

# Assessing aluminum bioavailability in oral care products by an in vitro double step approach



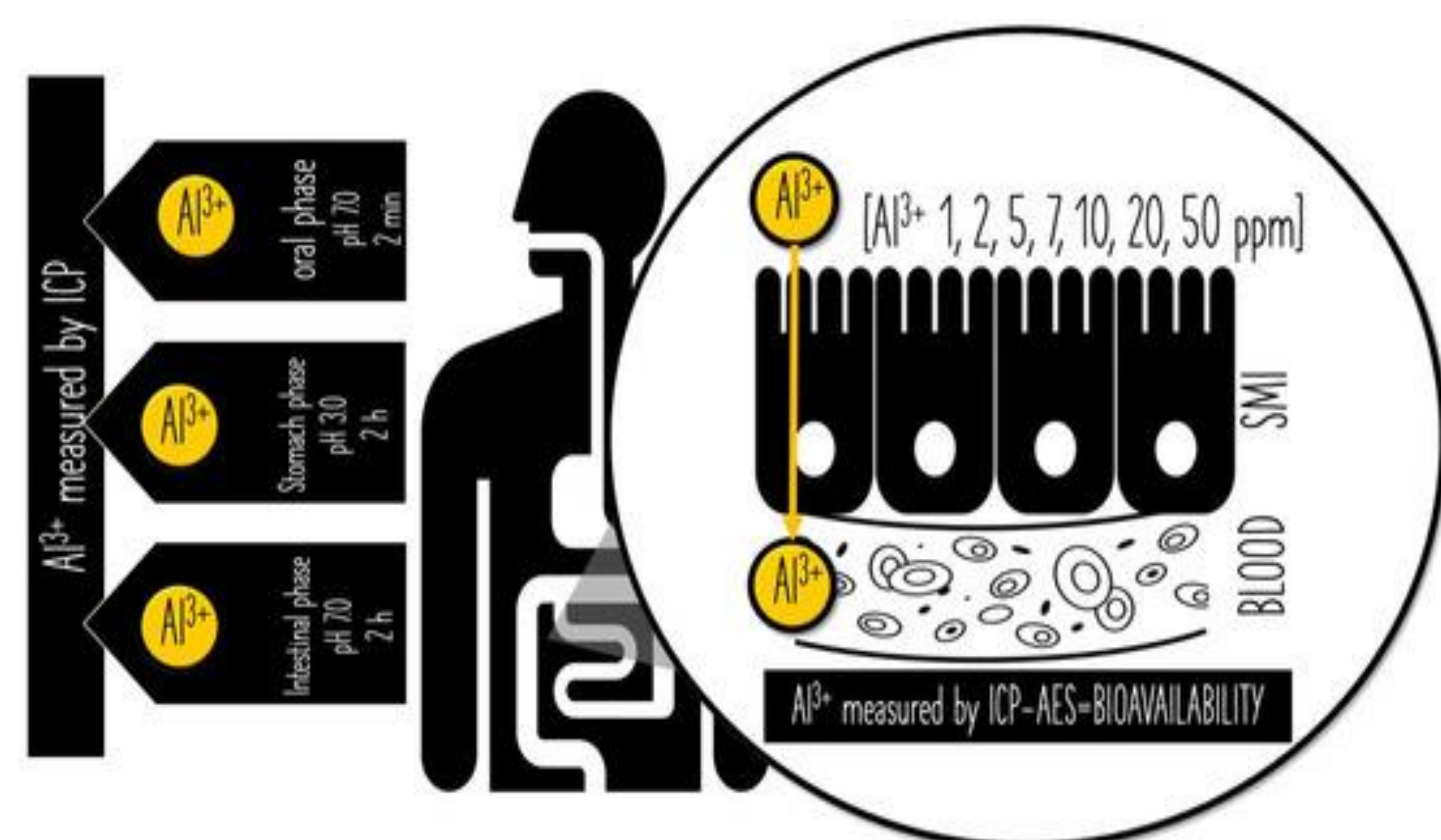
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## Introduction:

Aluminum is an ubiquitous element found in nature and in human-made products. It may trigger several adverse health effects in humans. In fact, aluminum may interfere with metabolism of other cations and induce gastrointestinal disorders and possibly neurotoxicity. In the light of recent data, the Scientific Committee on Consumer Safety (SCCS) considers that the use of aluminum compounds is safe at the percentage of 2.65% in toothpastes. No data are available on aluminum leach, eventually ingested with toothpaste. In this study, the bioavailability of aluminum included in cosmetic products used for oral care was assessed.

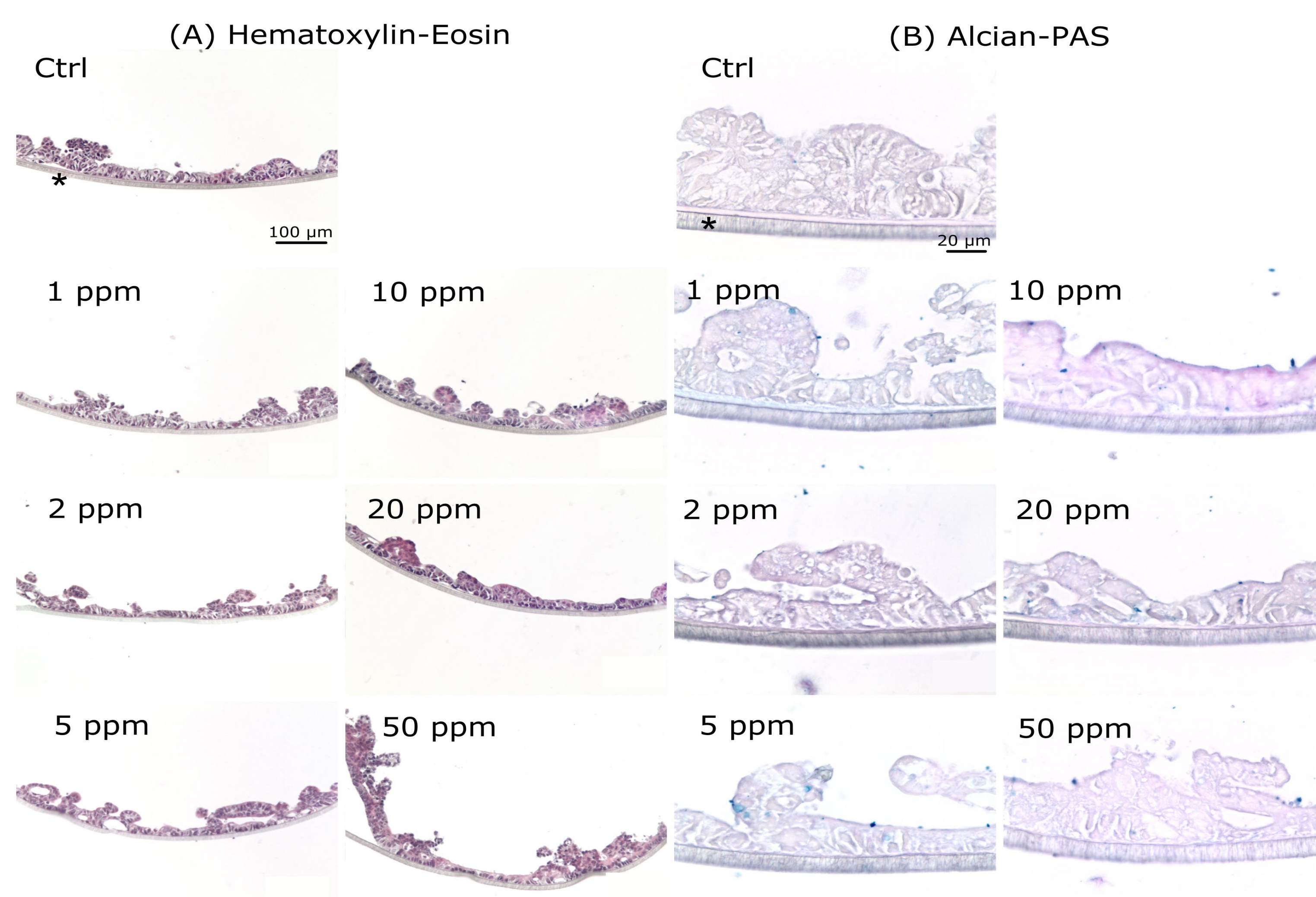
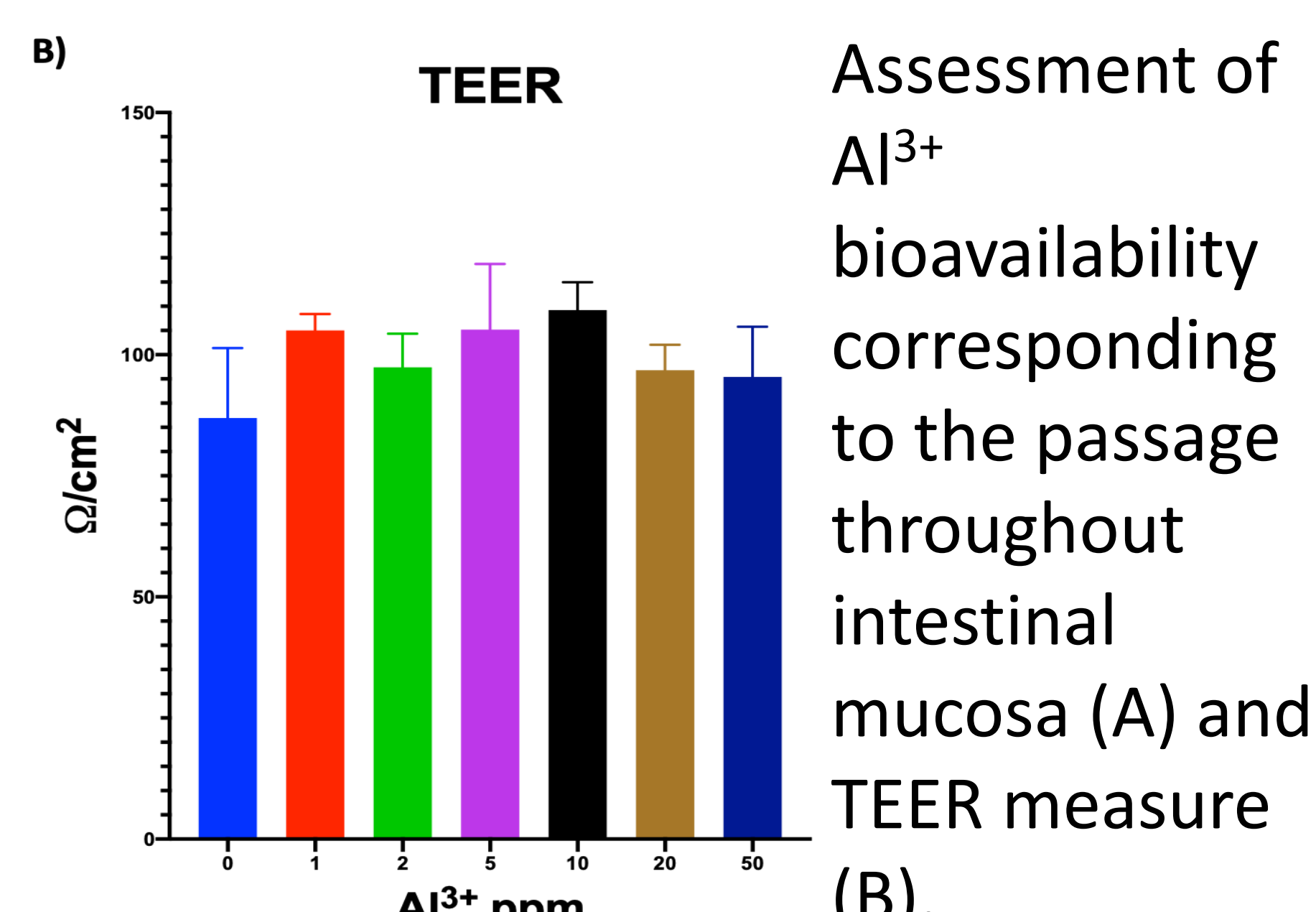
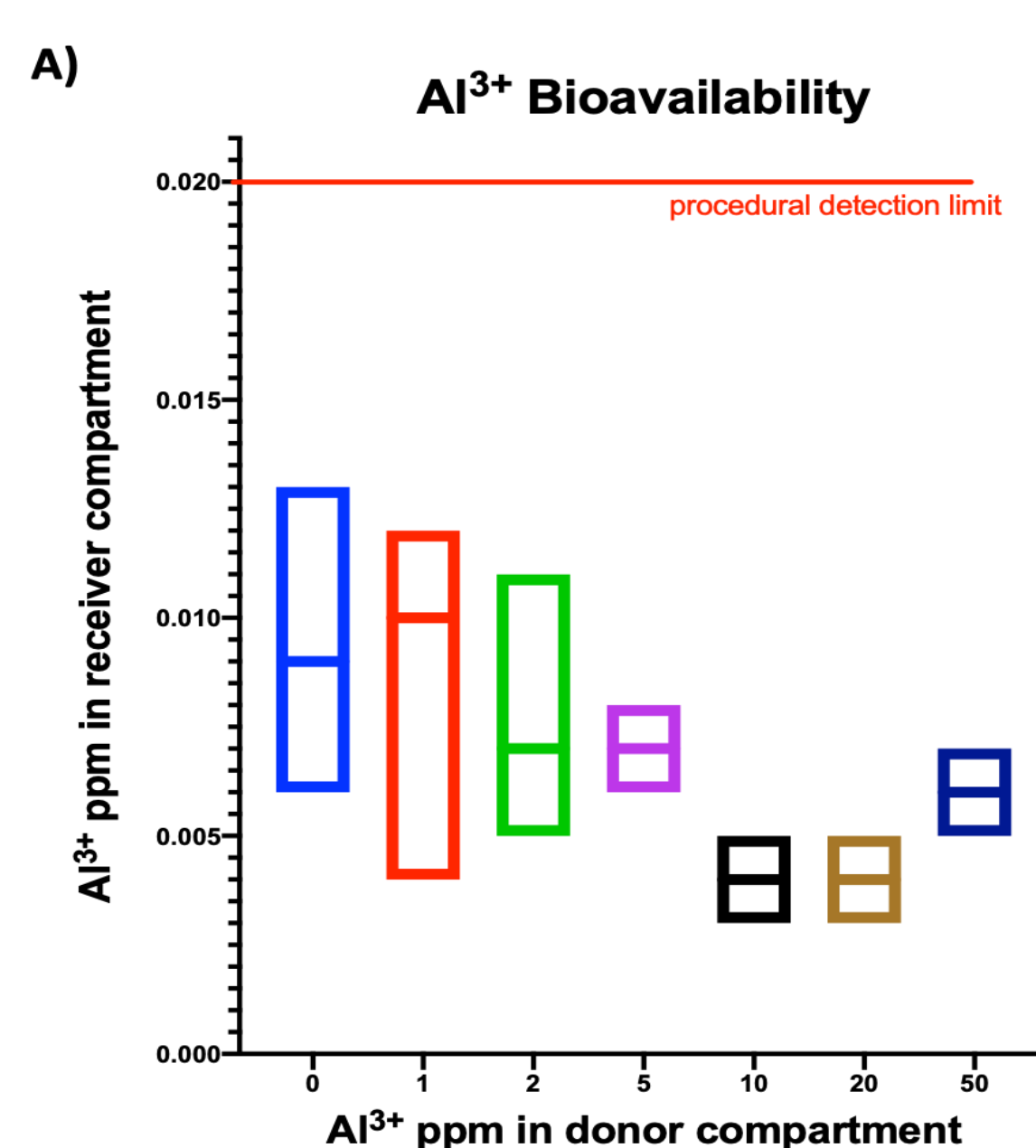
## Material and methods:



Representation of Al<sup>3+</sup> leach from toothpaste in a two-step model. The first step consists in INFOGEST COST model composed of oral, gastric, and intestinal phases of digestion. At each phase, the mixture was centrifuged and the supernatant was measured for Al<sup>3+</sup> leach by ICP-AES. The second step consists in incubating several amounts of Al<sup>3+</sup> (1,2,5,7,10,20,50 ppm) to assess its passage throughout the small intestine (SMI). The amount of Al<sup>3+</sup> measured by ICP-AES in the side-B compartment corresponds to the amount of Al<sup>3+</sup> into the bloodstream (BLOOD) and, ultimately, to Al<sup>3+</sup> bioavailability.<sup>1</sup>

## Results:

|                  | Al <sup>3+</sup> starting amount (ppm) | Al <sup>3+</sup> leached (ppm) | Al <sup>3+</sup> leached (% with respect to starting amount) | Assessment of aluminum leached from toothpaste during the passage through the digestive tract. |
|------------------|--|--------------------------------|--|--|
| Oral phase       | 131500                                 | 167±22.3                       | 0.12%  |  |
| Gastric phase    | 32900                                  | 17.7±7.2                       | 0.05%  |  |
| Intestinal phase | 16500                                  | 3.4±3                          | 0.02%  |  |



(A) Hematoxylin-Eosin staining does not show visible alterations compared to the control after Al<sup>3+</sup> exposure. (B) Alcian-PAS staining is quite weak and does not show any increase of mucopolysaccharide synthesis or accumulation compared to the control after Al<sup>3+</sup> exposure.

## Conclusion:

The data presented show that the small amount of Al<sup>3+</sup> able to trespass intestinal mucosa is safe. This is in line with SCCS opinion stating about safety of aluminum daily applications through cosmetic products.

## Reference

1Allaria G, De Negri Atanasio G, Filippini T, Robino F, Dondero L, Soggia F, Rispo F, Tardanico F, Ferrando S, Aicardi S, Demori I, Markus J, Cortese K, Zanotti-Russo M, Grasselli E. Innovative In Vitro Strategy for Assessing Aluminum Bioavailability in Oral Care Cosmetics. *International Journal of Environmental Research and Public Health*. 2022; 19(15):9362. <https://doi.org/10.3390/ijerph19159362>.