Distribution of zinc isotopes in breast cancer tissues

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The development of biological markers of breast cancer is crucial for early detection and improving treatment outcomes. Zinc importer and transporter proteins facilitate Zn homeostasis in normal cells [1], but Zn homeostasis breaks down in cancerous cells due to the increased expression of Zn importers and metallothionein, which produce an influx of Zn into the neoplastic cells [2,3].

To better understand the distribution of Zn and assess the potential of Zn isotopes in serum as a biological marker of breast cancer, Zn concentrations and isotopic compositions were determined in benign and malignant tumours, their adjacent histologically normal tissues, and serum from healthy controls and patients. Zinc concentrations and isotopic compositions were analysed by MC-ICP-MS following [4]. The $\delta^{66}Zn_{IMC\text{-}Lyon}$ values were determined with an external reproducibility of 0.08 ‰ (2SD).

Zinc concentrations are elevated in histologically normal tissue adjacent to benign tumours compared to tissue adjacent to malignant tumours (Wilcoxon-Mann-Whitney U-test, p_{value} = 0.021), having potential implications for control sampling protocols. Benign tumours have a unique δ^{66}Zn value intermediate to histologically normal tissue adjacent to tumours and malignant tumours. Malignant tumours contain elevated levels of Zn (p_{value} = 3.4 x 10^{-5}) and distinct low δ^{66}Zn values (p_{value} = 0.04) compared to histologically normal tissue adjacent to malignant tumours. No statistically significant difference in bulk serum Zn concentration or δ^{66}Zn value was observed between healthy controls and patients, suggesting that specific compartments in serum such as the main Zn-binding proteins, albumin and α-2-macroglobulin, should be investigated to determine if they host a resultant isotopically heavy Zn pool.

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