Transition period: Accommodating Group Changes and Cow Need

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Strategies to Improve Transition Cow Health

• Management
  – Duration of the close-up period
  – Reproductive management
  – Comfort
    • Minimize heat stress
  – Separation of heifers and cows
  – Stocking density
  – Regrouping

• Nutritional
  – Intake: dry matter and water
  – Anionic salts
    • ↓ Hypocalcemia
  – Monensin and choline
    • ↓ Ketosis
  – Fatty acids (omega 6)
    • ↑ Pro-inflammatory

• Hormonal
  – rbST
    • ↑ Immunity & ↓ ketosis
  – GCSF
• Good animal welfare is present when animals are healthy, comfortable, well nourished, safe, able to express innate behavior, and are not suffering from pain, fear, and distress (WOAH)

• Animal-based measureable outcomes (beef): behavior, morbidity and mortality, changes in BCS, reproductive efficiency, and physical appearance (WOAH)

Fraser et al. (1997)

Housing and Management of Transition Cows to Achieve Sustainability

Foto: J. Santos

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What is the Ideal Stocking Density in the Prepartum Period?

Effect of Overstocking on Feeding Behavior

- Close-up cows housed in pens with 1 cow/bin or 2 cows/bin (Hosseinkhani et al., 2008)
  - ↑Rate of intake and ↓meals/day = ↑risk for ruminal acidosis
  - ↑Sorting immediately after feeding

- 30 vs. 60 cm/cow of feed-bunk space pre- and post-partum (Proudfoot et al., 2009)
  - 1 wk before calving = ↓visit feed time, ↓visit intake, ↓DMI, ↑standing time, ↑displacement rate
  - 1 wk after calving = ↓visit feed time, ↓daily feed time
  - 2 wk after calving = ↓visit feed time, ↑rate of intake
**Effect of Competition on Feeding Behavior**

![Graph showing eating rate over time with and without competition.]

**Association Between Prepartum Stocking Density and Production**

- Field trial to evaluate dry cow feed additive
  - Nulliparous animals grouped with parous animals pre- and post-partum
  - Pre-fresh stall stocking density ranged from 62 to 138% of stalls
  - No stall overstocking in post-fresh pens
- Retrospective evaluation of the association of prepartum stocking density and milk production
  - Nulliparous animals produced 1.6 lb/d less milk for every 10% unit increase in stocking density above 80%
  - Retrospective data not controlled for changes in ration, season, management, etc.

*Oetzel et al, 2007*
• Evaluation of behavior, metabolites, immune function, and performance of Jersey cows housed at 100 vs 80% stocking density (headlocks) during the prepartum period

• Nulliparous (n = 324) and parous (n = 404) animals assigned to one of two treatments at 28 d before expected calving date
  – 80SD = 38 animals, 48 headlocks, and 44 stalls
  – 100SD = 48 animals, 48 headlocks, and 44 stalls
  – Nulliparous and parous animals separate throughout the study

• After calving, animals from different treatments were commingled in the same pens

Silva et al. (2014)

Prepartum Pen Design

SD80: 38 cows, 80% headlocks, 86% stalls
SD100: 48 cows, 100% headlocks, 109% stalls

Silva et al. (2014)
Effect of Stocking Density on Immune, Health, Reproductive and Productive Parameters

- Weekly blood samples (innate immunity, hemogram, metabolites)
- Behavior
- Calving
- Exams for RFM and metritis (d 1, 3, 7, 10, and 14 postpartum)

- Cows were observed daily from 0 to 60 d postpartum for mastitis and DA
- Milk yield and milk composition in the first 150 d postpartum
- Reproductive performance after first postpartum AI and pregnancy rate by 150 d postpartum

Stocking Density According to Headlocks

Avg. stocking density:
- 80% = 72.5 ± 0.3%
- 100% = 92.6 ± 0.4%

Silva et al. (2014)
Effects of Stocking Density on Daily Displacement

![Graph showing daily displacements and displacement rate](image)

Displacement rate ($P = 0.23$):
- **80D**: $0.43 \pm 0.03$ events/cow/day
- **100D**: $0.47 \pm 0.03$ events/cow/day

Lobeck et al. (2013)

Effect of Stocking Density on Health and Removal from the Herd

- No effect on innate and adaptive immunity or concentrations of haptoglobin

<table>
<thead>
<tr>
<th>Health Measure</th>
<th>80SD, %</th>
<th>100SD, %</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFM, %</td>
<td>5.1</td>
<td>7.8</td>
<td>0.19</td>
</tr>
<tr>
<td>Acute metritis, %</td>
<td>9.9</td>
<td>9.4</td>
<td>0.64</td>
</tr>
<tr>
<td>Metritis, %</td>
<td>21.2</td>
<td>16.7</td>
<td>0.11</td>
</tr>
<tr>
<td>Endometritis, %</td>
<td>5.8</td>
<td>7.9</td>
<td>0.35</td>
</tr>
<tr>
<td>DA up to 60 DIM, %</td>
<td>1.0</td>
<td>0.7</td>
<td>0.78</td>
</tr>
<tr>
<td>Removed within 60 DIM, %</td>
<td>6.1</td>
<td>5.1</td>
<td>0.63</td>
</tr>
<tr>
<td>1st AI P/AI, %</td>
<td>36.8</td>
<td>44.0</td>
<td>0.29</td>
</tr>
<tr>
<td>Milk yield, kg/d (±SEM)</td>
<td>$34.2 \pm 0.5$</td>
<td>$33.8 \pm 0.5$</td>
<td>0.56</td>
</tr>
</tbody>
</table>
Stocking Density in the Prepartum Period and Performance

- 100% stocking density reduced lying time and increased displacement rate from the feedbunk
- Stocking density did not affect:
  - Innate immune parameters
  - Incidence of health disorders during the postpartum period
  - Body condition and locomotion score during the peripartum period
  - Energy corrected milk yield in the first 150 d postpartum
  - Reproductive performance
- Reduced close-up pen use in approximately 20%

Association between Stocking Density in the Prepartum and Rumination/Activity

- Retrospective evaluation of daily rumination of Holstein animals according to daily stocking density in the prepartum period
  - Stocking density: Heifers = 76-128%; cows = 53 to 119%
  - Observations: Heifers = 1,070; cows = 3,635
- Animals fitted with rumination/activity monitors from -21 to 21 d relative to calving
- Cows and heifers housed separately
**Correlation between Stocking Density and Rumination**

- **Multiparous**
  - $P = 0.72$
  - $r = -0.0075$

- **Primiparous**
  - $P = 0.34$
  - $r = 0.03$

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**Do we Know the Ideal Stocking Density of Prepartum and Postpartum Pens?**

- **What we know:**
  - When cows and heifers are housed separately, increasing stocking density from 80 to 100%, on the day of move, affects behavior but has no effect on immune and metabolic parameters or performance.
  - Recent study from Guelph corroborates these findings:
    - Overstocking cows (18 vs 35.4 inches of feed bunk space and 80 vs 120% stall) had minimal impact on metabolites and no effect on immune function (Miltenburg et al., 2014).
  - Heifers commingled with cows and housed at 200% vs 100% stocking density have significant changes in metabolism resembling insulin resistance (Huzzey et al., 2012).
Association Among Management Practices and Reproductive Performance of Dairy Herds

- Evaluation of reproductive performance of 153 herds (WI, TX, CA, OH, NY, MN, MI, WA, PA, IA, ID)
- Average herd size = 613 ± 46 lactating cows
- Decision trees: hierarchical sets of “if-then” tests that are used to classify records into their most likely outcomes based on various explanatory variables
- The algorithm created was compared with actual reproductive performance and classified 71.4% of herds correctly
- Most important risk factor for pregnancy by 150 DIM: **bunk space per cow** (lactating pen), **number of cows in the maternity pen**, temperature for thawing semen, percentage of cows with low body condition scores, strategy for using a clean-up bull, and milk yield at first service

Caraviello et al. (2006)

Association Among Management Practices and Reproductive Performance of Dairy Herds

- Increased number of cows in the maternity reduced probability of pregnancy by 150 DIM
  - Herds with > 22.5 cows per maternity pen = 2
- Increased bunk space in the breeding pen from 12” to 24” increased probability of pregnancy by 150 DIM
  - Herds with < 14” of feed bunk space in the breeding pen = 6

Caraviello et al. (2006)
**Associations among Herd-level Feeding Management Practices and Feed Sorting and Milk Production**

- Observational study in 24 Canadian herds (66 to 570 lactating cows, mean = 161.8 ± 120 lactating cows)
- Average feedbunk space = 21” (14” to 39”)
  - No description of grouping strategy (e.g. commingled primiparous and multiparous)
- Management associated with DMI:
  - Milking frequency: 2x vs 3x milking = ↑ DMI by 1.42 kg/d
  - Feeding frequency: 1x vs 2x feeding = ↑ DMI by 1.19 kg/d
- Management associated with milk yield:
  - Milk frequency: 3x vs 2x milking = ↑ milk yield by 5.9 kg/d
  - Feeding frequency: 2x vs 1x feeding = ↑ milk yield by 2.01 kg/d
  - Linear water space: ↑ linear water through space by 0.4” (1.5 to 4.6”) = ↑ milk yield by 0.88 lb/d

(Sova et al., 2013)

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**Regrouping of Dairy Cows**
Effects of Regrouping of High-Producing Dairy Cows on Behavior and Milk Yield

• Experiment conducted at 'UBC' - Canada, with 80 high producing dairy cows
• 4 groups of 11 cows/pen (TEST) and 3 groups of 12 cows/pen (SOURCE)
  - Feed bunk space = 24”/cow
• Cows evaluated 3 d before and 4 d after the pen change

![Diagram of cows in pens]

Effects of Regrouping of High Producing Dairy Cows on Behavior and Milk Yield

• Reduced feed time (↓ 15 min) during the first hour after pen change
• Increased number of displacements from the feed bunk (↑ 2.5x) in the first day after regrouping
• Reduced resting time (↓ 3 h) in the first day after regrouping
• Reduced milk yield (↓ ~4 kg) on the day of regrouping

![Graph showing events over days]
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von Keyserlingk et al. (2008)

Pattern of Social Disturbance

All-In-All-Out system = Transient disturbance

Conventional system = Continued disturbance

Pattern of Social Disturbance

- Even though cows are social animals, the effects of regrouping large numbers of cows into large pens are questionable
  - Dairies with 1,000 to 10,000 lactating cows = close-up pens 50 to 350 cows

Adapted from N. Cook
Effect of Frequency of Regrouping in the Close-up Pen on Immune and Metabolic Parameters, Health, Production, and Reproduction

- 567 cows (> 2\textsuperscript{a} lactation) assigned to 1 of 2 treatments:
  - AIAO (n = 259) - groups of 44 cows moved to close-up every 5 weeks (no new cows until all have calved)
    - ↓ Social disruption = ↑ DMI = ↑ Performance
    - ↑ Cost
  - Conventional (n = 308) - cows entering the close-up weekly to maintain stocking density of 44 Cows/48 headlock (5-15 new cows every week)

Silva et al. (2013a; 2013b); Lobeck et al. (2012)

Regrouping of Cows in the Conventional vs “All-In-All-Out” System

- Advantages and disadvantages of AIAO:
  - ↓ Social disruption = ↑ DMI = ↑ Health
  - ↓ Stocking density = ↑ Building cost
**Effect of Stocking Density on Immune, Health, Reproductive and Productive Parameters**

- Weekly blood samples (innate immunity, hemogram, metabolites)
- Calving
- Behavior
- 0
- BCS
- LS
- 14
- Endometritis
- BCS
- LS
- 35
- 56

Exams for RFM and metritis (d 1, 3, 7, 10, and 14 postpartum)

- Cows were observed daily from 0 to 60 d postpartum for mastitis and DA
- Milk yield and milk composition in the first 305 d postpartum are reported
- Reproductive performance after first postpartum AI and pregnancy rate by 305 d postpartum are reported

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**Close-up Regrouping Strategy and Stocking Density**

- Conventional
- AIAO

Average stocking density:
- Conventional = 86.9%
- AIAO = 71.9%

- Stocking density, %
- Days after entering the close-up pen

Silva et al. (2013a)
**Effect of Regrouping Strategy on Displacement Rate from the Feed Bunk**

Lobeck et al. (2012)

**Weekly Regrouping in the Close-up Period**

- No effect on innate immune parameters and concentrations of IgG, haptoglobin, NEFA and BHBA

<table>
<thead>
<tr>
<th>Items</th>
<th>Conventional</th>
<th>AIAO</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFM, %</td>
<td>10.9</td>
<td>11.6</td>
<td>0.82</td>
</tr>
<tr>
<td>Metritis, %</td>
<td>16.7</td>
<td>19.8</td>
<td>0.37</td>
</tr>
<tr>
<td>Acute metritis, %</td>
<td>1.7</td>
<td>3.6</td>
<td>0.22</td>
</tr>
<tr>
<td>DA, %</td>
<td>3.2</td>
<td>1.7</td>
<td>0.38</td>
</tr>
<tr>
<td>Cull/Death within 60 DIM, %</td>
<td>9.1</td>
<td>8.9</td>
<td>0.94</td>
</tr>
<tr>
<td>Cyclic by 53 DIM, %</td>
<td>90.1</td>
<td>90.2</td>
<td>0.97</td>
</tr>
<tr>
<td>$P/AI$ 66 ± 3 d after 1st AI, %</td>
<td>36.3</td>
<td>39.9</td>
<td>0.41</td>
</tr>
<tr>
<td>ECM after 305 DIM, kg/d</td>
<td>34.4 ± 0.6</td>
<td>34.3 ± 0.7</td>
<td>0.88</td>
</tr>
</tbody>
</table>
Health and Performance of AIAO Cows Regrouped before Calving

• 17 cows did not calve within 35 d and were regrouped within 4 d before calving (1 to 24 d before calving)

<table>
<thead>
<tr>
<th>Item</th>
<th>AIAO</th>
<th>Regrouped AIAO</th>
<th>P - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twins, %</td>
<td>3.8</td>
<td>0</td>
<td>0.42</td>
</tr>
<tr>
<td>Male calf, %</td>
<td>47.3</td>
<td>47.1</td>
<td>0.99</td>
</tr>
<tr>
<td>Metritis, %</td>
<td>20</td>
<td>17.7</td>
<td>0.81</td>
</tr>
<tr>
<td>DA, %</td>
<td>1.8</td>
<td>0</td>
<td>0.59</td>
</tr>
<tr>
<td>Cyclic by 53 DIM, %</td>
<td>89.6</td>
<td>100</td>
<td>0.19</td>
</tr>
<tr>
<td>P/AI after 1st AI, %</td>
<td>38.3</td>
<td>62.5</td>
<td>0.06</td>
</tr>
<tr>
<td>ECM, kg/d</td>
<td>32.3 ± 1.4</td>
<td>39.1 ± 2.4</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

Weekly Regrouping in the Close-up Period

• AIAO strategy reduces negative interactions among cows in small and medium size pens (< 45 cows)
  - The number of negative interactions appears to return to 'normal' within 2 to 5 d after regrouping

• AIAO strategy had no benefit to:
  - Immune and metabolic parameters
  - Health, production, or reproduction

• ↓ Stocking density in AIAO strategy (AIAO = 73% vs conventional = 87%) = ↑ Cost to build close-up cows' facilities in 16%
Cow Budget Time during the Prepartum Period

During the prepartum period = 13-15 h lying time + 4-6 h feeding time = 3-7 h left

Cow Budget Time: Effect of Lameness on Lying Time

Treatment x day - $P = 0.04$

Prepartum period = 13-15 h lying time + 4-6 h feeding time = 3-7 h left
Postpartum period = 10-12 h lying time + 4-6 h feeding time = 6-10 h left
**What is Normal?**

- Primary goals of good transition cow management must be:
  - Constancy
  - Comfort
  - Well balanced diets
  - Water availability
  - Heat abatement
  - Proper stockmanship
  - Careful monitoring
  - Prompt intervention

**Peripartum Management to Optimize Performance**

- **Feed bunk space**
  - 27” to 36” per cow
    - Particularly in dairies without stanchions
  - Smooth surface, easy to clean and remove stale food
  - ~ 3% leftover

- **Water availability**
  - 3” to 5” per cow
  - 1 trough per 20 cows
  - Clean water

- Close-up diets > 21 d

- **Grouping strategy**
  - Separate cows and heifers
    - Heifers = ↓ 3.5 lb/d
  - Reduce diet changes
  - 100% stocking density
    - Cows and heifers together ~ 80%

- **Comfort**
  - Reduce heat stress
    - Shade, sprinkler, fans
    - ↑ 2 to 6 lb/d
  - Comfortable, clean, dry stalls
Thank you!!!

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