# Mercury exposure in Portuguese adolescents

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International Conference on Food Contaminants
Challenges on early-life exposure

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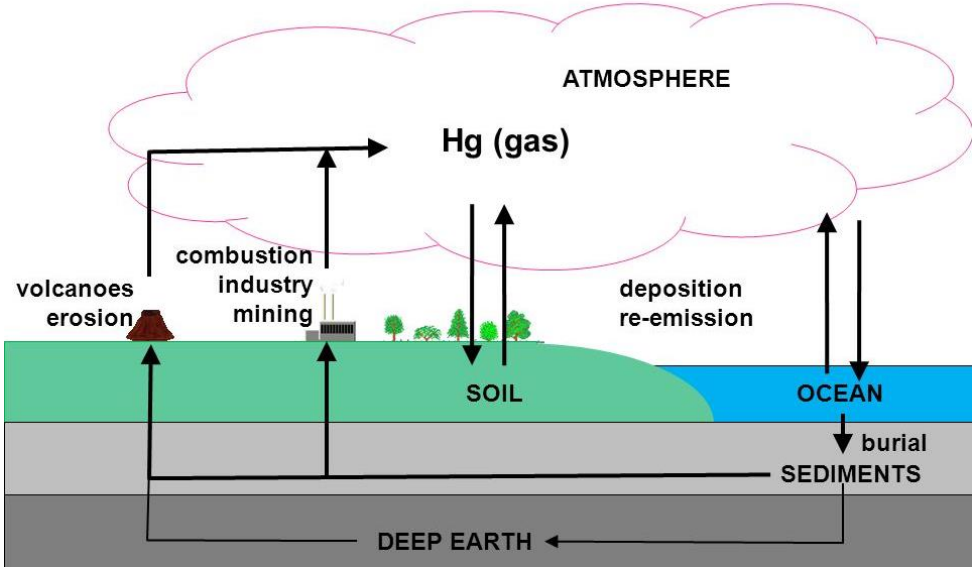
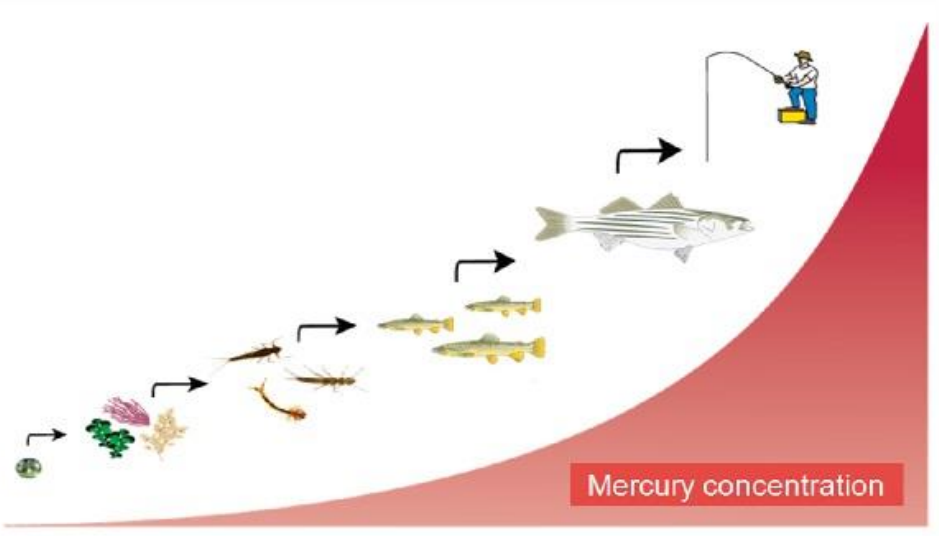
- Citizens, in particular younger generations, are currently very interested in environmental and health problems associated with exposure to hazardous chemicals.
- Mercury has been recognized as a chemical of concern due to its well-known neurotoxicity and endocrine disrupting potential.
- Besides natural sources, Hg is released into the environment through industrial processes, such as metal mining and fossil fuels combustion.




https://slideplayer.com/slide/9527359/ by David Barry Ryan

- In the environment Hg accumulates along the food chain.




- According to the United Nations, mercury poses serious risks to human health and the environment.


https://inhabitat.com/mercury-found-in-california-fog-may-threaten-the-food-chain/mercury-contamination-through-food-chain/

- Despite regulations restricting its use, the European population is still exposed to mercury.

- In this work, a group of teenagers from a school in Lisbon together with their teachers and researchers from the academia conducted a human biomonitoring survey on mercury in the students from their school with the aim to:
  - assess adolescents exposure to mercury in Lisbon;
  - investigate the potential determinants of exposure.

https://inhabitat.com/mercury-found-in-california-fog-may-threaten-the-food-chain/mercury-contamination-through-food-chain/

**Study design:** cross-sectional study.

**Recruitment:** performed at a private school in Lisbon by the students enrolled in the study team after having received training.

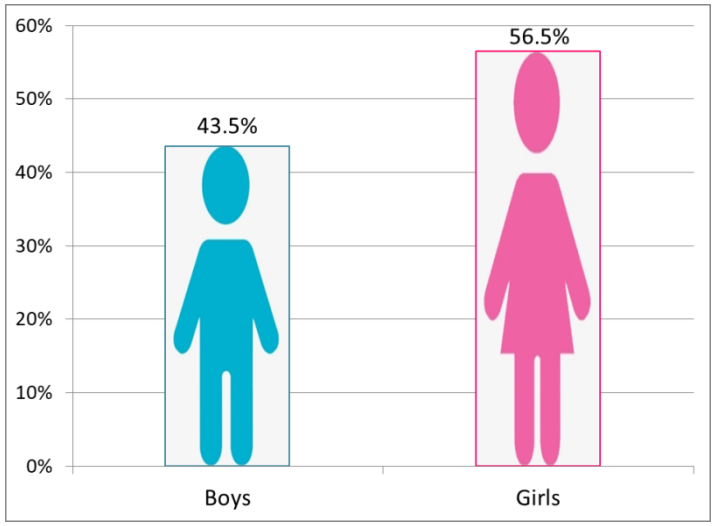
**Sample collection:** hair samples were collected following standardized protocols.

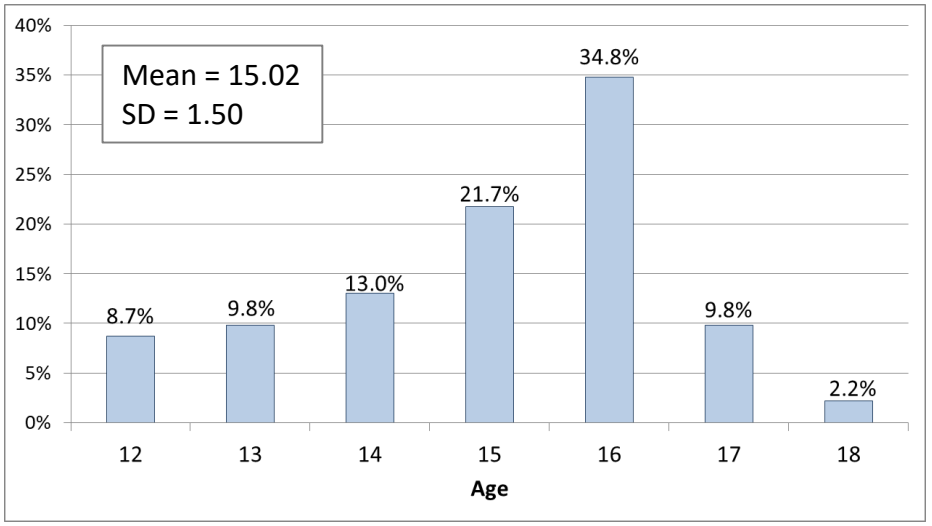
**Data collection:** data on sociodemographic characteristics, seafood and fish consumption, dental amalgams and hair dye was obtained through a questionnaire.

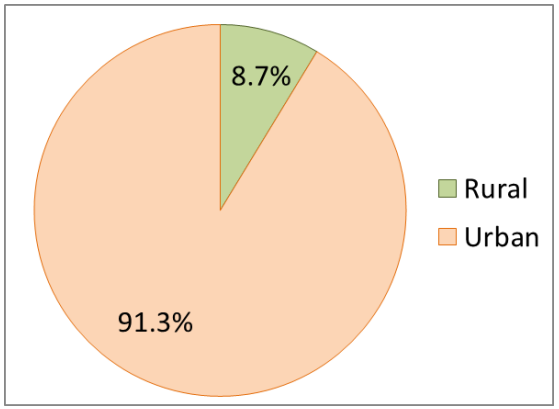
**Ethics:** study protocol approved by the Pedagogical Board of Colégio Valsassina and authorized by the National Data Protection Agency.

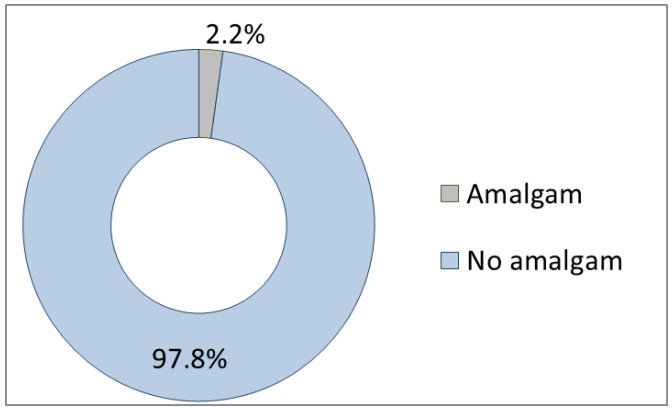
**Chemical analysis:** total mercury analysis performed using atomic absorption spectrometry with thermal decomposition and gold amalgamation in a NIC-MA-3000 equipment using human hair certified reference material.

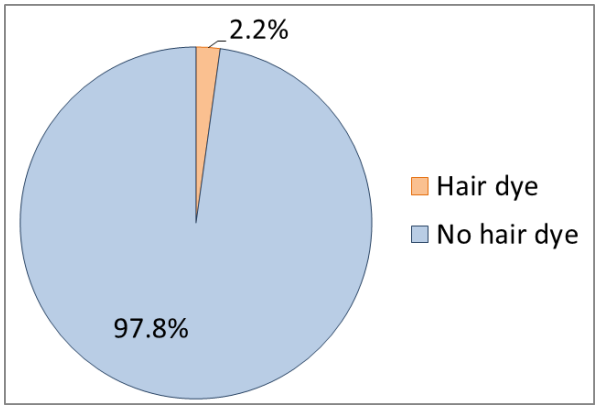
## 92 participants

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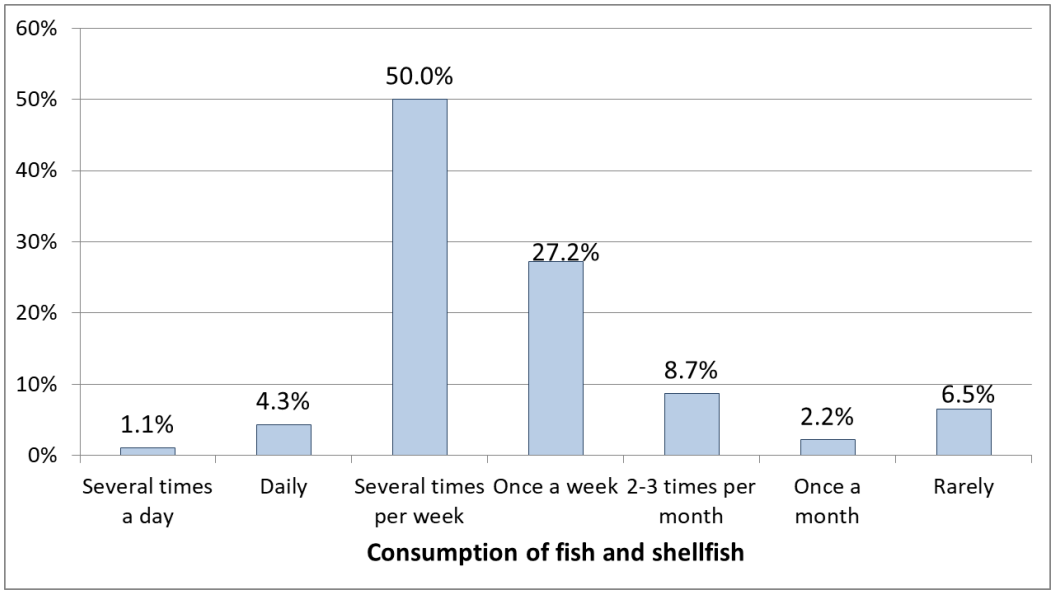
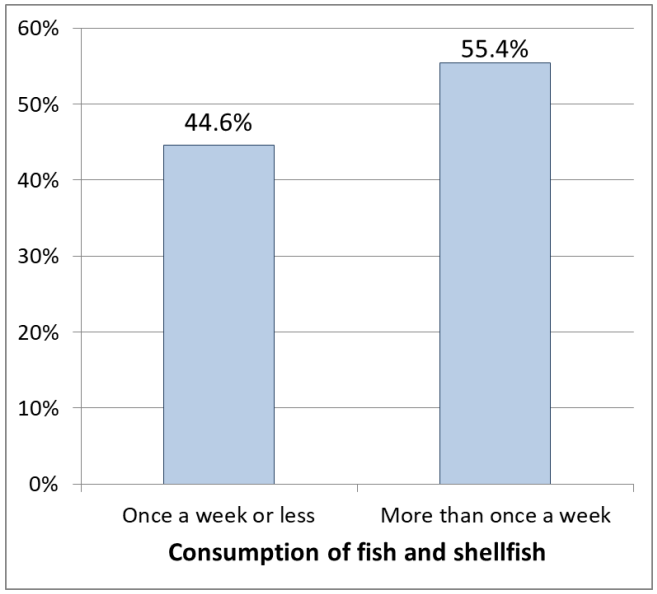
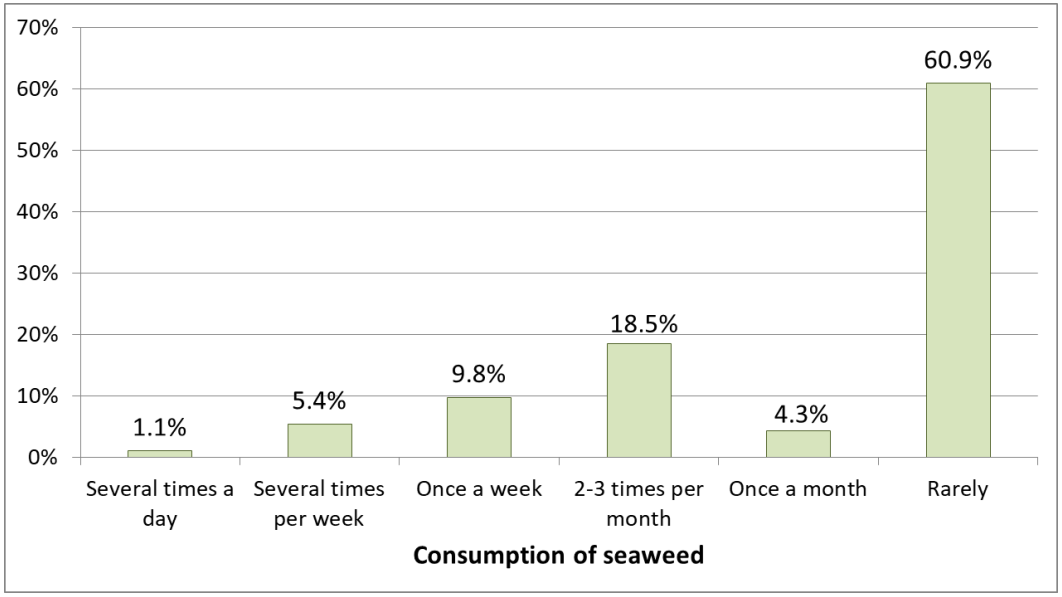
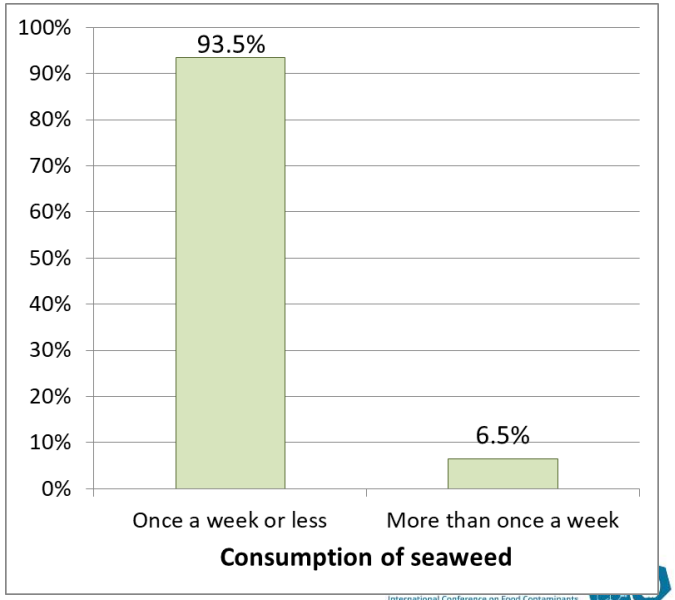

60%
50%
40%
30%
20%
10%
0%
1.1%
4.3%
50.0%
27.2%
8.7%
2.2%
6.5%
Several times a day
Daily
Several times per week
Once a week
2-3 times per month
Once a month
Rarely
Consumption of fish and shellfish


60%
50%
40%
30%
20%
10%
0%
44.6%
55.4%
Once a week or less
More than once a week
Consumption of fish and shellfish


70%
60%
50%
40%
30%
20%
10%
0%
1.1%
5.4%
9.8%
18.5%
4.3%
60.9%
Several times a day
Several times per week
Once a week
2-3 times per month
Once a month
Rarely
Consumption of seaweed


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
93.5%
6.5%
Once a week or less
More than once a week
Consumption of seaweed

## Results from total Hg analysis in 92 hair samples

Mean = 1.09 µg/g

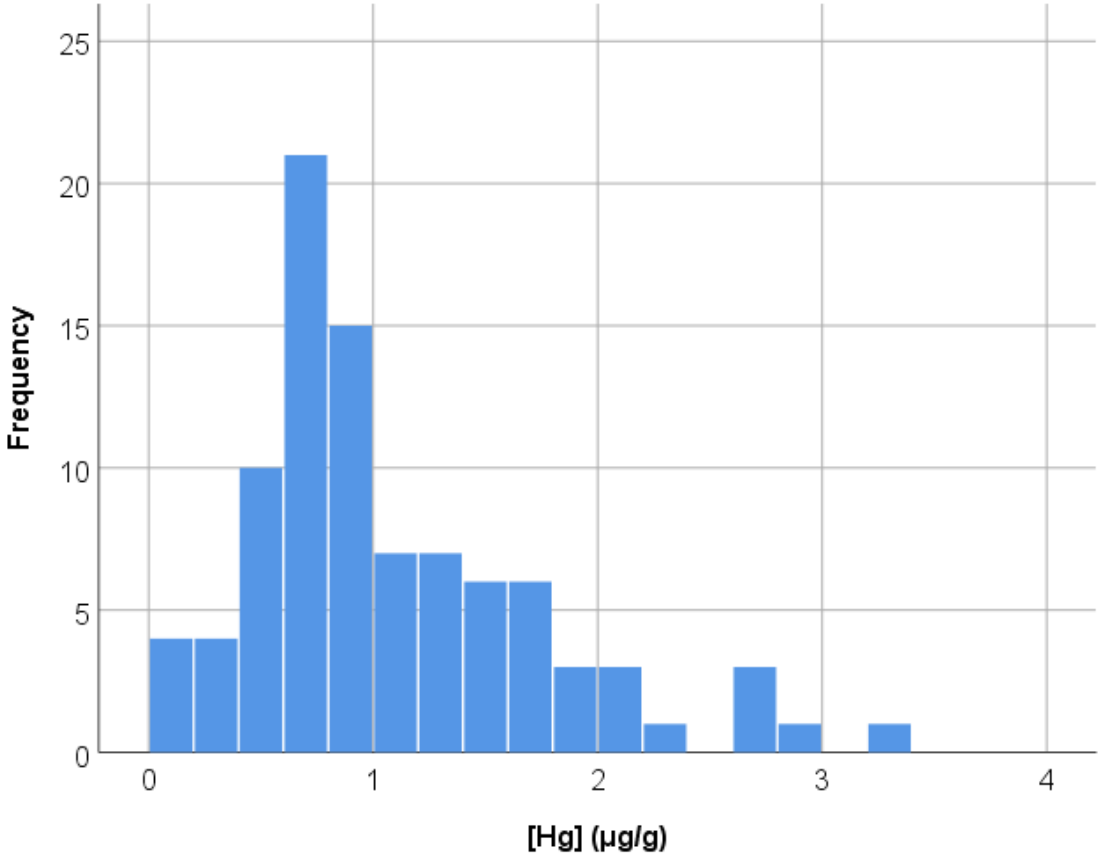
SD = 0.66 µg/g

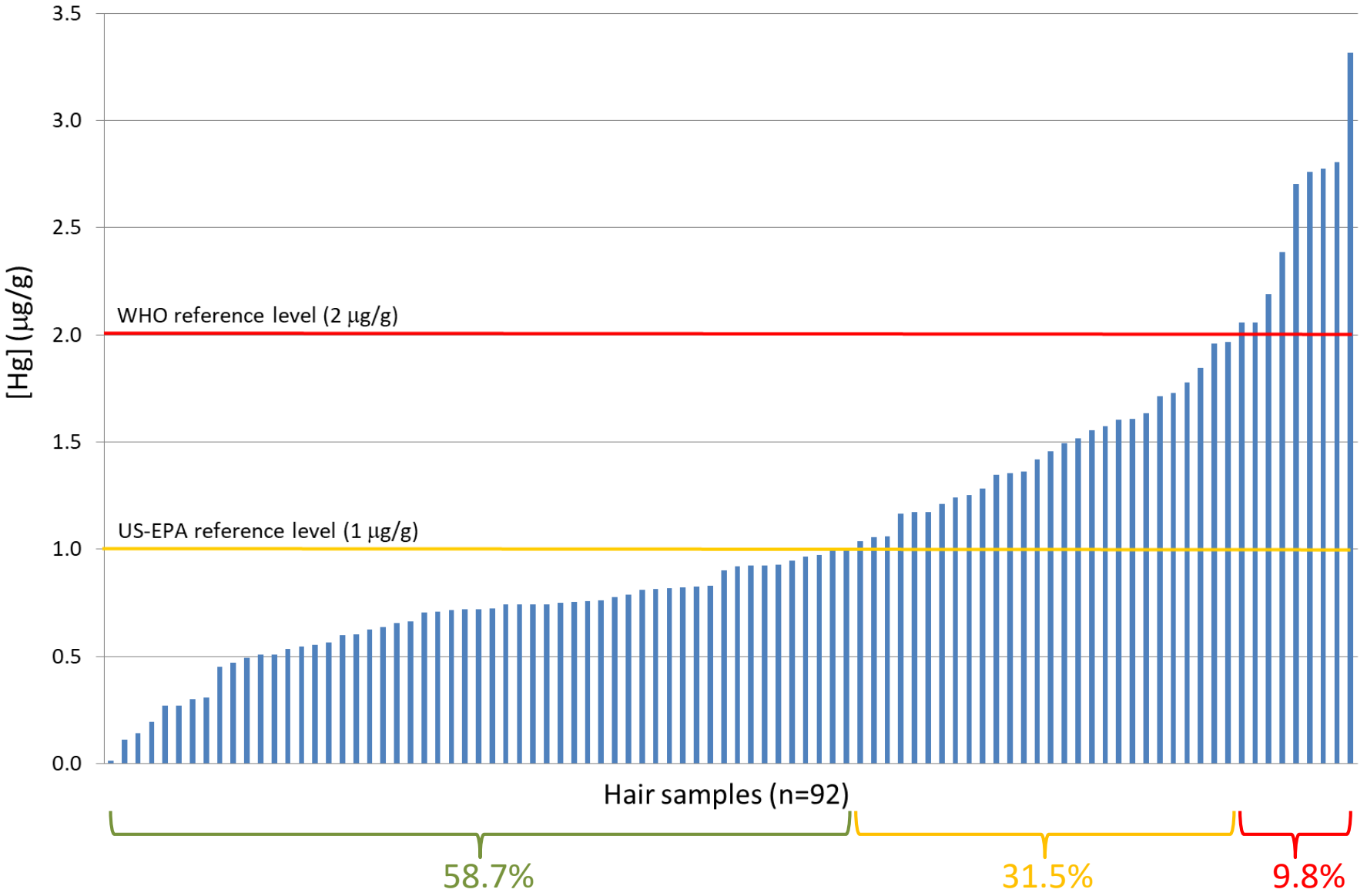
Min = 0.01 µg/g

Max = 3.32 µg/g

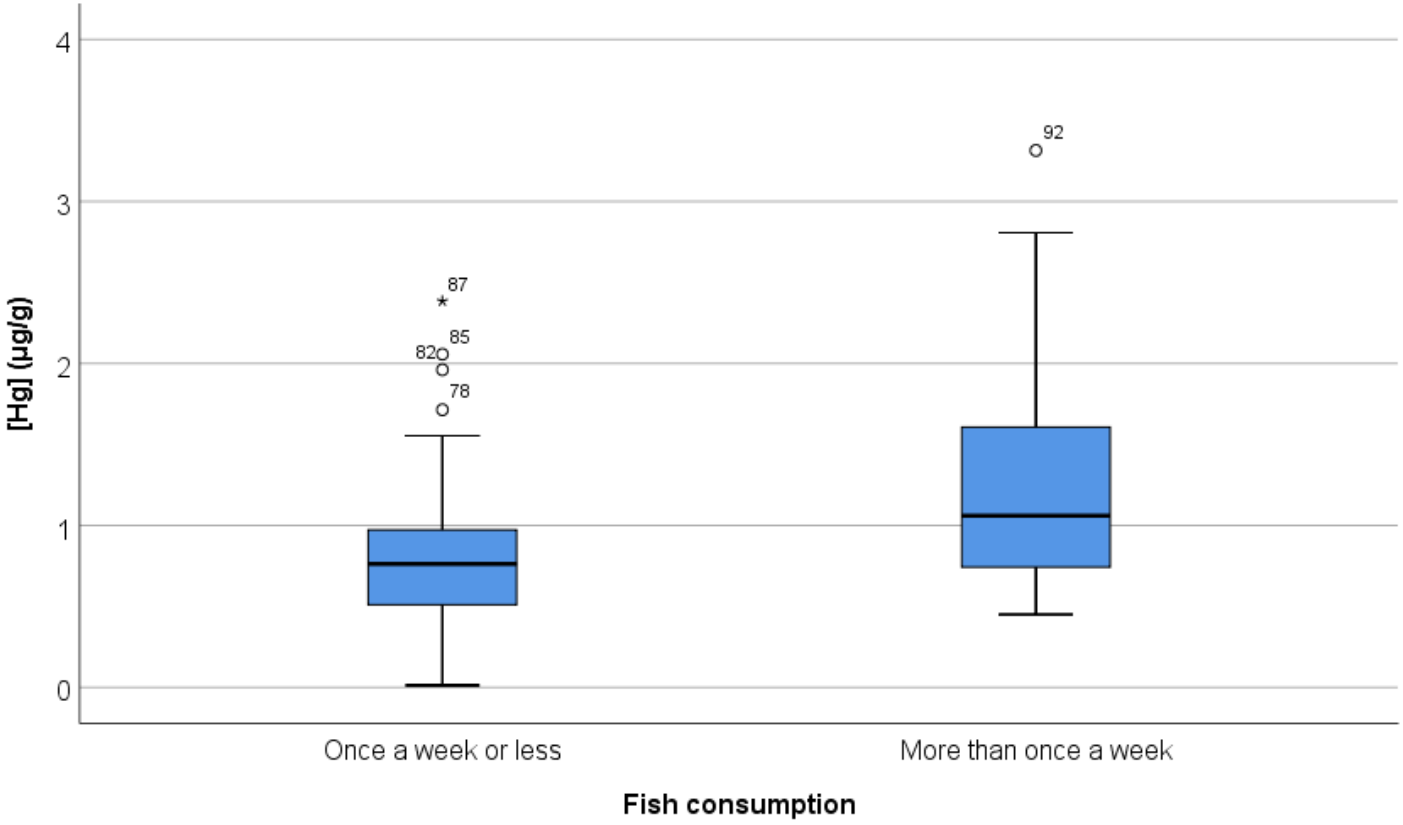
P90 = 2.03 µg/g

P95 = 2.72 µg/g




3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
[Hg] (µg/g)
WHO reference level (2 µg/g)
US-EPA reference level (1 µg/g)
Hair samples (n=92)
58.7%
31.5%
9.8%

Mercury concentrations were significantly associated with higher fish consumption (more than once a week), but not with shellfish and seaweed consumption (p=0.002, Mann-Whitney test).



# Comparison with other studies

| Location | Sample collection | Study population | Age | Mean [HG] (µg/g) | Min-Max [Hg] (µg/g) | % [Hg] above reference values | Reference |
|---|---|---|---|---|---|---|---|
| Lisbon | 2017 - 2018 | 92 adolescents | 12 - 18 | 1.09 ± 0.66 | 0.01 - 3.32 | 41.3% > 1 µg/g<br>9.8% > 2 µg/g | Current study |
| Lisbon | 2011 | 60 children | 5 – 11 | 1.30 ± 0.93 | 0.32 - 5.82 | 60.0% > 1 µg/g | 1 |
| Golegã | 2011 | 60 children | 5 – 11 | 1.10 ± 0.56 | 0.20 – 2.67 | 46.7% > 1 µg/g | 1 |
| Aveiro | - (published 2013) | 49 adolescents /young adults | 16 – 21 | 0.86 ± 0.05 | 0.17 - 1.82 | 23.7% > 1 µg/g | 2 |
| Azores | - (published 2013) | 36 adolescents /young adults | 16 – 21 | 0.69 ± 0.05 | 0.17 - 1.82 | 18.4% > 1 µg/g | 2 |
| Lisbon | - (published 2014) | 73 adolescents | 14 – 18 | 1.13 ± 0.07 | 0.03 - 2.60 | 50% > 1 µg/g | 3 |
| Azores | - (published 2014) | 84 adolescents | 14 – 18 | 0.82 ± 0.06 | 0.03 - 2.13 | 25% > 1 µg/g | 3 |

1) Castaño A, Cutanda F, Esteban M, et al. Fish consumption patterns and hair Mercury levels in children and their mothers in 17 EU countries. Environ Res. 2015 Aug;141:58-68. doi: 10.1016/j.envres.2014.10.029.

2) Vieira, Hugo & Soares, A.M.V.M. & Morgado, Felisbela & Abreu, Sizenando. (2014). Mercury accumulation in adolescents scalp hair and fish consumption: a case study comparing populations having natural or anthropogenic sources. E3S Web of Conferences. 1. 41038. 10.1051/e3sconf/20130141038.

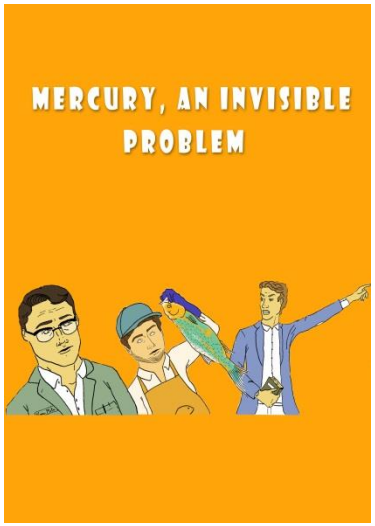
3) Vieira HC, Morgado F, Soares AM, Abreu SN. Real and potential mercury accumulation in human scalp of adolescents: a case study. Biol Trace Elem Res. 2015 Feb;163(1-2):19-27. doi: 10.1007/s12011-014-0159-5. Epub 2014 Oct 31. PMID: 25359702.

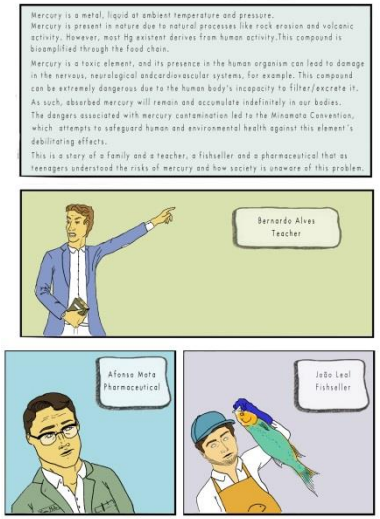
Results show that mercury concentrations are higher among students that consume fish more frequently and that a considerable part of the students presented [Hg] above the US-EPA reference level. However, given the small sample size and the fact that the study sample was a convenience sample, such results should be interpreted with caution.

Nevertheless, this study reinforces the need to **continue to monitor the mercury levels in the Portuguese population** and to **develop and implement strategies** regarding risk communication focused on the selection of fish species with lower mercury concentration in order **to prevent human exposure to mercury in Portugal**, especially in particularly susceptible populations like adolescents.

## Dissemination of results and public awareness

- In order to disseminate the results, the students elaborated a prototype of a comics book and performed video interviews around Lisbon and at their school.





- The results obtained highlight the importance of the collaboration between academia and schools for raising awareness to environmental health issues.

Acknoledgements:
The authors thank all the volunteers that participated in this study.

Thank you very much for your attention!

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