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
  - Thyroid hormone component
    - Cell activity regulators
- Narrow margin of safety
  - Tolerable upper level ~3x's greater than adult requirement
    - 200 vs. 600 mg/d
- Milk & dairy products
  - leading nutritional source
  - Iodine secreted into milk
  - 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

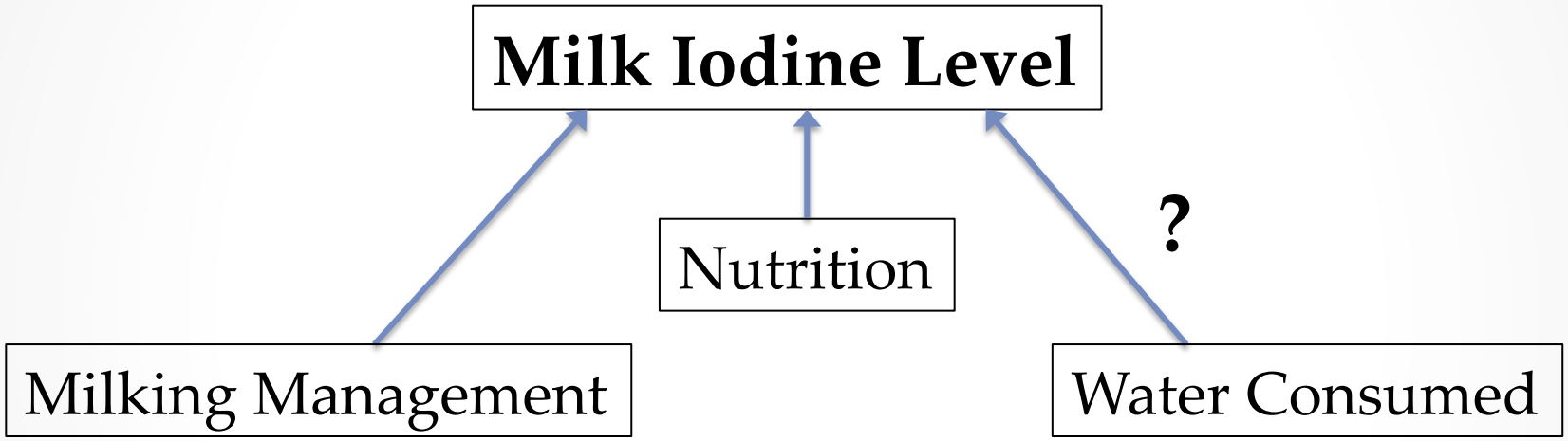
2) 2010 Canadian study- Borucki Castro, 2010

- 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3) 2004-2005 Canadian study- Robichaud, 2006 (Unpublished)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



*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)
  - [milk I^-] = normal (<300 μg/L), elevated (300-499 μg/L), high (>500 μg/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 [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
- [H_2O I^-]
  - Ranged <6.1 to 2100 ppb
  - Mean = 134 ppb

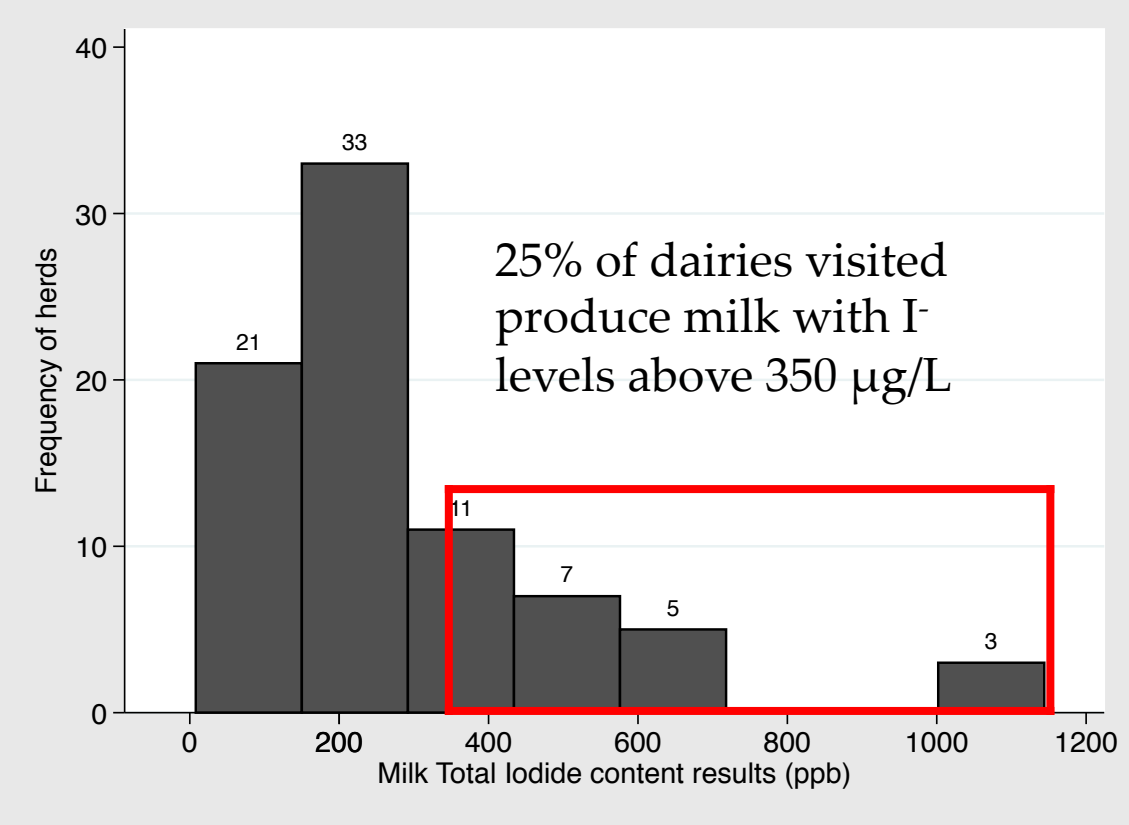


Figure 1. Frequency distribution of farms according to milk iodine concentrations (ppb or micrograms per liter).

Linear Model Results

- I^- content in water
  - Significant (+) correlation with BMI
- Type of post disinfectant used
  - Post disinfectants [ ] ≤5% or ≥10% I^- significant (+) correlation
- Post-disinfectant coverage goal
  - Full teat + udder base coverage significant (+) correlation

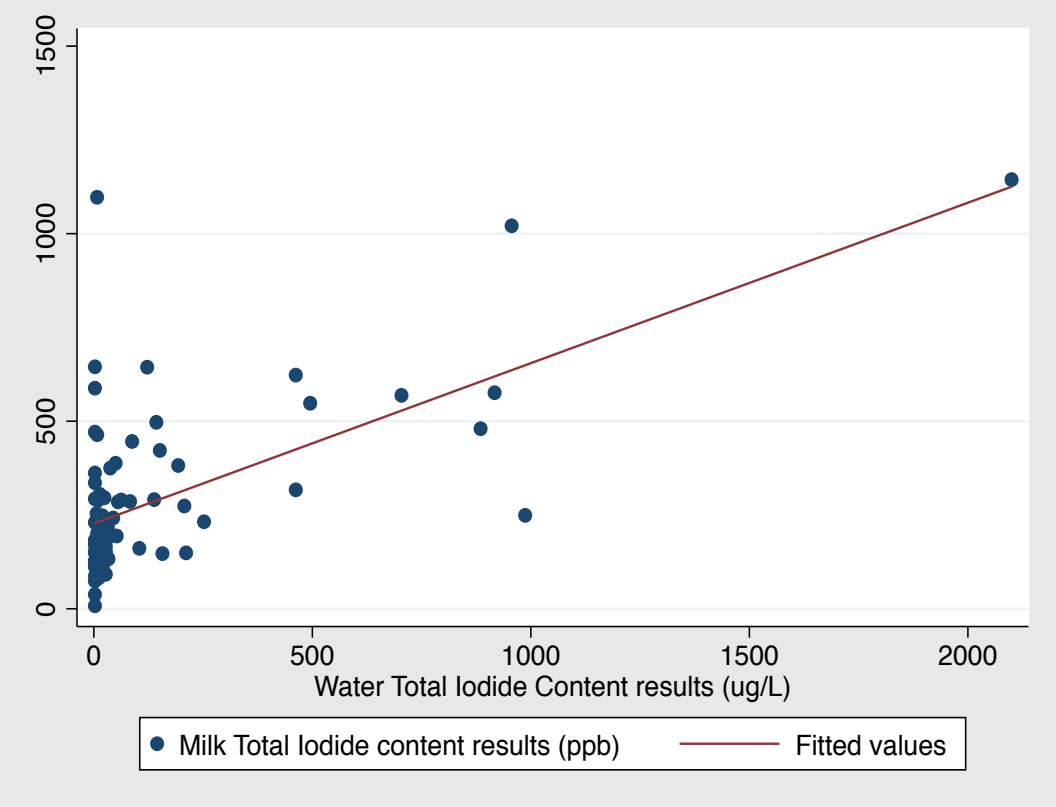


Figure 2. Two-way scatter plot suggesting a positive linear correlation between BMI and I^- content in water.

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
  - Milking Management (Post-dip use & coverage goal)
  - Water Consumption**

Subsequent Investigations:

- Isotopic analysis of iodine-129 (^{129}I) and $^{127}I/\ ^{129}I$ ratio in samples to fingerprint source of I^-.

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- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
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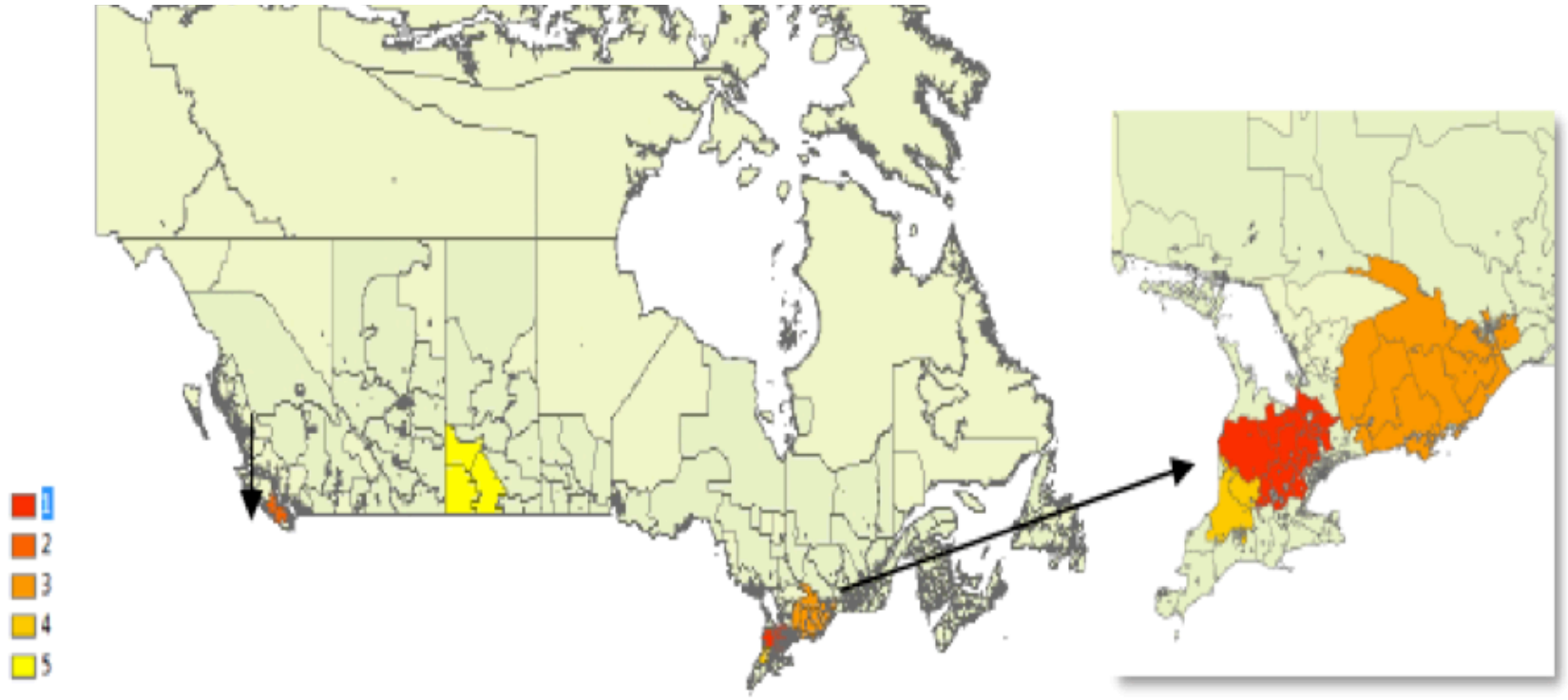
Figure 1. Areas at risk of having high milk iodine (>500ppm), colours indicate ranking of regions regarding relative risk weighted by dairy herd population in each region.



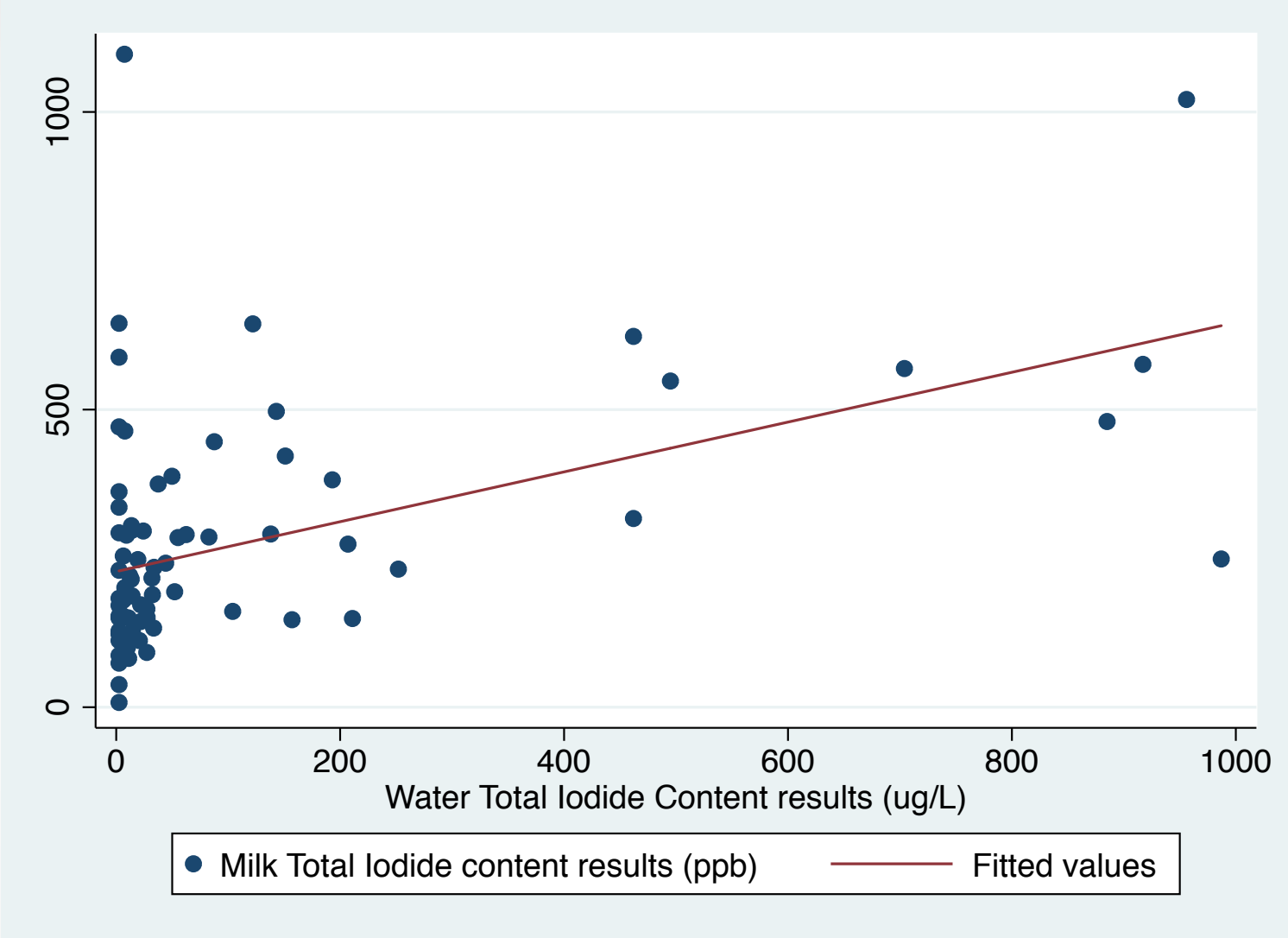


Figure 4. Two-way scatter plot suggesting a positive linear correlation between BMI and I^- content in water with farm ID 1 removed (suggested outlier).