

GEOCHEMICAL AND MICROSTRUCTURAL CHARACTERIZATION OF GALLBLADDER STONES: IMPLICATION FOR BIOMINERALIZATION

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Stone formation in the gallbladder is one of the growing health issues reported throughout the world. However, the studies on the characteristics of gallbladder stones (GBS) in the Sri Lankan community are scarce. Investigating the composition and microstructures of GBS is important for identifying the causative factors. The present study examined the compositional and structural characteristics of GBS in Sri Lankan patients. Twenty-three patients who were admitted for GBS removal surgery were selected for the study. The socio-demographic information was collected from patients using a structured questionnaire. The GBS removed from the surgery were analyzed by Fourier Transformed Infra-Red Spectrometer (FTIR) and Inductively Coupled Plasma Mass spectroscopy (ICP-MS) to investigate the functional groups and chemical composition. Microstructural and morphological features of GBS were observed by Scanning Electron Microscope (SEM) and stereo polarizing microscope. Selected samples were analyzed in duplicate. The most common type among the studied samples was “Mixed GBS”(n = 10, 43.5%) comprising cholesterol and bilirubinate followed by the “Pigment GBS”(n = 7, 30.4%), which contain bilirubinate. The “Pure cholesterol GBS”, which comprised only cholesterol, was the least common type of GBS. Calcium was identified as the main constituent in GBS together with Cu, Mn, Fe, Mg, Zn, and Ni. The Pigment GBS contained higher concentrations of these elements compared to the other two types. The core region and the crust were enriched with Ca compared to the central part of the stone. Concentric layers of alternating dark and light colour bands observed in the crust reflect the compositional difference in bile involved in the GBS formation. The SEM imaging confirmed lightly stacked cholesterol with plate- and needle-like crystals and irregularly arranged clumps of bilirubinate. The Ca-rich core of GBS confirmed that the Ca-salt precipitation possibly provided a nucleus for the GBS formation.

Keywords: Bilirubinate, Cholesterol, Gallbladder stones, Microstructure, Trace elements