Intensive calf feeding programs

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Feeding dairy calves

• Is anything wrong with this picture?
Intensified feeding for calves

- What is it and how does it affect the calf?
- Feeding methods and behavior
- Current considerations and challenges
Intensified feeding for calves

• Conventional feeding
  • feeding at about 10% of body weight
  • E.g. 1 – 1.5 gallons

• Intensified feeding
  • Higher feeding levels of milk/milk replacer

Milk intake over time

Adapted from Miller-Cushon et al. 2013. J. Dairy Sci. 96: 551-564
Feeding for accelerated growth

- Intensified feeding programs vs. conventional
- Greater average daily gain
  - 0.5 – 1 lb/d vs. 1.5 – 2.5 lb/d
- Greater structural growth (girth and height)


Feeding behavior

- Feeding patterns are affected by milk feeding level
  - Meal frequency and duration
  - Feeding activity over the day
Milk meal characteristics

<table>
<thead>
<tr>
<th></th>
<th>Ad libitum</th>
<th>Restricted (1.3 gallons/d)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meal frequency</td>
<td>7.1</td>
<td>2.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Meal duration (min)</td>
<td>8.2</td>
<td>5.6</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>


When do calves eat in the day?

![Graph showing feeding activity time (min/h) vs. time of day for Ad libitum and Restricted milk feeding.]

When do calves eat in the day?

Feeding method matters

- Calves are highly motivated to suck
  - Physiological consequences (de Passille et al., 1993)
- Non-nutritive (or cross-sucking) reduced by
  - Providing a teat versus a bucket
  - Providing more milk
Other effects on behavior

- Providing more milk results in
  - More play behavior (Krachun et al., 2010)
  - Longer lying times (de Paula Vieira, 2008)
  - Fewer vocalizations (Thomas et al., 2001)

- Intensified feeding reduces hunger and improves welfare

Long-term advantages

- Whole milk vs. restricted milk replacer
  - Reduced age at conception and calving
  - Improved milk production or milk fat yield
    (Bar-Peled et al., 1997; Shamay et al., 2005; Moallem et al., 2010)
Long-term advantages

• Whole milk vs. restricted milk replacer
  • Reduced age at conception and calving
  • Improved milk production or milk fat yield
    (Bar-Peled et al., 1997; Shamay et al., 2005; Moallem et al., 2010)

• Intensified vs. conventional milk replacer levels
  • Earlier age at first breeding (Raeth-Knight et al., 2009; Davis Rincker et al., 2011)
  • Correlation between preweaning ADG and milk yield
    (Soberon et al., 2010)

Managing intensively-fed calves

• Weaning strategies
• Solid feed provision
• Housing
Intensified feeding and weaning

- When and how do calves start eating solid feed?
- Intensified milk feeding programs
  - Reduce solid feed meal frequency and duration
  - Delay rumen development and reduce post-weaning nutrient digestibility (Terré et al., 2007; Hill et al., 2010)

When do calves eat in the day?

When do calves eat in the day?

*Ad libitum* milk feeding
Restricted milk feeding
*Ad libitum* solid feed intake time
Restricted solid feed intake time

Time of day
Feeding activity time (min/h)

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</tbody>
</table>

Intake of solid feed

*Ad libitum* intake
Restricted intake

Milk-feeding stage
Post milk-weaning
Weaning

<table>
<thead>
<tr>
<th>Week</th>
<th>Intake, lbs/d</th>
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<tbody>
<tr>
<td>0</td>
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<td>10</td>
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</tr>
<tr>
<td>12</td>
<td>12.00</td>
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</table>

P < 0.001
P = 0.4

Adapted from Miller-Cushon et al. 2013. J. Dairy Sci. 96: 551-564
Intensified feeding and weaning

- Weaning success relies on sufficient solid feed intake early in life
- Post-weaning body weight advantages vary
  - 17 – 45 lbs (Jasper and Weary, 2002; Miller-Cushon et al., 2013)
  - No difference (Borderas et al., 2009; DePassillé et al., 2011)

Pre- and post-weaning growth

Intensified feeding and weaning

• Post-wean performance hinges on a successful transition at weaning
• Achieved through
  • Gradual weaning (Sweeney et al., 2010)
  • Weaning later (de Passillé et al., 2011)

Intensified feeding and weaning

Automated calf feeders

- Control feeding programs
  - Gradual weaning
  - Potential to wean according to starter intake

Automated calf feeders

• Control feeding programs
  • Gradual weaning
  • Potential to wean according to starter intake

• Weaning based on starter intake
  • Start/end of weaning defined by target starter intakes
  • Individual variability in weaning
    • Age (30 – 80 d)
    • Duration (4 – 38 d)

Solid feed provision

• Concentrate
  • Stimulates rumen papillae development

• What about forage?
Solid feed provision

• For calves provided elevated amounts of milk, access to hay
  • Increased total DM intake (Khan et al., 2007)
  • Improved rumen environment
    • Increased rumen pH
    • Did not delay rumen metabolic development

• Calves choose to select a proportion of hay in their diet
Selection of solid feed

Selection of solid feed

- Proportion of forage selected in the diet varies
  - 5 – 30 %
- Depends on type of forage (Castells et al., 2012)

Adapted from Miller-Cushon et al. 2013. JDS: 96:4624-4633.
Social housing

- Group-housing for dairy calves
  - Encourages solid feed intake prior to weaning

Social housing and intake

Miller-Cushon et al. unpublished data
Social housing

• Calves housed in groups
  • Vocalize less frequently (Thomas et al., 2001)
  • Gain weight more consistently through weaning (Chua et al., 2002)

Social housing and competition

• Computerized calf feeders
  • 10 – 15 calves / feeder
  • How does competition affect intake and growth?
Social housing and competition

• 24 vs. 12 calves/feeder
  • Greater rate of intake
  • Longer wait times
  • More frequent displacements/disturbances


Social housing and competition

• 24 vs. 12 calves/feeder
  • Greater rate of intake
  • Longer wait times
  • More frequent displacements/disturbances

• Changing the feeding schedule reduced competition
  • Milk consumed in 4 vs. 8 allotments/day

Social housing and competition

• Pair-housed calves offered 1 teat instead of 2
  • More frequent displacements

Miller-Cushon et al. 2014. J. Dairy Sci. 97: 6450-6462

Competition and milk intake

<table>
<thead>
<tr>
<th>Week of age</th>
<th>Competitive (1 teat/pen)</th>
<th>Non-competitive (2 teats/pen)</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
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</tr>
<tr>
<td>7</td>
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<td></td>
</tr>
</tbody>
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Miller-Cushon et al. 2014. J. Dairy Sci. 97: 6450-6462
Behavior persists post-weaning

- Week of 13 of age (6 weeks post-weaning)

Take home message

- Intensified feeding for calves improves growth and affects behavior early in life
- Gradual weaning and encouraging early solid feed intake are critical
- Social housing can encourage solid feed intake but competition for access to milk must be considered
- Computerized calf feeders can be a useful tool
Questions?