Uncertainty of postmortem metals concentration in long-term preserved samples

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INTRODUCTION

Postmortem testing for metals and accurate interpretation of the test results are crucial in revealing whether that analyte contributed to a person's death. To ensure proper judgments, postmortem testing requires both appropriate sampling procedures and, for comparison purposes, established and validated reference ranges. At present, such values are limited or nonexistent for analytes like zinc and iron resulting in the utilization of reference ranges setted for living persons, an approach that can lead to misattribution and to costly and unnecessary follow-up investigations. Inductively coupled plasma optical emission spectroscopy (ICP-OES), is an analytical technique used for the detection of chemical elements. It is a type of emission spectroscopy that uses the inductively coupled plasma to produce excited atoms and ions that emit electromagnetic radiation at wavelengths characteristic of a particular element. The plasma is a high temperature source of ionised source gas (often argon). The plasma is sustained and maintained by inductive coupling from electrical coils at megahertz frequencies. The source temperature is in the range from 6000 to 10,000 K. The intensity of the emissions from various wavelengths of light are proportional to the concentrations of the elements within the sample. Metal/metalloid exposure is inevitable and may exert toxicity in humans. Zinc has a normal blood concentration ranging from 68 to 150 µg/dl. Zinc serum levels higher than 120 mg/dl can be risk factors for stroke. [1] Similarly, Iron blood levels varies from 50 to 170 µg/dl in healthy people. Serum levels above 500 micrograms/dL leads to severe systemic toxicity. [2]

METHOD

ICP-OES analysis was set with water ignition mode using mini torch as attached instrument. The radio frequency power was 1.20 kW and gas flows were 10.00 L/min, 0.60 L/min and 0.70 L/min for plasma gas, auxiliary gas and carrier gas, respectively. The exposure time was of 30 sec and the view direction was axial. Figure 1 shows the instrument used.

RESULTS

We measured postmortem whole blood levels of zinc and iron in selected death cases (50 samples with no physiological symptoms of metal intoxication) to determine whether general post-mortem blood levels were different from established reference ranges for living persons and whether blood levels varied with postmortem interval. We found a strong correlation of metals concentrations in relation to preservation time, for both zinc (figure 2) and iron (figure 3). Such data were explained by diffusion and redistribution phenomena from surrounding tissues and other organs (e.g., lungs, gastrointestinal tract, and myocardium) in corpses. [3] Moreover, these findings corroborated the need to establish an updated "reference range" in postmortem situations.

Figure 1. ICPE-9820 Shimadzu

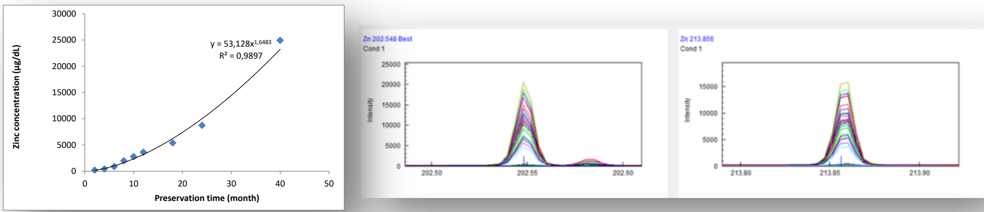

Figure 2. Zinc blood concentration in relation to preservation time

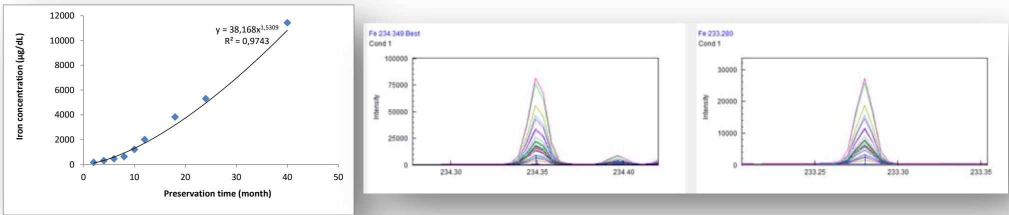

Figure 3. Iron blood concentration in relation to preservation time

CONCLUSION

This work provides an updated background on the variation of heavy metal levels in post mortem blood samples. It may contribute to defining "normal" heavy metal levels in the dead and living, allowing future interpretations of results obtained in other studies. This work also highlights the need for clearly defining postmortem changes.

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