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89 - Mechanical, chemical, structural, and radiological changes in pigeon bone, associated with the dietary intake of nickel recovery slag as a grit source.

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Slag from nickel smelting operations in the Sudbury basin in Ontario has become ubiquitous. This material rich in heavy metals such as iron, upon ingestion has the potential to effect physical, radiological, chemical, mechanical, and structural changes in biological systems. In this work, we analyze the effects of slag ingestion through diet, on several quantitative and qualitative parameters of the tibio-tarsal bones in pigeons (*Columba livia domestica*). The specimens were divided into a control group provided a “normal” diet of clean limestone, and an experimental group fed slag-based grit, both for a period of one year. Their tibio-tarsal bones were then harvested for analysis. Quantitative analytical methods included measurement of caliper-based cortical bone thickness of the tibia, conventional density measurements, bone mineral density measurements using Dual Energy X-ray Absorptiometry, calcium and iron concentration measurements using mass spectrometry, and the determination of Young’s Moduli and ultimate breaking strength (both in compression) using a universal testing machine. A Welch’s t test (single tail) was used to compare means of the seven quantitative parameters between control and experimental samples, and in six parameters, a statistically significant difference was found ($p \leq .05$). Microscopy, both optical and electron – coupled with energy dispersive spectroscopy (EDS) was also carried out for both sample groups. Microscopy and EDS analysis revealed structural differences in bone between the two groups. We conclude that slag ingestion through diet in the species examined, is associated with measurable changes in physical, radiological, mechanical, chemical, and structural properties of the tibio-tarsal bones.

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