

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



Julie A. Gard, BS, DVM, PhD, DACT



AUBURN

UNIVERSITY

# 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%.

[http://www.agrview.com/news/dairy/navel-dipping-are-you-putting-your-calves-at-risk/article\\_cob65630-fda8-11e1-969c-001a4bcf887a.html](http://www.agrview.com/news/dairy/navel-dipping-are-you-putting-your-calves-at-risk/article_cob65630-fda8-11e1-969c-001a4bcf887a.html)



# 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

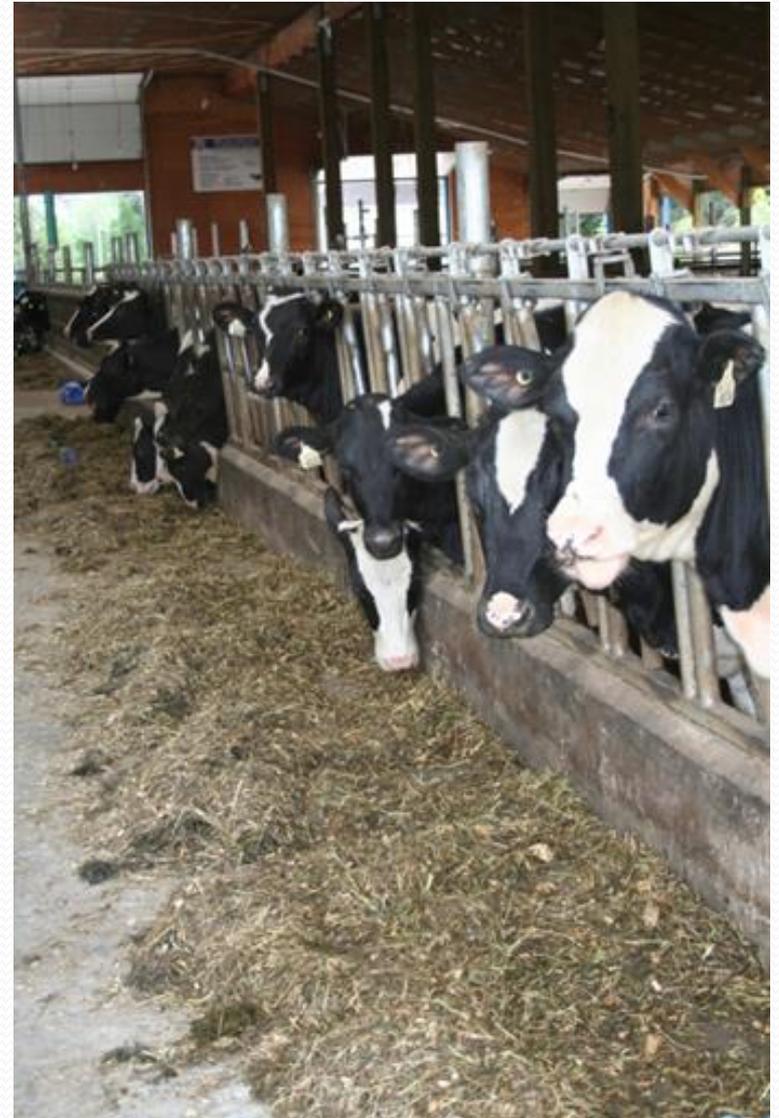
# Navel Dipping

- 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 (H<sub>2</sub>O=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+ <sup>TM</sup> 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 a 100 neonatal Holstein heifers were utilized in this study from Auburn University Extension Dairy & Barrington Dairies



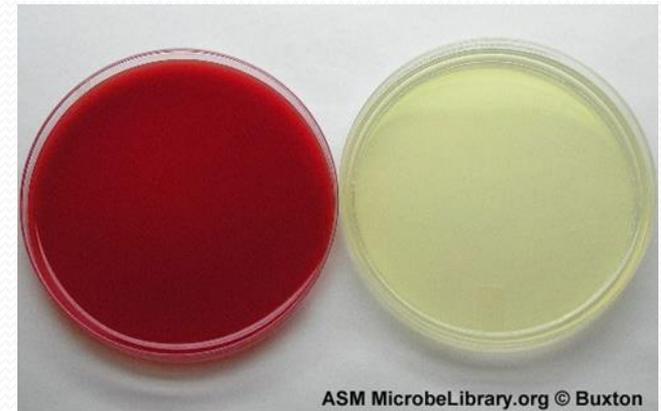
# Experimental Design

- 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

| Treatment             | Sample was determined to be desiccated to less than 10% moisture: |              |
|-----------------------|---|--------------|
|                       | 48 hours  | 60 hours     |
| Super7+™ Navel Dip    | 44/50 (88%)   | 50/50 (100%) |
| 7% Tincture of Iodine | 29/50 (58%)   | 50/50 (100%) |

# Statistical Results -1

- 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<sup>0</sup>% tincture of iodine and one segment was immersed in Super7+ <sup>TM</sup> 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.

[http://catalog2.corning.com/Lifesciences/en-US/Shopping/ProductDetails.aspx?productid=3294\(Lifesciences\)&categoryname=Plastic+CellBIND+Surface+Culture+Dishes\(Lifesciences\)](http://catalog2.corning.com/Lifesciences/en-US/Shopping/ProductDetails.aspx?productid=3294(Lifesciences)&categoryname=Plastic+CellBIND+Surface+Culture+Dishes(Lifesciences))



# 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

| <b>Treatment</b> | <b>The sample segment determined to be clinically desiccated to less than 10% moisture by the specified time period</b> |                 |                   |                   |
|------------------|---|-----------------|-------------------|-------------------|
|                  | <b>24 hours</b>   | <b>36 hours</b> | <b>48 hours</b>   | <b>60 hours</b>   |
| <b>Super 7+</b>  | 38/100<br>(38%)   | 90/100<br>(90%) | 100/100<br>(100%) | 0/100             |
| <b>Iodine</b>    | 15/100 (15%)  | 87/100<br>(87%) | 100/100<br>(100%) | 0/100             |
| <b>Control</b>   | 0/100   | 40/100<br>(40%) | 97/100<br>(97%)   | 100/100<br>(100%) |

# 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 of 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

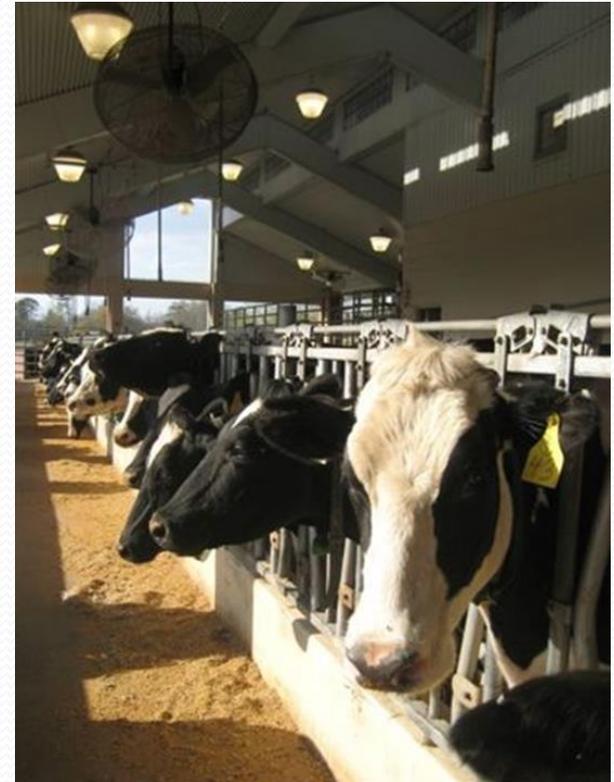
| Product and Volume                       | Price  | Saving              |
|--|--|---------------------|
| 7% tincture of Iodine (Gallon)           | \$100-\$350 USP Grade,<br>\$65 non-USP Grade |                     |
| Super7+ <sup>TM</sup> Navel Dip (Gallon) | \$58.99                                      | \$6-\$40 per gallon |

# 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
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Questions ???