Health effects and toxic potency of Saharan dust particles

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The Sahara Desert is the largest source of mineral dust (MD) in the world. An estimated 200 million tons of mineral dust are released annually, impacting air quality and public health. Saharan dust events in the North African region contribute to the long-range transport of chemical and biological species, impact biogeochemical cycles, and exacerbate atmospheric, water, and soil pollution. Despite the considerable amount of mineral dust emitted annually, few studies have investigated the effects of Saharan dust composition and its associated harmfulness in detail. The DUSTRISK project (A risk index for health effects of mineral dust and associated microbes) highlights the influence of Saharan dust composition on human health and provides new investigations to understand the impact of dust events on human life. Hence, this study provides insights into the Saharan dust chemical composition, including oxidative potential (OP) assessment, toxicological studies, and aerosol-associated microbiomes. During dust events, the particulate matter (PM) oxidative potential increases significantly for coarse and fine particles, with OP values approximately 3 to 4 times higher. This is undoubtedly related to the significant increase in trace elements and organic compounds during dust events, particularly Cu (1.8 ng m^{-3}), Fe (5189 ng m^{-3}), Mn (101 ng m^{-3}), and Zn (215 ng m^{-3}), which can reach levels that are ten times higher than during non-dust events days, in both PM_{10} and $PM_{2.5}$. Similarly, organic carbon (OC) and elemental carbon (EC) are 10 and 21 times higher on dusty days, respectively, with average values of OC: 2.73 µg m^{-3} and EC: 0.25 µg m^{-3}.

Particle-bound mercury (PBM) was found to increase by about 74% during the dust episodes, with an average PBM of 35.2 pg m^{-3} and 16.1 pg m^{-3} for PM_{10} and $PM_{2.5}$, posing an added health risk of the PM-associated particles. In addition, Saharan dust events enhance the intrinsic inflammatory potency of $PM_{2.5}$, which is associated with endotoxins. Iron and Mn may be essential factors for the inflammatory effect of $PM_{2.5}$. Furthermore, dust events increase the abundance of the genera *Domibacillus* sp., *Acinetobacter* sp., and *Cytophaga* sp., which contain several opportunistic pathogens. Saharan dust carries a significant variety of chemical and biological systems affecting human health and air quality in African regions.