

## Hair Tissue Mineral Analysis Reference Intervals

Elemental analysis of hair samples by ICP-MS determines the concentration of various elements in a hair sample. The concentration results can be interpreted for clinical significance by means of a reference interval or range.

The reference range of laboratory data is the range of results that includes most of the results from a normal, reference population and excludes others. Typically, the mean and standard deviation (sd) of test results from a large population of healthy patients are used to establish a  $\pm 2$  sd reference range. In the case of Gaussian-distributed results data, the reference range includes 95% of results, with 2.5% being below the range and 2.5% being above. This central 95% portion of the data distribution curve is referred to as the normal range. Note that with the Gaussian distribution, there is a probability that 5% of results from the reference population of healthy patients will fall outside of the normal reference range. In addition, not all laboratory test data follow a Gaussian distribution. For example, in the elemental analysis of hair, certain elements such as lead (Pb) would not be expected to be found in a healthy population. In this case, the reference range may include zero as the starting point, creating a one-sided reference range.

Our laboratory, Trace Elements Inc., determined the reference range based upon the selection of a reference population of apparently healthy individuals. The reference population used for this range consists of individuals originating from North America, Europe, South America, East Asia, Australia and New Zealand. All ages and sexes were included. Selection criteria required that the complete hair specimen originate from the scalp to include the proximal portion, in accordance with established sampling procedures. Samples were free of any chemical treatment known to potentially adversely affect or contaminate elemental test results, for example bleaches, permanent wave solutions, and dyes containing lead or other metals. In addition, use of medicated shampoos was cause for exclusion from the study. The accompanying patient history was also used to ensure no past or current organic disease or symptoms.

The reference range provides healthcare providers with a starting point to interpreting laboratory results. Clinical interpretation of a laboratory test result using a reference range requires careful insight and consideration into the health conditions of the individual patient.

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