Dry Period Heat Stress: Effects on Immune Status in Dam and Daughter

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Temperature Humidity Index higher than 72 throughout the entire day

Heat Stress Increases Mean Rectal Temperature

Heat Stress
Cooling

Treatment Effect; P<0.05

Milk yield?
Metabolism?
Immune function?

Late gestation
DAM vs.
DAUGHTER

Cow performance?
Thermoregulation?

Calf health?
Calf growth?

Heifer growth?
Reproduction?

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Cooling Dry Cows Increases Milk

Cooling Dry Cows Increases Lymphocyte Proliferation

Cooling Dry Cows Increases Neutrophil Action Postpartum
Effect of Cooling Dry Cows on Metabolic Profile

OmniGen for Dry Cows?

- Reduces RT and RR
- Improves DMI
- Immune modulation

OmniGen Increases L-Selectin mRNA

Omnigen Increases Phagocytosis in Late Lactation

Omnigen Increases Neutrophils in Dry Cows
Heat Stress Decreases Milk Yield

- CL vs. HT P < 0.04; OG vs NO P < 0.10

Cooling Increases Calf Birth Weight

Treatment effect: P < 0.01

36.7 kg vs. 42.4 kg

Cooling Improves Total IgG and AEA

Tao et al., J. Dairy Sci. 95:7128-7136

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Why Does Cooling Affect AEA? Calf or Colostrum Effect?

Experiment 1 - In utero heat stress for ~6 weeks reduces body weight and height to weaning

Cooling Increased Apparent efficiency of IgG absorption (AEA*)

Experiment 2 – No Effect of Colostrum from Cooled or Heat Stressed Cows on Calf Performance

Growth performance of calves born to cows under thermostatic conditions during the dry period and fed frozen colostrum from cows exposed to either heat stress or cooling during the dry period

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Heat Stress</th>
<th>Cooling</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Weight (kg)</td>
<td>38.8 ± 1.4</td>
<td>39.2 ± 1.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Weaning Weight (kg)*</td>
<td>68.4 ± 2.5</td>
<td>64.8 ± 2.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Preweaning BW Gain (kg/d)</td>
<td>29.6 ± 2.3</td>
<td>25.6 ± 2.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Avg. Daily Gain (kg/d)</td>
<td>0.49 ± 0.7</td>
<td>0.43 ± 0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Weaning Withers Height (cm)*</td>
<td>84.3 ± 0.8</td>
<td>87.0 ± 0.9</td>
<td>0.4</td>
</tr>
<tr>
<td>Preweaning Height Increase (cm)*</td>
<td>7.8 ± 1.1</td>
<td>6.2 ± 1.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Weaning weight and weaning height were measured at 60 of age.

*Preweaning BW gain and height increase was calculated by individually subtracting data at 60 of age by data at birth.

AEA = [Serum [IgG] (g/L) * birth weight (kg) * 0.091 / IgG fed (g)] x 100

trt: P < 0.05

Monteiro et al., J. Dairy Sci. 97:6426-6439
Omnigen Effects on Calf Immune Status

Skibiel et al., J. Dairy Sci. 100:7659-7668.

Retrospective analysis of records of calves from 5 studies between 2007 and 2011


Heat Stress Experiments 2007 - 2011

<table>
<thead>
<tr>
<th>Heat Stress Experiments 2007 - 2011</th>
<th>Bulls</th>
<th>Heifers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling</td>
<td>31</td>
<td>41</td>
<td>72</td>
</tr>
<tr>
<td>Heat Stress</td>
<td>30</td>
<td>44</td>
<td>74</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>85</td>
<td>147</td>
</tr>
</tbody>
</table>

In Utero Heat Stress Decreases Calf Bodyweight to Puberty

In Utero HS Decreases Calf Survival


Table 1. Effect of maternal heat stress (HS) or cooling (CT) during late gestation on calf survival

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AI</th>
<th>IVF Total</th>
<th>%</th>
<th>AI</th>
<th>IVF Total</th>
<th>%</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth calves, n</td>
<td>39</td>
<td>1 31</td>
<td>28</td>
<td>2 30</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Heifer calves, n</td>
<td>29</td>
<td>12 41</td>
<td>29</td>
<td>15 44</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>DOA*</td>
<td>0</td>
<td>0 0</td>
<td>0</td>
<td>2</td>
<td>1 3</td>
<td>3.1</td>
<td>0.25</td>
</tr>
<tr>
<td>Males mortality by 4 mo of age</td>
<td>1</td>
<td>0 3 3.2</td>
<td>3</td>
<td>0</td>
<td>3 10.0</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Heifers leaving herd before puberty</td>
<td>1</td>
<td>4 12.2</td>
<td>3</td>
<td>7</td>
<td>10 22.7</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Due to sickness, malformation or growth retardation</td>
<td>1</td>
<td>0 1 2.4</td>
<td>3</td>
<td>5</td>
<td>8 18.2</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Heifers leaving herd after puberty, before first lactation</td>
<td>1</td>
<td>0 1 2.4</td>
<td>3</td>
<td>0</td>
<td>3 6.8</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Heifers completing first lactation</td>
<td>27</td>
<td>8 35</td>
<td>85.4</td>
<td>22</td>
<td>7 29 65.9</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

*IVF = in vitro fertilization.
1 Percentage of animals (AI + IVF) affected out of total animals (males or females) in the respective treatment.
2 Treatment.
3 Dead on arrival. Includes male and female calves.