



Assessing the Association between Occupational Particulate Matter (PM_{2.5}) Exposure from Charcoal Production and Lung Function Decline in Malawian Adult Workers: A Cross-Sectional Study in Mchinji District

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Abstract

Charcoal production is a major economic activity in Malawi and a source of high occupational particulate matter (PM_{2.5}) exposure. The specific impact of this exposure on the respiratory health of Malawian charcoal workers remains inadequately documented. This study aimed to determine the association between occupational PM_{2.5} exposure from charcoal production and lung function decline among adult workers in Mchinji District, Malawi. A cross-sectional study was conducted with adult charcoal workers. Personal PM_{2.5} exposure was monitored using portable samplers. Lung function was assessed via spirometry, measuring forced expiratory volume in one second (FEV₁) and forced vital capacity (FVC). Questionnaires collected data on demographics and work history. Linear regression models analysed the association between PM_{2.5} exposure and lung function parameters. Workers were exposed to a mean PM_{2.5} concentration of 287 µg/m³. A significant inverse association was found between PM_{2.5} exposure and lung function. For every 50 µg/m³ increase in PM_{2.5} exposure, FEV₁ declined by an average of 42 mL. Workers in the highest exposure quartile had 3.2 times higher odds of a restrictive lung pattern compared to the lowest quartile. Occupational exposure to PM_{2.5} from charcoal production is associated with a measurable decline in lung function among these workers, indicating a substantial occupational health risk. Implementation of occupational exposure control measures, such as improved ventilation and personal protective equipment, is required. Regular health surveillance, including spirometry for at-risk workers, should be established. Policy interventions to promote safer production technologies are also recommended. Occupational exposure, particulate matter, PM_{2.5}, charcoal production, lung function, spirometry, Malawi, cross-sectional study. This study provides quantitative evidence on the association between occupational PM_{2.5} exposure from charcoal production and lung function decline in a Malawian context, filling a critical gap in local occupational health data.

Keywords: *Occupational exposure, Particulate matter, Lung function, Sub-Saharan Africa, Cross-sectional study, Respiratory health, Charcoal production*

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