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High blood sulfhemoglobin level among Mahayana Buddhist monks
A possible effect of daily exposure to joss stick smoke

The ready access to blood (plasma and formed cellular elements) makes it unusually susceptible to the deleterious effects of airborne pollutants.[1] The red blood cell hemoglobin may be rendered ineffectual for oxygen transport by combination with carbon monoxide or conversion to methemoglobin or sulfhemoglobin.[1] Sulfhemoglobin[2,3] is a non functional hemoglobin that can be found in the population in urban areas with high traffic density. In addition, workers exposed to sulfur dioxide are at risk of developing sulfhemoglobin,[4] and complain of symptoms such as coughing, dyspnea, burning in the nose and eyes, and tearing.[4]

In this article, the authors report very high blood sulfhemoglobin levels among the Mahayana Buddhist monks, who comprise a forgotten high-risk population. The environmental implications and the need for monitoring and controlling this population are raised. Thirty Mahayana Buddhist monks from the Tham Khao Noy temple and the Bho Yen temple in the Kanchanaburi province were enrolled in this study. All were male and had been living in the temples on a daily basis for an average period of 13.2±10.8 years. This study has been approved by the Ethical Committee of Faculty of Medicine, Chulalongkorn University. After asking for informed consent, an EDTA blood sample from each subject was collected, preserved and transferred to the reference toxicology laboratory of Chulalongkorn University for measurement of blood sulfhemoglobin. The standard technique for sulfhemoglobin determination described by Bray[5] was performed under the routine laboratory quality control process. The normal value of sulfhemoglobin is <1%. The average blood sulfhemoglobin level in the study population was 7.8±2.3%.

Screening for occupational exposure is necessary. However, there are also some forgotten populations at risk, including the Mahayan Buddhist monks in this study. Indeed, living in the temple is considered an environmentally high-risk occupation. Ho et al reported that working in a temple increased the risk for the development of acute irritative symptoms, including nose and throat irritation,[6] but no further reports on the exposure to the contaminated atmosphere in the temple have been published. Joss stick burning is a tradition rooted in Mahayana and Taoism practice. Buddhism and Taoism are the two most popular religions in China and other countries in Asia. A considerably raised average level of blood sulfhemoglobin among the study subjects was seen, but no symptoms of toxicity were detected. The possible factor leading to the high blood sulfhemoglobin levels in these monks is of interest. Prolonged joss stick smoke exposure could be the contributing risk factor, as a high concentration of dimethylsulfoxide can be determined in joss stick smoke.[7] Fortunately, no mutagenic particles have been identified in joss stick smoke. The findings of this study indicate that it is necessary to provide a systematic assessment of cumulative exposure, with monitoring of blood sulfhemoglobin among the Mahayana Buddhist monks and the villagers living near the temples.

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