[ID-P#151] A review of lead toxicity in Chhattisgarh state, central India

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Lead toxicity is a significant public health issue in developing countries like India, especially in Chhattisgarh, a region rich in mineral resources. This review explores the sources, exposure, and effects of lead toxicity in the region, based on a PubMed search using the key terms “Lead” and “Chhattisgarh.” Initially, 136 articles were identified and screened for studies related to lead exposure or pollution, resulting in the selection of 11 relevant articles. Of these, 3 articles related to medicinal chemistry, microbiological studies, or technical notes were excluded. Primary sources of lead exposure in Chhattisgarh include air pollution from mineral- based coal-fired emissions, natural dust, and automotive exhausts with high lead and chromium concentrations. Mishra et al. (2018) demonstrated that inhalation is the chief carcinogenic pathway for both children and adults due to the bioavailability of PM2.5 metalloids. A study by the India State-Level Disease Burden Initiative Air Pollution Collaborators (2020) reported a 115% increase in deaths due to ambient particulate matter pollution from 1990 to 2019. Premature deaths and morbidity from air pollution accounted for 1.36% of India’s GDP, with the impact being higher in low per-capita GDP states, including Chhattisgarh. Singh et al. (2023) reported PM2.5 levels 2.5-28.3 times higher than the prescribed standards of 60 µg/m3. Heavy metals such as silica (Si), lead (Pb), nickel (Ni), and manganese (Mn) were found at higher levels than the National Ambient Air Quality Standards in Raipur and Korba, Chhattisgarh. Earlier, Sharma (2003) noted elevated concentrations of respirable suspended particulate matter in sites along the Drug- Bhilai region of Chhattisgarh, with blood lead levels ranging from 7.92-31.22 µg/dL. Patel et al. (2006) found Pb concentrations in water, soil, and sediment samples (n=158) collected from 70 locations in the Raipur region, with surface water ranging from 6 to 1410 µg/g, groundwater from 3 to 52 µg/g, soils from 12.8 to 545 µg/g, and sediments from 31 to 423 µg/g, with mean values of 305, 16, 102, and 190 µg/g, respectively. Lead exposure in Chhattisgarh occurs through various pathways, including the ingestion of contaminated water with high Pb levels in rain and runoff, especially in industrial areas, and through food grains, vegetables, and wild plants with bioavailable Pb. A Geochemical Survey by Das et al. (2018) reported human blood lead levels of 28 µg/ dL with a high 207Pb/206Pb ratio, noting that the mean 207Pb/206Pb lead ratio decreased in the order of diesel (0.9012) > flyash (0.8757) > coal (0.8498)
> soils and sediments (0.8374). In another study by Das et al. (2020), approximately 25% of sampled dust had Pb Igeo classified under class IV, indicating heavy contamination, with coal burning identified as a major contributor to lead contamination from both geogenic and anthropogenic sources. Despite the severe health implications of lead exposure, including neurological damage, hypertension, and cardiovascular issues, there is a lack of comprehensive data on lead exposure levels and consequent health outcomes in the region.