In Vitro Bioaccessibility of Mercury from Traditional Foods of Bigstone Cree First Nation (Alberta, Canada)

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BACKGROUND

- Aboriginal communities are particularly susceptible to mercury (Hg) contamination given that their traditional foods, which play a significant role in their health, culture, recreation, and spirituality, are known to be contaminated with Hg[1].
- Most studies have focused on seafood, with relatively fewer studies on other food sources.
- Our understanding of Hg contamination in traditional foods focuses mostly on the total mercury (THg) concentration and not methylmercury (MeHg).
- Studies have assumed that 100% of ingested Hg in food items is absorbed in the body. However, recent research suggests otherwise[2].
- There can be great variability in Hg contamination across communities, and thus there is a need for site-specific information.
- Bigstone Cree Nation (BCN) is located in northern Alberta's boreal forest. The members of this community are concerned about the safety of their food due to the heavy oil sands development activity occurring in their territory. This community is rich in fish and wild game[3].

Figure1: Bigstone Cree Nation location in Canada.

OBJECTIVES

- Measure THg and MeHg in muscle tissues sampled from key traditional food items (fish, grouse, hare, and duck);
- Determine the %THg bioaccessibility in the muscle tissues.

METHODS

- Animals were collected through a participatory research activity by Bigstone Cree members.
- In this study an *In vitro* simulated digestion *assay* was used. This model includes a gastric phase, a small intestinal phase, and a colonic phase, with sequential addition of pepsin, pancreatin, bile extract, and fecal bacteria, along with appropriate pH changes.
- The food samples were processed, dried, and analyzed for THg and MeHg using a direct mercury analyzer and GC- CVAFS, respectively.

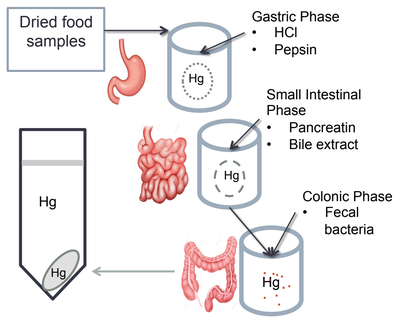

Figure 2: *In vitro* simulated digestion model.

RESULTS

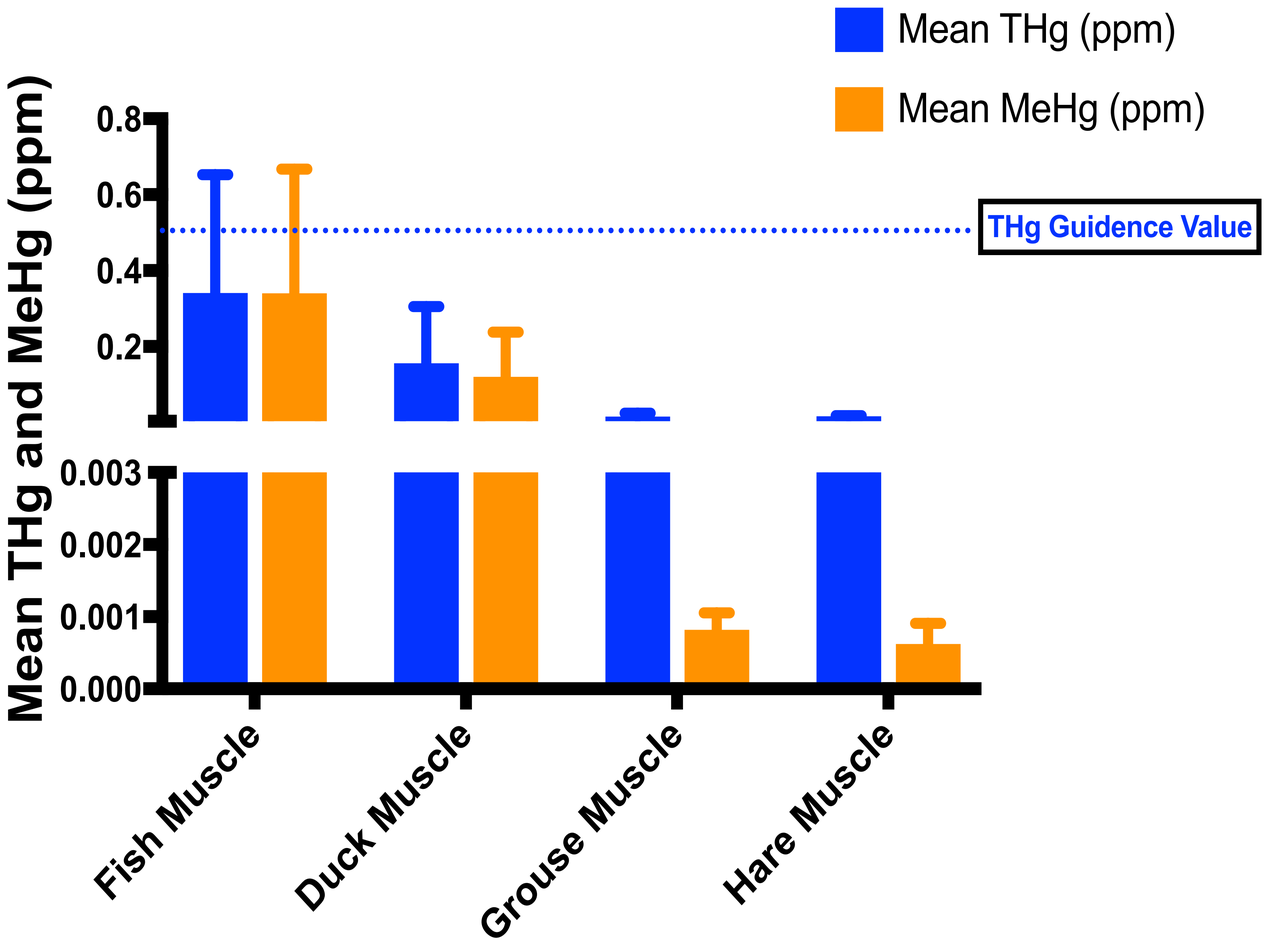

Figure 3: Mean concentration of THg and MeHg (ppm) - dry weight.
Health Canada Guideline for THg- 0.5 ppm. (N:7-14, Bars represent Mean ±SD).

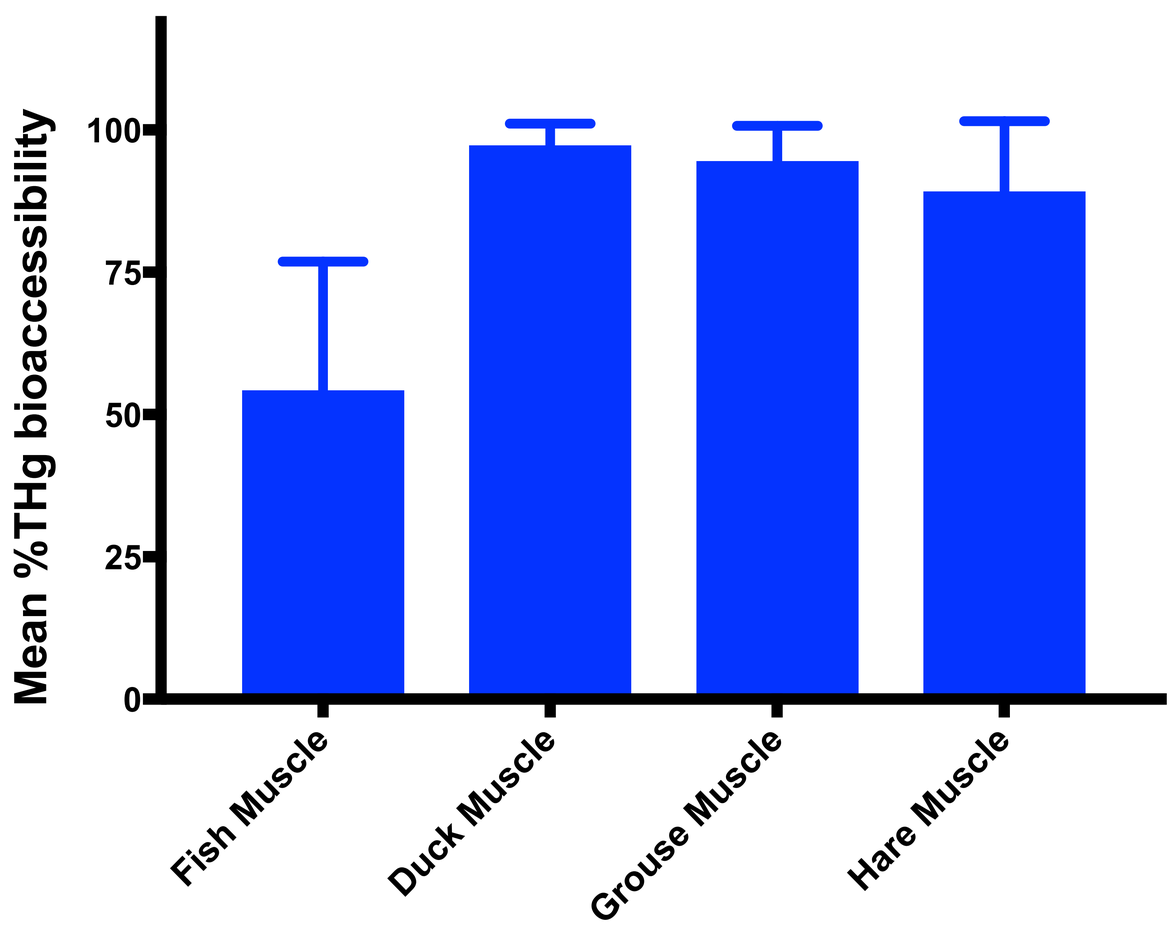

Figure 4: Mean percentage of THg Bioaccessibility.
(N:7-14, Bars represent Mean ±SD).

LIMITATIONS & NEXT STEPS

- *In vitro* bioaccessibility procedure can provide valuable understanding of distribution of digested Hg into blood circulation and bioavailability of Hg in the body. However, the *in vitro* method may not be 100% representative of the human digestion system.
- Bioavailability of metals can be affected by cooking processes and we should keep in mind that results reported in this research are achieved from uncooked food.

CONCLUSIONS

- Most studies have measured the concentration of THg in seafood. However, the amount of Hg in the forms of MeHg varies with types of samples. In this study, 100% of Hg in fish muscle is MeHg. However, for duck muscle, grouse muscle, and hare muscle this amount is 59%, 6.8%, and 3.35%, respectively.
- Our results indicate that bioavailability of Hg is not always 100% and varies amongst the type of animal (terrestrial animal vs. seafood).
- The mean bioaccessibility of THg for duck muscle, grouse muscle and hare muscle were between 89% to 97%, however, the mean bioaccessibility of THg for fish muscle was 54%.

REFERENCES

1. Oostdam, J Van et al. 2005. "Human Health Implications of Environmental Contaminants in Arctic Canada : A Review." *Science of the Total Environment* 351–352: 165–246.
2. Bradley, Mark A, Benjamin D Barst, and Niladri Basu. 2017. "A Review of Mercury Bioavailability in Humans and Fish" ed. Paul B Tchounwou. *International Journal of Environmental Research and Public Health* 14(2): 169. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5334723/.
3. Bigstone Cree Nation. (2013). Bigstone Cree Nation from http://www.bigstone.ca/content/location-1

ACKNOWLEDGEMENTS

- Jenny Eng
- Marie Perkins
- Andrea Santa Rios
- Bigstone Cree Nation
- CREATE EI Program
- First Nations Environmental Contaminants Program (FNECP).

NSERC CRSNG