INDOOR AIR POLLUTION ASSOCIATED WITH COOKING FUELS: AN EXPOSURE AND RESPIRATORY HEALTH ASSESSMENT STUDY IN JHAJHAR DISTRICT OF HARYANA

by

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CERTIFICATE

It is hereby certified that the thesis entitled **"Indoor Air Pollution Associated with Cooking Fuels: An Exposure and Respiratory Health Assessment Study in Jhajjar District of Haryana"** which is being submitted by **Ms. Vinod Joon (2005ESZ8296)** is entirely the result of her own efforts. The work was carried out by her under our supervision at Indian Institute of Technology, Delhi and the results contained in it have not been submitted in part or full to any other university for award of any degree/diploma.

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(Vinod Joon)

ABSTRACT

Indoor air pollution due to cooking fuels is a major public health problem in developing countries like India. This thesis is an attempt to investigate the indoor air pollution levels during cooking with various fuels and its health effects on the cook. A survey was done in study area to study the fuel use pattern. More than 80% households were using biomass fuels for cooking either exclusively or along with some clean fuel usually LPG. The commonly used fuels/stoves combinations were tested in the laboratory for carbon monoxide (CO) and TSP emissions. The results show that dung cakes produced maximum emissions when burned in traditional Indian stove (Chulah) followed by dung cake/Hara, crop residues/Chulah, kerosene and LPG in that order. Characteristics of the cooking fuels have also been studied by doing proximate and ultimate analysis fuels. Mass and energy based emission factors of various fuels/stoves combinations were then determined.

Monitoring of indoor air quality was done in five villages of Jhajjar district of Haryana for particulates (PM2.5) and CO, the most important pollutant from health point of view, during cooking and non-cooking periods. Exposure level for the main cook of each household was estimated on case-to-case basis, based on results of field monitoring of PM2.5 and CO and time activity data of the cook. Exposure levels of the cook were influenced by type and amount of fuel used for cooking, heating and preparing cattle feed, type of stove, type of kitchen and duration of cooking. Indoor cooking resulted in maximum exposures while outdoor cooking in open reduced it significantly. The findings of this study's exposure assessment component, strengthen the evidence that the use of biomass fuels in traditional stoves exposes the cook to levels of air pollution that well exceed health guidelines available. Importantly, the study

shows that this holds true even when cooking is done in open.

Pulmonary function test by spirometry and American Thoracic Society's respiratory questionnaire were used to assess the respiratory health of the cook in both biomass and LPG using households. The results show that the cumulative exposure to biomass smoke was associated with greater prevalence of respiratory symptoms. Self-declared respiratory symptoms (cough, phlegm, nasal discharge, nasal obstruction and sneezing) were present in 49.1 % of women who cooked exclusively with biomass fuels, 36.7% of women who cooked with mix fuels in contrast to 11.7 % of LPG-users. In addition, biomass users had significantly higher prevalence of recurring headache and dizziness. Lung function was impaired in 71% of biomass and 53% of mix fuel users against 37.5% of LPG users. Lung function impairment was mostly of obstructive type. Reduction of lung function was found positively associated with levels of exposure to biomass smoke. Exhaled breath CO was also measured as a biomarker of recent exposure, before and after cook's exposure to smoke in a sub sample of population. The results showed that, cooking smoke caused a significant CO body burden as the breath CO levels of biomass users were 4-6 times higher as compared to the LPG users. Considering the extensive use of biomass fuels in the countryside and their potential health hazard, immediate measures like provision of cleaner fuels, better stoves, improved kitchen ventilation, better housing design and public awareness, should be taken by all concerned.

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