

Identifying whether the source is the tube or the stopper: Evaluation of zinc and antimony contamination in BD blood collection tubes

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Background

In a previous study [1], various blood collection tubes were evaluated regarding their suitability for trace element quantitation. Elevated zinc (^{66}Zn) and antimony (^{121}Sb) levels were detected in certain blood collection tubes manufactured by Becton Dickinson (BD).

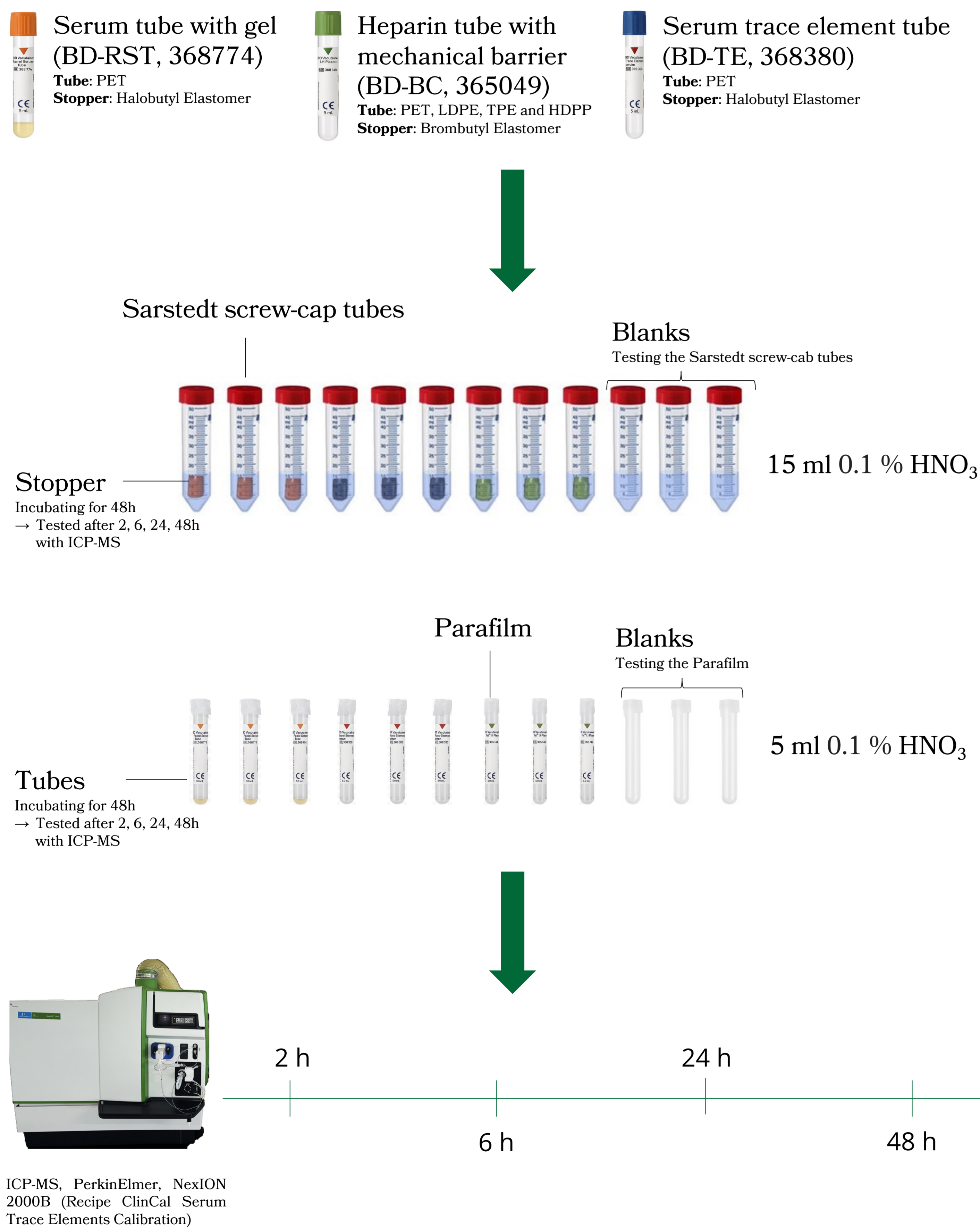
These outcomes were hypothesized to be related to the tube components: most BD stoppers consist of butyl rubber, whose manufacturing process involves the use of zinc salts, while the tubes themselves are made of polyethylene terephthalate (PET), where antimony is used as a catalyst during fabrication.



Objective

This study aimed to clarify whether the source of contamination is the tube or the stopper.

Methods



Three representative tube types were included: BD-RST, BD-BC and BD-TE. Each type was analyzed in triplicate. Tubes were filled with 5 ml of 0.1 % HNO₃ (16 mM) and stored upright until analyzed. Stoppers were incubated separately in Sarstedt screw-cap tubes containing 15 ml of 0.1% HNO₃. Zinc and Antimony were quantitated after 2, 6, 24, and 48 h of incubation using ICP-MS. Contaminations were considered as relevant if the measured concentration exceeded 25% of the lower limit of the reference range (Zn 0.18 mg/L) or the clinical cut-off (Sb 0.05 µg/L).

Discussion and Conclusion

Zinc

- **Stoppers** were identified as the source of contamination in conventional devices
- Contamination **increased with exposure time**

Antimony

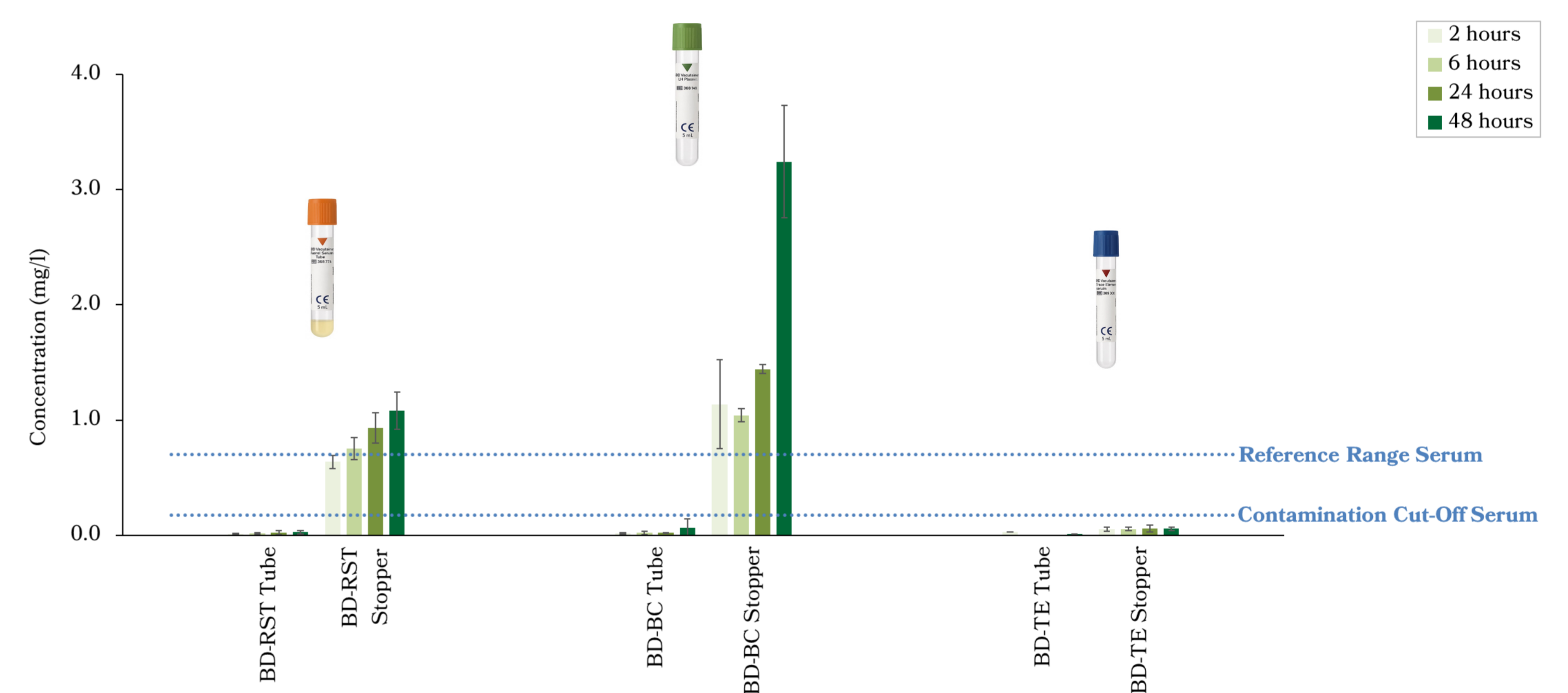
- **Tube** contamination originated primarily from the PET material (as also noted by the manufacturer)
- Contamination **did not** increase with exposure time

Limitation

HNO₃ was used as a surrogate matrix instead of serum, and the stoppers were fully immersed rather than exposed to a brief contact typical in clinical blood draws. Despite this worst-case design, the findings indicate that a clinically relevant influence remains a realistic concern.

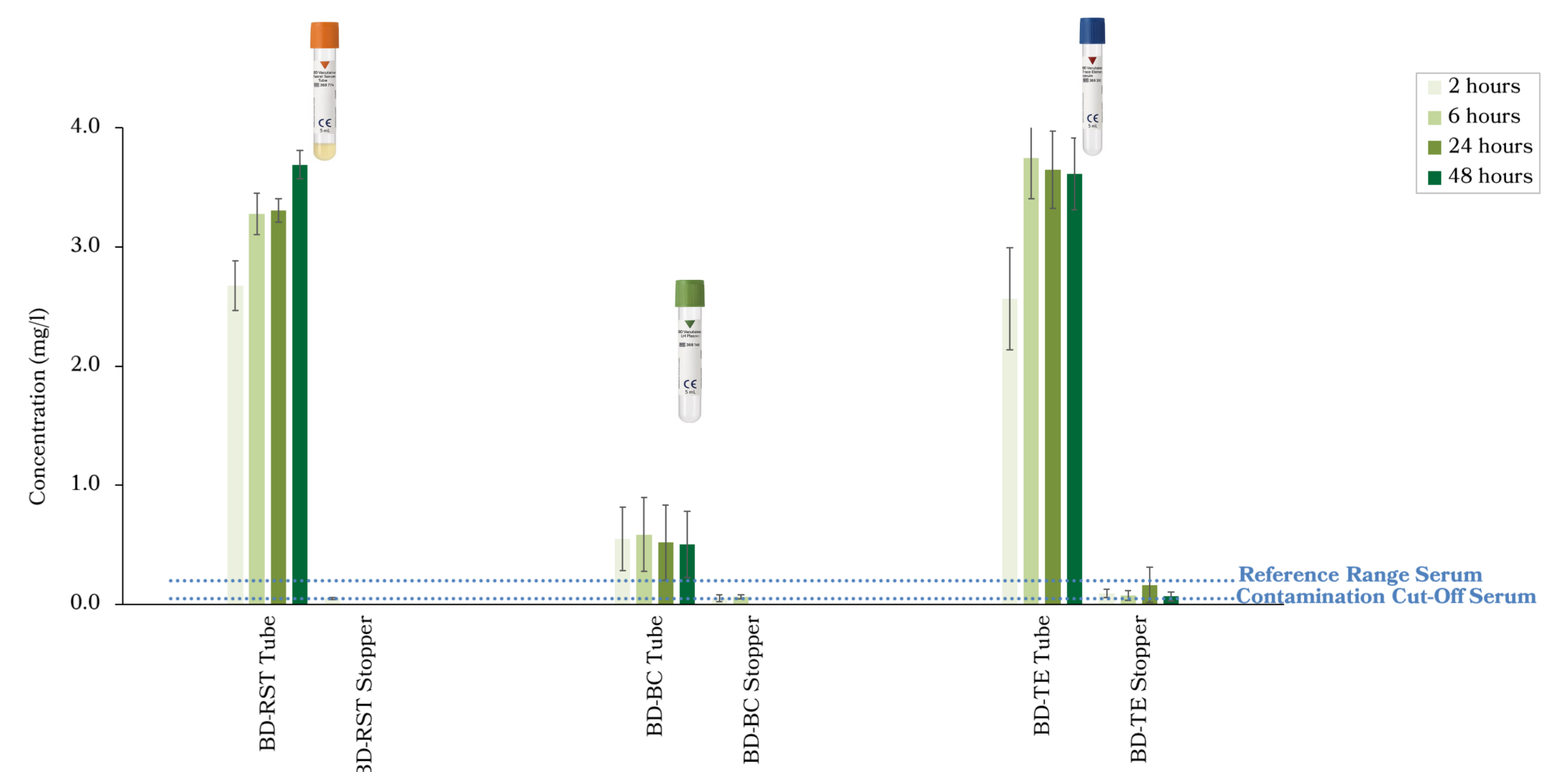
Results

Zinc



- Clinically relevant Zinc levels were detected in the stoppers of both conventional tubes (BD-RST, BD-BC)
- The tubes themselves showed no relevant Zinc release
- For the trace element device (BD-TE), no relevant contamination was observed in either tube or stopper

Antimony



- Significant Antimony contaminations were detected in all three tubes
 - BD-RST and BD-TE: contamination levels exceeded the defined cut-off by more than 100-fold
 - BD-BC: markedly lower, but still relevant contamination
- Stoppers showed only minor contamination
 - most likely caused by cross contamination with the tube