Prevention of Neonatal umbilical infections in Holstein calves through accelerated desiccation of the umbilical remnant

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Navel Dipping

- Morbidity during the first 3 weeks of life was attributed to umbilical disease 29% of the time.
- Decrease naval infection rates from an incidence rate of 20-28% to 5-14%.
- Calves with non-dipped navels had an 18% death rate, compared to calves with dipped navels at 7%.

Iodine Navel Dip

- The standard product utilized for dipping of the umbilicus
- Tincture of iodine (7%), has antibacterial and antifungal characteristics
- Contains alcohol which has a drying effect on the umbilical cord.
Tincture of Iodine (7%)

- The ability to obtain has become problematic due to illegal drug manufacturers have utilized to produce methamphetamines; Crystal Meth Industry
- United States Drug Enforcement Agency (DEA) moved iodine, from previously designated as a List 2 chemical, to a List 1 chemical.
Tincture of Iodine (7%)

- The DEA now regulates sales of all products containing more than 2.2% iodine and can only be purchased through a vendor who is registered to handle controlled products.
- Allergic reactions following handling common finding
- Costly – 1oz - $17.90; can get a gallon for $64 - $100
Navel Dipping

- Standard in Europe 10% Tincture of Iodine
- Cheaper Products – quality control is a concern; reports of contaminated products - Salmonella
- Utilizing Iodine Teat Dips for Navel dipping
Alternatives - Super7+™ Navel Dip

- Physical State: Liquid
- Boiling Point: The lowest known value is 100°C (212°F) (Water)
- Specific Gravity (H₂O=1): 1.04
- ORP: 82 mV
- Osmolality: 650-1000 Osm/kg
- 96.9% Electrolyzed Water
- 0.8% Sodium Hydroxide
- 2.0% Sodium Bicarbonate
- Color Reddish Brown Dye
- pH of 11.00 to 13
- Odorless
Alternatives

- Desiccating ability
- Eliminates growth of microorganisms
- Greater than 5 log bacterial reduction in 1min
- Negligible cytotoxicity profile

Cytotoxicity
Safety Profile

- A skin irritation study in rabbits - results showed no edema observed; irritation index of 0.5
- Test for product LD50 - demonstrated no mortality or evidence of toxicity observed in the rats for the 14-day study when 20ml/kg was given to the animal by oral administration.
- Super7+ ™ Navel Dip is a safe to use, non-toxic and non-irritating solution.
Focus

- Evaluation of Super7+™ Navel Dip as an alternative to 7% Tincture of Iodine as an umbilical dip in neonatal dairy calves
  - Desiccation of the umbilical remnant
  - Irritation to surrounding skin
  - Comparisons – Time to dry and Cost
Experimental Design

- A total of 100 neonatal Holstein heifers were utilized in this study from Auburn University Extension Dairy & Barrington Dairy.
Experimental Design

- Solution A = Super7+™ Navel Dip
- Solution B = 7% Tincture of Iodine
- Both solutions were the same color
Experimental Design

- All 7% Tincture of Iodine & Super7+™ Navel Dip utilized in these experiments underwent anaerobic and aerobic culturing
- Cultures were submitted to AUCVM Microbiology Laboratory
- Results – Negative on all dips
Experimental Design

- All workers dipping the calves were blinded to what solution they were utilizing.
- They dipped 50 calves with solution A & 50 calves with solution B
- 2oz/calf; individual cup for each calf
Experimental Design

- The umbilicus and the umbilical remnant of all calves were evaluated within 48 hours following dipping.
Results

- Umbilical remnants & the surrounding skin clinically appeared dry with & no inflammation, or discharge
Preliminary Findings

• 40 Jersey and Holstein dairy calves with a range of IgG levels were dipped with Super7+™ Navel Dip once shortly after calving.

• All calves, heifers and bulls had a clinically dried umbilical cord within 24 hours following dipping of the umbilical cord with Super7+™ Navel Dip.
Experimental Design

- A segment of umbilical remnant was removed and placed in a labeled airtight container at the 48 hour evaluation point.
Experimental Design – Study 1

- All samples were analyzed for moisture content utilizing a water activity meter within 6 hrs of sampling.
- Samples were placed in labeled 35mm culture dishes & exposed to normal environmental temperatures.
- Samples were analyzed at 12 hr increments until less than 10% moisture, technician blinded to treatment.
# Results of Desiccation - #1

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Sample was determined to be desiccated to less than 10% moisture:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48 hours</td>
</tr>
<tr>
<td><strong>Super7+™ Navel Dip</strong></td>
<td>44/50 (88%)</td>
</tr>
<tr>
<td><strong>7% Tincture of Iodine</strong></td>
<td>29/50 (58%)</td>
</tr>
</tbody>
</table>
There was a strong association between treatment A and drying at 48 hours. (P = 0.0008, Mantel-Haenszel Chi-Square).

Odds of drying out at 48 hours were 5.31 times higher with treatment A (Super7+™ Navel Dip) compared to treatment B (7% Tincture of Iodine)
Experimental Design – of Study 2

- On the day of calving, 4 inches of the umbilical cord was cut from the calf was placed into a sealed plastic bag with the calf’s number and placed into the refrigerator until processing.
- Following harvesting, the segments were measured and cut into 3 equal 1 inch segments.
- One segment was immersed in 7% tincture of iodine and one segment was immersed in Super7+™ Navel Dip & one as the control.
Experimental Design – of Study 2

- The technicians were **blinded** to what solution they were immersing the segments, aside from the control segment which was not immersed in any substance.
- Segments were placed in individual 35mm culture dishes with no media & labeled appropriately.

Experimental Design

- All samples were exposed to normal environmental temperatures
- All samples continued to be analyzed at 12 hr increments until the samples contained less than 10% moisture
- Technician blinded to treatments
### Results of Desiccation - #2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>The sample segment determined to be clinically desiccated to less than 10% moisture by the specified time period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 hours</td>
</tr>
<tr>
<td><strong>Super 7+</strong></td>
<td>38/100 (38%)</td>
</tr>
<tr>
<td><strong>Iodine</strong></td>
<td>15/100 (15%)</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>0/100</td>
</tr>
</tbody>
</table>
Statistical Results - 2

- Overall treatment effect (all 3 treatments evaluated at same time (P < 0.0001, Generalized Estimating Equation).
- For individual treatment comparisons
  - A vs B (P < 0.0001)
  - A vs C (P < 0.0001)
  - B vs C (P < 0.0001).
Experimental Design for Immune Status

- A serum sample was collected from each calf within 48 hours of birth and tested for total protein, specific gravity & IgG levels
- Specific gravity measurements were made utilizing a digital refractometer (Sper Scientific)
- IgG levels were then determined by utilizing radial immunodiffusion (RID) kits (Triple J Farms, Bellingham, WA)
Results

- The range of total protein was 4.5 to 7.2 g/dL and the range of specific gravity was 1.032 to 1.048.
- Range of IgG was 8.0 to 17.6 mg/mL; average IgG for the Super7+ Navel Dip group was 13.7 mg/mL & average IgG for the 7% tincture of iodine group was 13.4 mg/mL.
**Results of IgG**

- Of the samples that were 10% moisture by 60 hours for the Super7+™ Navel Dip group their average IgG levels were **14.1mg/mL** and for the 7% tincture of iodine group the average IgG level was **13.41mg/mL**.
Statistical Results of Immune Status

- TP was not significantly different between treatments (P = 0.415, Mixed Linear Models).
- IGG was not significantly different between treatments (P = 0.439, Mixed Linear Models).
- SG was not significantly different between treatments (P = 0.300, Mixed Linear Models).
## Cost Analysis

<table>
<thead>
<tr>
<th>Product and Volume</th>
<th>Price</th>
<th>Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>7% tincture of Iodine (Gallon)</td>
<td>$100-$350 USP Grade, $65 non-USP Grade</td>
<td></td>
</tr>
<tr>
<td>Super7+™ Navel Dip (Gallon)</td>
<td>$58.99</td>
<td>$6-$40 per gallon</td>
</tr>
</tbody>
</table>
Results

- Navel Dip appears to be superior to tincture of iodine in its ability to more quickly desiccate the umbilical remnant.
- Super7+™ Navel Dip appears to function competently as a navel dip and is a viable alternative to 7% tincture of iodine.
Acknowledgements

- Innovacyn for funding this study
- Barrington Dairies
- Dr. Fred DeGraves - statistics
- Dr. Sue Duran
Questions ???