127-I levels in Ontario bulk tank milk and its association with groundwater, milking management, and other risk factors.

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Outline

1. Why are we interested in Milk Iodine?
2. Research Objective & Approach
3. Major Results
4. Implications
Why are we interested in Milk I⁻?

• Mammalian nutrient requirement
  o Thyroid hormone component
    • Cell activity regulators

• Narrow margin of safety
  o Tolerable upper level ~3x’s greater than adult requirement
    • 200 vs. 600 mg/d

• Milk & dairy products
  o Leading nutritional source
  o Iodine secreted into milk
  o Levels have been increasing
    • DFO implemented testing and limits
Current Canadian Milk I⁻ Reports:

1) 2011-2013 DFC funded project – Keefe, 2013
   - 12,000 farms
   - Mean BMI = 258, Range <10 to 3,937 ppm
     - 5% of Canadian dairies ship milk with I⁻ levels >500ppm
   - Ontario = highest milk I⁻ levels in country
     - 3/5 high risk areas located in Ontario

2) 2010 Canadian study - Borucki Castro, 2010
   - 501 farms
   - Mean BMI = 304 µg/kg, Range 54 to 1,902 µg/kg

3) 2004-2005 Canadian study - Robichaud, 2006 (Unpublished)
   - 411 retail milk samples (9 provinces)
   - 393 µg/kg mean I⁻ content in retail milk
Risk Factors Identified in Literature

Milk Iodine Level

- Milking Management
- Nutrition
- Water Consumed

*farms continue to have high milk iodine after controlling for iodine in ration and during/after milking, indicating another source exists.
**Research Approach**

- **Case-Control design**
  - 80 commercial dairy herds
  - Eastern ON (n=58) & southwestern ON (n=22)
  - \([\text{milk } I^-] = \text{normal} (<300 \, \mu\text{g/L}), \text{elevated} (300-499 \, \mu\text{g/L}), \text{high} (>500 \, \mu\text{g/L})\)

- **Farms visited from August – September 2016**
  - Bulk tank milk, groundwater, & ration sampled
  - Risk assessment survey completed

- **Bulk tank milk & water samples tested for I-127**
  - Animal Health Laboratory, University of Guelph

- **Survey information (Excel & Stata13)**

**Objectives:**
1) Determine \([\text{I}^-]\) in milk sampled from 80 dairy farms
2) Identify risk factors associated with high milk iodine
Current Preliminary Results

- **[Milk I⁻]**
  - Ranged 8 to 1,144 ppb
  - Mean = 284 ppb

- **[H₂O I⁻]**
  - Ranged <6.1 to 2100 ppb
  - Mean = 134 ppb

*Figure 1. Frequency distribution of farms according to milk iodine concentrations (ppb or micrograms per liter).*

25% of dairies visited produce milk with I⁻ levels above 350 µg/L
Linear Model Results

- I\(^-\) content in water
  - Significant (+) correlation with BMI

- Type of post disinfectant used
  - Post disinfectants \(\leq 5\%\) or \(\geq 10\%\) I\(^-\) significant (+) correlation

- Post-disinfectant coverage goal
  - Full teat + udder base coverage significant (+) correlation

**Figure 2.** Two-way scatter plot suggesting a positive linear correlation between BMI and I\(^-\) content in water.
Implications for Ontario Dairies

Who is directly impacted by this research:

- Ontario Dairy Producers
- Dairy Farmers of Ontario (DFO)
- Raw milk consistency
- Quality assurance
- Consumer safety
- Maintain marketability
Conclusions & Further Investigations

• Many Ontario dairy producers continue to produce milk containing elevated to high iodine levels

• [Milk I⁻] is influenced by many risk factors
  o Milking Management (Post-dip use & coverage goal)
  o Water Consumption**

Subsequent Investigations:
• Isotopic analysis of iodine-129 (¹²⁹I) and ¹²⁷I/¹²⁹I ratio in samples to fingerprint source of I⁻.
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Figure 1. Areas at risk of having high milk iodine (>500ppm), colours indicate ranking of regions regarding relative risk weighted by dairy herd population in each region.
Figure 4. Two-way scatter plot suggesting a positive linear correlation between BMI and $\text{I}^-$ content in water with farm ID 1 removed (suggested outlier).