Colostrum
“Don’t be born without it!”

Gerald R. Bertoldo, DVM
Extension Dairy Specialist
Cornell Cooperative Extension

A Foundation for Health and Growth

- Passive immunity
- Superior nutrition
- Growth and development factors
Newborn Immunity

- No antibodies or immunoglobulins (Ig) at birth in the neonatal bovine
- No transplacental transfer occurs
- Active immune system although competent is naïve

Immune Competence

Conception

100-150 days

Birth

3-6 weeks

Ron Schultz, U of W
Colostral Protection

- Antibodies from the dam
- IgG (88%), IgA (5%), IgM (7%)
- IgG1 = 80-85% of IgG
- Somatic cells (leukocytes) > 1 million/ml

Colostrum Formation

- From 3-4 weeks before term
- Ig enhanced by vaccination of dam
- Quality reduced by long dry period or ones shorter than 3-4 weeks
- May be affected by nutrition and stress
Passive Immunity

- Immediate
- Short-lived Ig (11.5-16 day half-life)
- Antigen specific

![Graph showing Ig levels over time]

3 weeks

Failure of Passive Transfer of Immunity (FPT)

- Based on measuring the level of systemic immunity
- Calves with serum IgG levels of <10g/L at 24-36 hours of age are considered in the FPT category
- The equivalent serum total protein threshold is between 5.2-5.5 g/dL
Colostrum Management

- Quantity
- Quality
- Quickly
- Cleanly

Colostrum Feeding

- 3-4 quarts (8% of BW) within 4 hours of birth
- Won’t drink it? Tube it!
- Feed 2 quarts again in 8-10 hours
- Sanitized and dry feeding articles!
**Colostrum Absorption Factors**

- Age of the calf
- Volume consumed
- Ig concentration
- Metabolic status of calf

**How soon is quick enough?**

![Graph showing absorption of immunoglobulin over time](Quigley, 2001)

- 10% reduction
- 50% reduction
- Average early absorption
Late action = poor protection

![Bar chart showing Max Serum IgG (g/L) vs. Age at First Feeding (Hours)]

Source: Penn State

**Ig Concentration Factors**

- **Age of dam** - better with age to a point
- **Antigen exposure** - natural or vaccine
- **Time of milk out** - lose 40% by 6 hours
- **Volume of first milking** - 18 lb. rule
- **Pre-milking or leaking** - milk replacing Ig
Effect of Milk Output at 1\textsuperscript{st} Milking on IG Concentration

- >37 lbs. produced at 1\textsuperscript{st} milking
- 29-35
- 20-26
- 11-18
- <11

Evaluation of IgG content

- **Colostrometer**
  - Calibrated for 68°-74°F
  - Fat and non-Ig protein variations skew results
  - Inexpensive

- **Immunodiagnostic test**
  - Measures IgG directly
  - Reports above or below 50mg/ml IgG level
  - Higher cost
Grams IgG absorbed = volume x concentration

90 lb calf needs 36 grams IgG
Average absorption rate = 35%

Good colostrum = 50g/L
50g/L x 0.35 x $\frac{2 \text{ L}}{}$ = 35 grams

Fair colostrum = 25g/L
25g/L x 0.35 x $\frac{4 \text{ L}}{}$ = 35 grams

The Volume Status Quo

Percent of Dairy Heifers Calves by amount of Colostrum Fed during the first 24 hours

- 2 quarts or less: 16.5%
- 2 - 4 quarts: 45.3%
- greater than 4 quarts: 38.2%

NAHMS 2002
Metabolic Impact of Dystocia

- Physical trauma, inactivity and congestion
- Low blood oxygen levels
- Hypothermia (<101°F)
- Respiratory acidosis
- Transient hypoglycemia

Dystocia Affects Absorption of IgG

Distribution of Immunoglobulin (IgG) Levels in Dairy Calves
National Dairy Heifer Evaluation Project

- > 20 mg/ml: 33.1% (720)
- 6.2-9.9 mg/ml: 13.6% (296)
- < 6.2 mg/ml: 27.4% (597)

Comparison of Calf Survival Rates by Level of Immunoglobulin (IgG) Concentration
National Dairy Heifer Evaluation Project

- < 10 mg/ml IgG
- > 10 mg/ml IgG
First one there is the winner!

The delivery of pathogenic bacteria to the gut whether from environmental exposure or through the feeding system can alter the outcome expected by the passive transfer indicated.

<table>
<thead>
<tr>
<th>Feeding</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli fed alone</td>
<td>High level of bacteria attachment to intestine and high level of E. coli in lymph (circulation)</td>
</tr>
<tr>
<td>Colostrum and E. coli fed together</td>
<td>No bacteria attachment to intestine</td>
</tr>
<tr>
<td>Colostrum feeding followed in one hour by E. coli feeding</td>
<td>No bacteria attachment to intestine. High level of circulating antibodies. No E. coli in lymph (circulation)</td>
</tr>
</tbody>
</table>

Source: Conley et al., 1977

1st day nutritional needs

- Calves are only 3% fat by body weight compared to 18% for human infants
- Only 180 grams of glycogen stores
- Only 18 hours of energy reserve in thermo-neutral environment (>60°F)
- Acute need for absorbable and available energy and protein
# Mother Nature’s Best

The average Holstein “first milking” colostrum compares to normal milk as follows:

<table>
<thead>
<tr>
<th>Colostrum contains:</th>
<th>2 times the solids (24%)</th>
<th>4 times the protein (14%)</th>
<th>2 times the fat (7%)</th>
<th>65 times the IgG (3.2%)</th>
<th>2 times the calcium (.26%)</th>
<th>10 times the Vitamin A</th>
<th>3 times the Vitamin D</th>
<th>10 times the iron</th>
</tr>
</thead>
</table>

## Other Properties

- Growth factors
- Hormones
- Immunomodulators
- Leukocytes (WBC)
- Antimicrobial protective factors
- Enzyme inhibitors
What about replacements and supplements?

- Invaluable in Johnes, BLV, etc situations
- Variations in IgG content and ratios
- No cellular component
- Presence of growth factors
- Nutritional content

Food for thought....

If you could be given the "perfect" product to lay the foundation for superior calf health and growth at no out of pocket cost just by adhering to best management practices, what would you say?
She’s counting on you!

Thank you