Health Assessment of Mercury Exposure of a Riparian Community in the Amazon Region.

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Introduction

Mercury exposure

- Fish consumption is the main pathway for human exposure to methyl mercury in the Amazon region. The local riparian communities have fish based diets and are, thus, at a risk for mercury exposure.

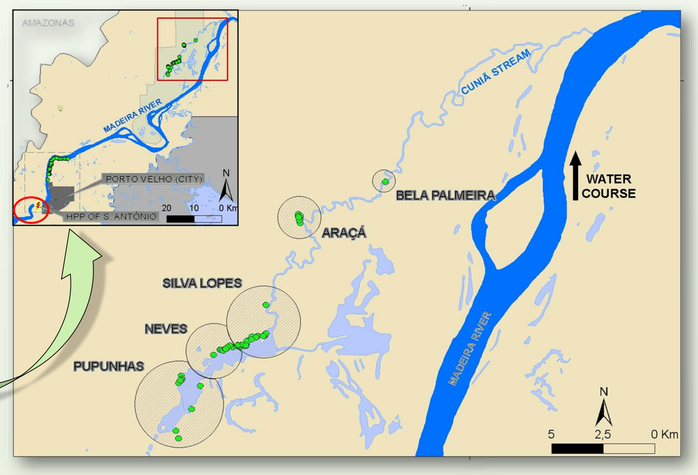
Why study Mercury in the Amazon region?

- Deforestation, biomass burning and former gold mining activity are events that increase Hg cycling in the Amazon ecosystem.
- The hydroelectric potential in Amazon begins to be incorporated to the Brazilian energy matrix, implicating in the flooding of new areas, mobilizing soil mercury. .
- The hydroelectric power plant construction at the Madeira River brings new threats and challenges, requiring new Hg data bases in order to monitor changes in mercury exposure patterns.

Objective

Create a data base of Hg levels in hair associated with fish consumption in a reference community, to support future researches for monitoring potential adverse effects on human health.

Methodology and study site



Location of the Cuniã RESEX *Red circle: hydroelectric power plant (in construction)*

- The Cuniã Lake RESEX is a riparian extractivist reserve located 200 Km northward from Porto Velho (capital of the Rondonia state);
- The population diet is based mainly on fish, and occasional aquatic birds and caiman (the local alligator), complemented with local fruit and Brazil Nuts;
- The area has no history of gold mining extraction, and therefore the local population is a good reference community for the study of mercury exposure in natural conditions.

Methodology: Transversal study

- Participatorial approach in the whole study
- Period: October 2010 - June 2011
- Interview administered questionnaires
- Hair collection for Hg determination

Figure 2. Collection of hair samples.

Sample digestion

Sample, 0.2g

$$\xrightarrow[80^oC]{1+1\ H_2SO_4:HNO_3 + 0.1\%\ V_2O_5} + 5\%\ (m/v)\ KMnO_4 \rightarrow \textbf{Sample solution}$$

Instrumental determination

Sample solution

$$\xrightarrow[\text{To 50 mL}]{20\%\ m/v\ NH_2OH}$$

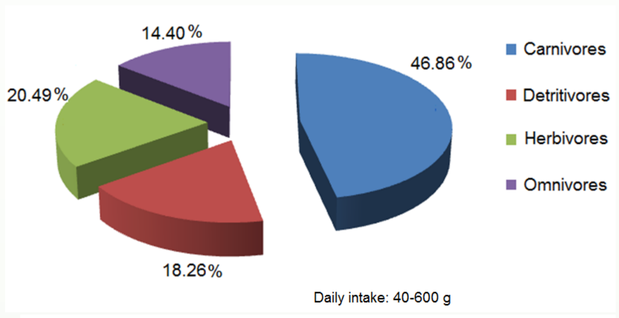
MHS 10 CVG + Model 3300 AAS (P Elmer)

External calibration with aqueous calibration solutions

← Reduction: 20 % m/v $SnCl_2$

Quality control:
- Strict blank control
- Analysis of replicates.

Results



Types of fish consumed at the Cuniã RESEX

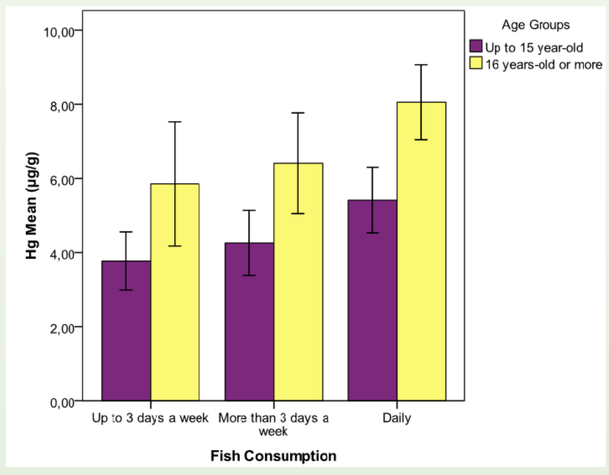
Frequency of fish consumption (%)

Never	0
Every 15 days	2
1 to 3 days a week	19
> 3 days a week	21
Daily	58

Mercury Hair Levels at Cuniã Lake RESEX (µg g^{-1} d.w.)

Gender	Mean	N	St. Dev.	Median	Min	Max
Male	7.4*	114	4.6	6.5	1	26.4
Female	5.1	135	3.1	4.3	0.6	18.7
Total	6.1	249	4	5.2	0.6	26.4

Hg hair levels vs fish consumption in adults and children at the RESEX Cuniã lake.



Correlations between blood pressure and Hg Hair Levels at Cuniã RESEX

	Male		Female	
	Adults	Children	Adults	Children
Sistolic Pressure	0.262*	0.145	0.078	0.007
Diastolic Pressure	0.282*	0.128	-0.004	-0.049

* significant at 0.05 level (2-tailed)

Conclusions

- One vessel digestion + CV-AAS: robust, accurate, cheap and easy for Hg determination in biological samples (fish and hair);
- Significant association (0.05 level, 2-tailed) between fish consumption and Hg hair for adults (<15 years old) and children (≥ 15 years old);
- 9% of the total population showed total mercury hair levels above the WHO reference dose (10 µg.g^{-1}). However, WHO limit is based on acute exposure events. At Cuniã, chronic exposure to low Hg doses by food ingestion (fish) is the case;
- Blood pressure showed a significant positive association with Hg hair levels only in adult men group; this association was weak and not observed in other groups.
- No evident abnormalities were observed in the neurological tests applied to children. However, school teachers complain about pupil´s vision problems, making it important to evaluate vision impairment at this community;
- Carnivore fishes (higher Hg levels) are the most frequently consumed → increased risk of Hg exposure in the population, mainly for women at reproductive age.
- These areas are important to monitor since anthropic activities, such as the construction of hydroelectric plants, may be affecting the ecosystem.

References

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