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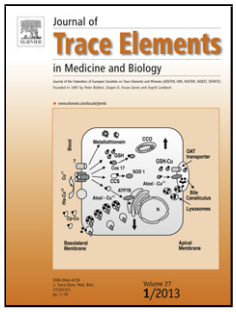

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Feasibility of the use of a handheld XRF analyzer to measure skin iron to monitor iron levels in critical organs

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Abstract

There exists a need for accurate, non-invasive point-of-care tests to detect body iron burden. This study investigated the use of x-ray fluorescence (XRF) measurements of skin iron as a marker for organ iron content in rats. This study also evaluated a novel application of a commercial XRF device, commonly used in mining and construction, as a rapid, portable, and non-invasive measurement tool. Rats (n=32) were loaded with iron dextran and the iron signal of each animal's skin, liver, and kidney was measured using a conventional XRF system. A quadratic correlation was observed between liver and skin iron signal (R^2=0.92) and a linear correlation was observed between kidney and skin iron signal (R^2=0.65). As such, it is concluded that skin iron content can act as a marker for both liver and kidney iron content. The same skin samples were measured using the portable XRF device and compared to the liver and kidney samples measured in the conventional XRF system. Again, a quadratic correlation was observed between liver and skin iron signal (R^2=0.91) and a linear correlation was observed between kidney and skin iron signal (R^2=0.83). Thus, the portable XRF device can provide rapid non-invasive, skin XRF measurements. Dosimetry was performed using the portable XRF device to assess the radiological hazard associated with its use. The average skin equivalent dose from this device is 30 ± 10 mSv/min, when the device is collimated and operated at 40 kV. In conclusion, skin iron XRF measurements can act as a surrogate marker for liver iron content, and can be measured using a commercial XRF device for a portable, fast, and non-invasive measurement.

Keywords: Iron; X-Ray Fluorescence; Skin; Liver; Iron overload