

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%.

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

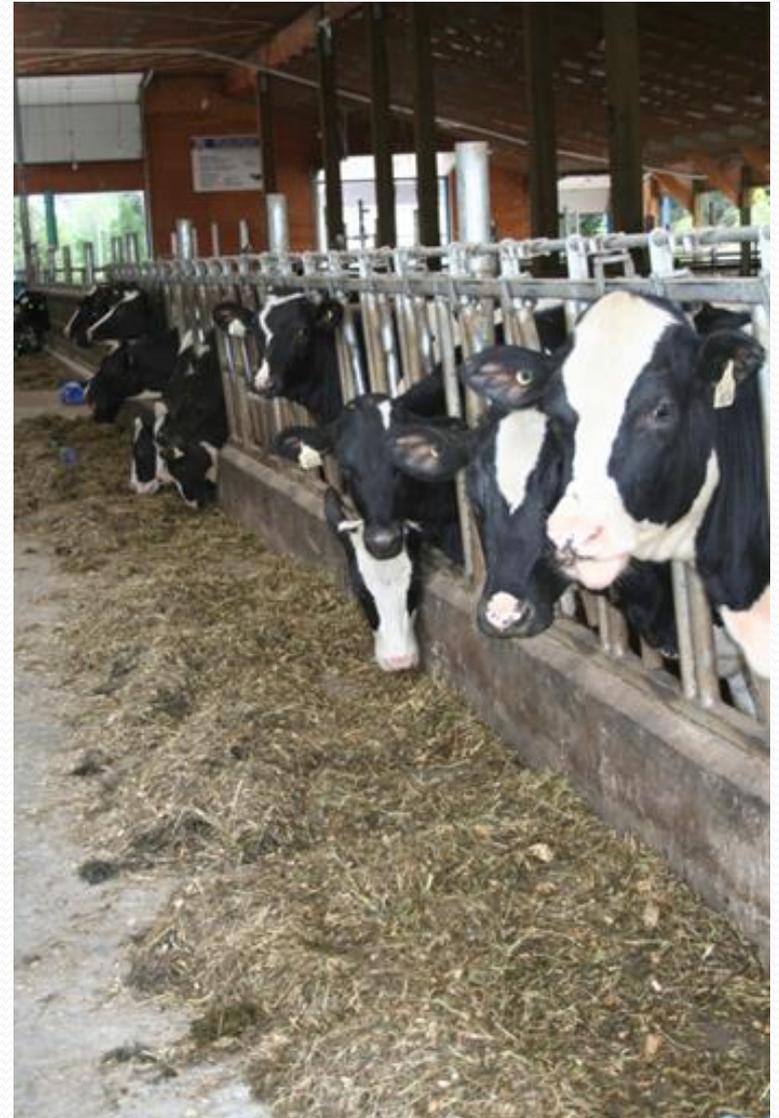
Navel Dipping

- 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



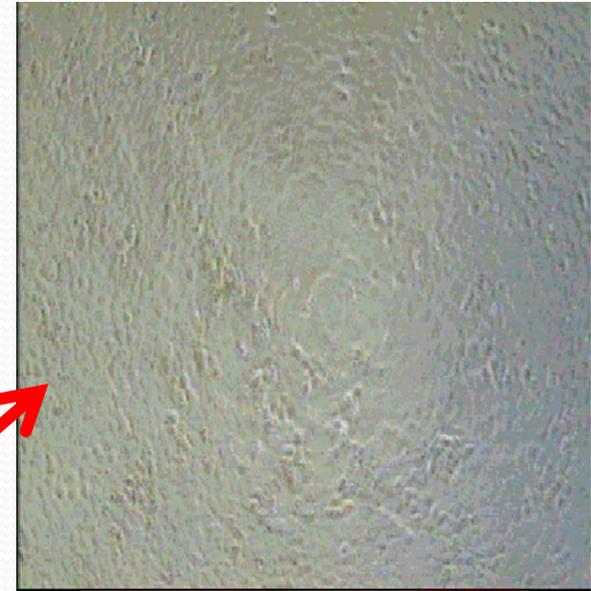
Alternatives - Super7+™ Navel Dip

- Physical State: Liquid
- Boiling Point: The lowest known value is 100°C (212°F) (Water)
- Specific Gravity (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+ TM 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



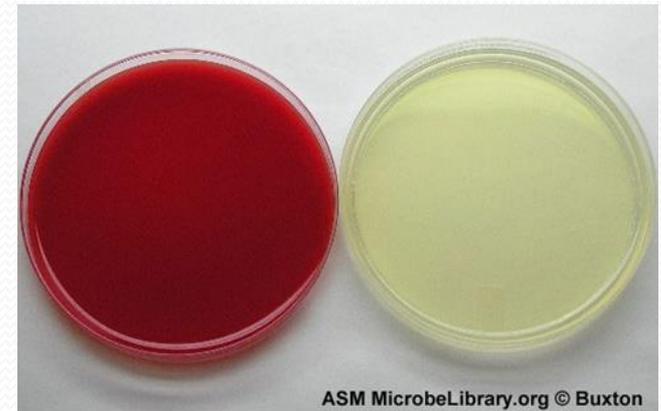
Experimental Design

- 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% 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.

[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

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

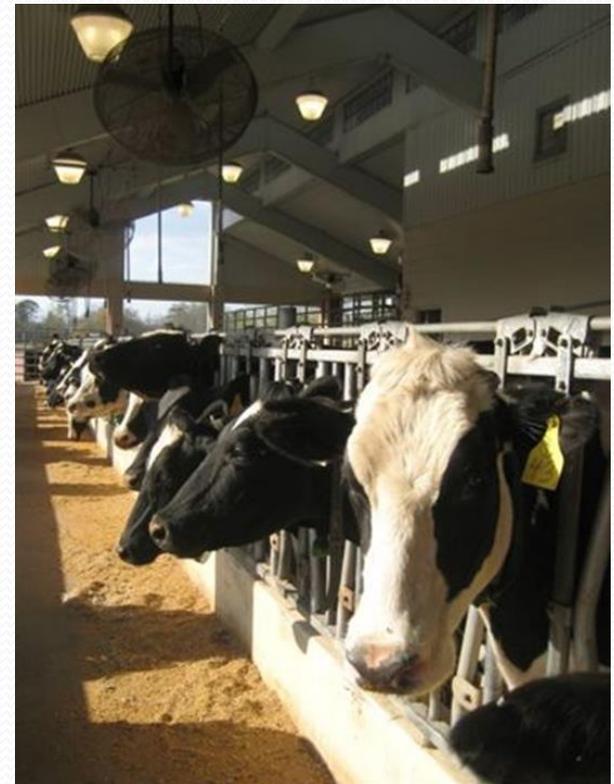
Product and Volume	Price	Saving
7% tincture of Iodine (Gallon)	\$100-\$350 USP Grade, \$65 non-USP Grade	
Super7+ TM Navel Dip (Gallon)	\$58.99	\$6-\$40 per gallon

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
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Questions ???