Choosing the Right Liquid Feed for Your Calves

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Why Feed Liquid Diet?
• Big picture question

• Could we feed a newborn calf a diet of only starter and hay for the first few weeks of life?

Why Feed Liquid Diet?
• Simple answer:
  – No! Calves need milk!

• More complex answer:
  – Abomasum ready for nutrient digestion
  – Rumen not developed for digestion and absorption
  – Calves won’t be eating much solid feed anyway!

Voluntary Starter Intake

• Low intake for first 2-3 weeks of life

Reticular Groove Closure

Milk or milk replacer

Abomasum

Rumen

Reticulum

Omasum

Importance of Liquid Diet

• Preweaned calf:
  – Main source of energy and protein
  – Rumen underdeveloped

Prenuminate calf at birth

Heifer after weaning

Yohe | Virginia Tech Dairy Science
Undeveloped Rumen

- 1 day old calf rumen

There’s a reason we call it “starter”

Liquid Feed Options

- Milk
  - Saleable
  - Nonsaleable/waste (pasteurized)
  - Acidified
- Milk replacer (MR)
  - Many formulations (protein:fat, ingredients)
  - Acidified

Saleable Milk

- High quality milk that is considered good enough for human consumption
  - Taken straight from bulk tank

Saleable Milk

<table>
<thead>
<tr>
<th>Milk</th>
<th>DM%</th>
<th>Fat%</th>
<th>Prot%</th>
<th>Lactose</th>
<th>Ash%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>12.5</td>
<td>3.6</td>
<td>3.0</td>
<td>5.0</td>
<td>.7</td>
</tr>
<tr>
<td>Jersey</td>
<td>14.5</td>
<td>5.0</td>
<td>3.8</td>
<td>5.0</td>
<td>.7</td>
</tr>
</tbody>
</table>

Comparing whole milk on a powder basis?

<table>
<thead>
<tr>
<th>Liquid feed</th>
<th>Milk</th>
<th>DM %</th>
<th>Fat%</th>
<th>Protein %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>100</td>
<td>28.8</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Jersey</td>
<td>100</td>
<td>34.5</td>
<td>26.2</td>
<td></td>
</tr>
</tbody>
</table>

Saleable Milk

- Pros:
  - Highly nutritious (24-27% protein, 28-36% fat DM)
  - Should not be limited in supply
  - “Lactocrine hypothesis”
- Cons:
  - Takes away from producer’s milk sales
Lactocrine Hypothesis

• Milk-borne factors that may influence development and function of tissues via epigenetic factors

Nonsaleable/Waste Milk

• Can include:
  – Nonsaleable transition milk
  – Nonsaleable/waste milk from cows treated with drugs that have withdrawal periods

• Lost economic opportunity for dairy farmers

• Potential for negating loss via feeding to calves

Nonsaleable/Waste Milk

• Pros:
  – Typically a good source of nutrition
  – Economically a good choice
  – Also fits lactocrine hypothesis

• Cons:
  – Nutritional variability
  – Variable supply
  – Should have system for pasteurization (expensive)
  – Potential large pathogen load
  – Big question regarding antibiotic resistance?

Milk Replacer

• Manufactured to replace whole milk using multitude of different ingredients

• Typically marketed as:
  – %Protein:%Fat
  – Dry matter basis
  – 20:20, 22:20, 26:20, 27:10

Popular Milk Replacers

• Most popular form of liquid feed for calves
• 2014 NAHMS data: % of operations that fed MR

Reading Milk Replacer Tag

• Important considerations:
  – Order of ingredients does not equal amount
  – Protein source(s)
  – Fat source(s)
  – *Medicated or nonmedicated?
Protein sources for liquid feeds (BAMN, 2014 Publication)

Protein is the most expensive ingredient in liquid feed for calves.

Milk Replacer
- **Pros:**
  - Many different nutrient and ingredient options
  - Consistent product
  - Potentially fits lactocrine hypothesis as well
- **Cons:**
  - Ingredient digestibility variable
  - Can be costly depending on what type and competing markets for ingredients

Milk Replacer Considerations
- New FDA Regulations effective 1/1/17
  - Veterinary Feed Directive (VFD) required for “medically important” drugs
  - Does not affect other feed additives:
    - Ionophores (Lasalocid, Monensin)
    - Coccidiostats (Decoquinate)
  - Main antibiotics in MR that will be affected:
    - Chlorotetracycline
    - Oxytetracycline
    - Oxytetracycline & Neomycin

Acidified Milk/Milk Replacer
- Effective means of preserving milk/MR without needing refrigeration
- Use of acid (e.g. citric, propionic) to preserve milk by preventing microbial growth
  - pH 4.5-5 suggested
- Helpful Penn State info regarding acidified MR

What Have Producers Fed?

<table>
<thead>
<tr>
<th>Percentage of Preweaned Heifers</th>
<th>2007 NAHMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR</td>
<td>19.1</td>
</tr>
<tr>
<td>Pasteurized</td>
<td>49.9</td>
</tr>
<tr>
<td>Unpasteurized</td>
<td>15</td>
</tr>
<tr>
<td>Pasteurized</td>
<td>20.9</td>
</tr>
<tr>
<td>Unpasteurized</td>
<td>13.8</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

MR | Waste Milk | Saleable Milk
---|------------|---------------
What do Producers Feed?

![Bar chart showing the percentage of preweaned heifers fed different types of milk.](chart.png)

<table>
<thead>
<tr>
<th>Type of Milk</th>
<th>Percentage of Preweaned Heifers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonmedicated</td>
<td>22.8%</td>
</tr>
<tr>
<td>Medicated</td>
<td>40.4%</td>
</tr>
<tr>
<td>Pasteurized</td>
<td>33.2%</td>
</tr>
<tr>
<td>Unpasteurized</td>
<td>2.5%</td>
</tr>
<tr>
<td>Acidified</td>
<td>1.1%</td>
</tr>
<tr>
<td>MR Saleable/Waste</td>
<td>2014 NAHMS</td>
</tr>
<tr>
<td>MR/milk</td>
<td></td>
</tr>
</tbody>
</table>

Future Implications?

- MR still probably most used liquid feed
  - Medicated continue to decline
- An increase in usage of pasteurized waste milk
  - As long as no restrictions are imposed
- Automatic calf feeders adapting to different liquid feed sources

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What Does This Mean?

- This scenario:
  - $0.17 more per calf per day to feed whole milk
  - Assuming 8 week weaning = $9.52 per calf
  - Is it worth it to pay that extra amount per calf?

Maybe So

- Study fed differing amounts of pasteurized whole milk at 26.7% CP and 31.7% fat (Rosenberger et al., 2017)
- Decreased preweaning starter intake
  - 300 g/d @ 5.7 L/d milk vs. 50 g/d @ 9.4 L/d milk

More to Consider

- 2016 meta-analysis (Gehlenger et al., 2016):
  - 500-900 g/d (1.1-1.98 lb/d) preweaning ADG linked with enhanced first lactation performance
- Included milk/MR and starter intake
  - Calves consuming ≥ 100 g of starter (on DM basis) expected to produce 127 kg (280 lb) more milk vs. calves consuming no starter preweaning
- Suggested synergistic effects of milk/MR + starter
Do I Need to Feed Whole Milk?

- Not necessarily

- What are some comparable options?
  - Pasteurized nonsaleable/waste milk
  - Enhanced/accelerated MR

Pasteurized Waste Milk vs. MR

- Calves given:
  - Pasteurized waste milk (n=223)
  - MR 20:20 (n=215)

<table>
<thead>
<tr>
<th>ADG</th>
<th>0.35</th>
<th>0.47</th>
</tr>
</thead>
<tbody>
<tr>
<td>20:20 MR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasteurized Waste Milk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Percentage of Total Calves

- Morbidity
- Mortality

Other Findings from Study

- Saved $0.69/calf/day ($34 from birth to weaning)
  - Savings from not purchasing MR and less treatments

- Important to note:
  - Didn’t analyze pasteurized whole milk for nutrients
  - Estimated 25.6% crude protein and 29.6% crude fat

Can We Rely on Waste Milk?

- It’s an interesting question

- Too much is a sign of questionable herd health

- Is it actually safe to feed?
  - Bacteria still shown to be present
  - Antibiotic residue still present as well

What about Milk Replacer?

- Cornell study (Soberon et al. 2012) found feeding elevated amounts of MR (4.5-5.3 Mcal of ME/d of 28.15 or 28.20) lead to:
  - high ADG preweaning (approx. 1.6 lb/d)
  - Increased first lactation milk production
    - Each additional 2.2 lb of ADG preweaning lead to an increase of 2,138 lb in first lactation milk production
  - How much 20:20 MR would be needed to reach that ADG? Would it be lean or fat growth?

What About Acidified Milk/MR?

- Recent study (Todd et al. 2017) compared ad libitum access to acidified MR vs. restricted MR feeding (6 L/d)
  - MR used for both treatments = 24:18

- Increased preweaning ADG for acidified (1.3 lb/d vs 0.948 lb/d)
  - when checked at 8 mo. of age no difference in BW or ADG

- Also, no differences in morbidity or mortality
More on Acidified Milk/MR

• Decent alternative option if necessary

• Safety hazard handling acids
  – No formic acid!
  – Must be careful to keep pH in acceptable range (4.5-5)

• Acid should only be added to cooled milk (68-75°F)
  – Temp above 75°F may start to cause curdling

• Feeding of acidified MR at ambient temperature
  – Ideally liquid feed should be at or close to body temp

Combining Liquid Feeds

• Potentially the most useful way to effectively and efficiently use your resources

• System where pasteurized waste milk can be used and if not enough then a combination of whole milk/MR can be used

• Use of milk balancer products

Other Important Factors

• Enhanced nutrition preweaning (whole milk or MR)
  – Increased mammary gland development
  – Lactocrine hypothesis
  – Decreased rumen development
    • Can potentially be mitigated via stepdown weaning

• Management important for any feeding regimen

Main Takeaways

• Many good options for liquid diets to feed calves
  – Stay away from unpasteurized waste milk!

• Pasteurized waste milk a decent option
  – At the moment unaffected by VFD

• Feeding as close to whole milk with lower fat best option
  – MR with high protein (25-28%) and low to mid fat (10-20% depending on season) with digestible nutrients good option

Benchmarks to Consider

• Preweaned calves:
  – ADG > 650 g/d (1.43 lb/d)
  – <10% treated for respiratory disease
  – <15% treated for scouring

• Method for helping to achieve benchmarks:
  – ≥ 8 L/d (approx. 8.5 quarts) milk or MR fed daily @ 12-12.5% solids
    • With protein (25-28%) and fat (10-20%) depending on season

Useful Tools

• Penn State Extension website
  – spreadsheet to assess costs of whole milk vs MR options
    • http://extension.psu.edu/animals/dairy/nutrition/calves/feeding/spreadsheet-to-compare-cost-of-milk-and-milk-replacer/view

• Calfnotes.com (Dr. Jim Quigley of Provimi NA)
Thanks!

- Questions?