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Trace Elements in Teeth: A Source of Information on Diet and the Environment

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Editorial

The nutritional and environmental status of a human population can be determined by monitoring the trace elements present in their teeth [1]. This is not unexpected as tooth enamel has both an organic and inorganic phase. The organic phase consists of proteins (amelogenin, ameloblastin and tuftelin) together with small amounts of proteolglycans and lipoids [2]. In contrast, the inorganic phase is composed of well-packed nanocrystals of calcium apatite together with quantities of trace elements [3]. The trace elements in teeth can vary depending on the source of food and water as well as from soil and dermal absorption [1]. For example the level of Zn and Mg in human dentine was correlated with their presence in soil while Pb indicated environmental pollution in the drinking water [1,4,5]. Studies have shown that nutritional deficiencies can affect teeth during dentition, a critical growth period for teeth Examination of the teeth of children and adults (40-60 years old) in a rural area of Egypt found a positive association between caries and the presence of Mg, Cd, Pb and Ba. Higher levels of Mg, Cd, Pb and Ba were observed in permanent teeth compared to primary teeth as well as in carious teeth pulps compared to healthy teeth pulps [6]. Using inductively coupled plasma-optical emission spectroscopy (ICP-OES), Ghadimi et al. [7] examined the trace elements in the tooth enamel of 38 extracted human teeth concluding that trace elements could influence its physical properties. For example, Pb, Ti and Mn were correlated with the size, and Se, Cr and Ni with the lattice parameters of apatite nanocrystals in tooth enamel.

A comparison of human, bovine, and swine teeth dentine and enamel by Falla-Sotelo et al. [8], showed no statistical difference between their Ca and P content, although Ba was only found in bovine teeth. Understanding the chemical and structure of tooth enamel from a Troodon tooth, a small bird-like dinosaur, clearly provided archeologists with an understanding of both the diet and the environment conditions during that period [9].

A recent study by Kohn et al. [10] on 69 minor and trace element concentrations in the teeth of modern herbiovores, omnivores and carnivores from Idaho showed that the trace element concentration depended on the tissue type examined, enamel, primary dentine and secondary dentine. Many elements including Li and Be, some transition and heavy metals, and rare earths and actinimides were present below 1 ppm [11]. The largest trace element load in terrestrial carnivores appeared to come from the soil and dust and not from food. Instrumentation, such as laser ablation inductively-coupled plasma mass spectrometry, and energy-dispersive X-ray spectroscopy can now be effectively be used to accurately measure trace elements in human and animal teeth.

Such information not only provides a useful assessment of the diet but reflects the specific environment conditions as well.

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