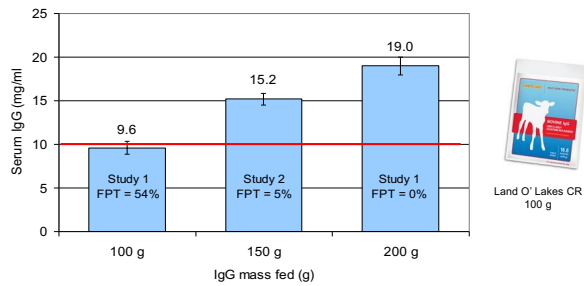


Calf's Choice Total HiCal
100 g; Sask. Colostrum Co.

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Dose response of serum IgG to IgG mass fed

(Godden et al., 2009. JDS. 92:1750-1757)



Land O' Lakes CR
100 g

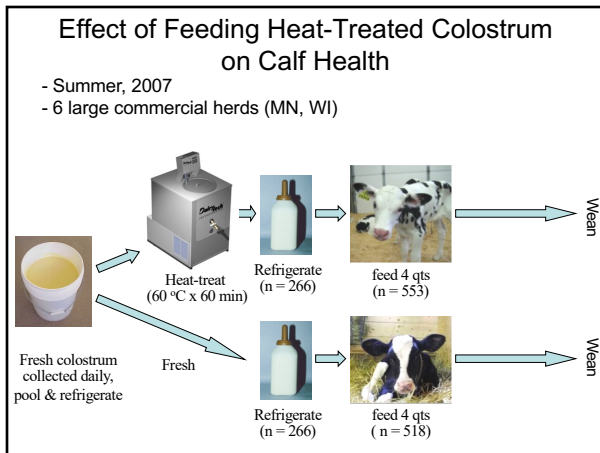
Conclusion: Producers wishing to reduce the risk of FPT may opt to feed higher doses IgG (150-200 g) in Colostrum Replacers

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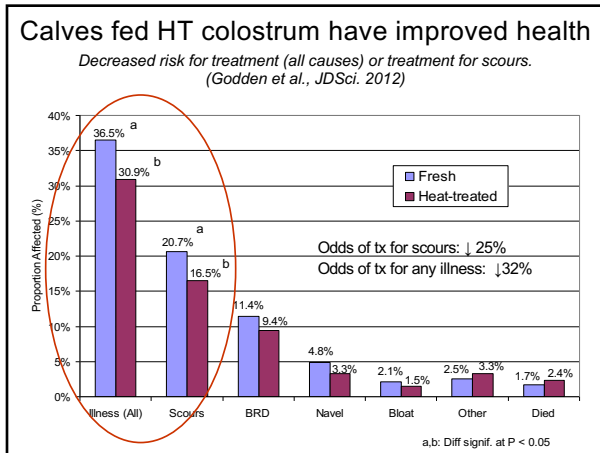
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Summary: Colostrum Management

- A cornerstone for successful calf rearing
- Still an opportunity for veterinarians to help producers improve calf health and future performance
- 5 Q's of colostrum management:
 - **Quantifying** passive transfer (monitoring): new goals
 - **Quality:** $\geq 90\%$ of samples > 50 g/L IgG
 - **Quantity:** 10% of Birth Weight at 1st feeding
 - **Quickness:** < 2 hrs (max 6 hrs)
 - **SQueaky clean:** TPC $< 100,000$ cfu/ml



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Acknowledgements

- Funding and in-kind support:
 - USDA – CSREES
 - JDIP
 - MN Rapid Agricultural Response Fund
 - Merck Merial Summer Scholars Program
 - DairyTech, Inc. (Greely, CO)
 - Saskatoon Colostrum Company (Saskatoon, SK)
- Participating dairy farms and staff
- Student and laboratory technicians



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Thank you!



Questions?

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