

An epidemiologic study has been carried out to examine the possibility of biomass smoke-induced inflammation, oxidative stress and genetic as well as epigenetic alterations in rural women of West Bengal who cook with biomass fuel for the past five years or more. A total number 382 never-smoking, premenopausal housewives (median age 37 year) who cooked exclusively with highly polluting biomass fuel were enrolled along with 361 age-matched control women from same locality who cooked with cleaner fuel liquid petroleum gas (LPG). The levels of PM10 and PM2.5 in indoor air were measured by real-time laser photometer. The PM10 and PM2.5 levels were 3-times more in biomass-using households, implying high level of particulate pollution in biomass-using households. Chronic biomass smoke exposure was associated with elevated levels of reactive oxygen species and depleted level of antioxidant enzyme superoxide dismutase in the airways and also in the peripheral blood, suggesting oxidative stress. As a consequence, biomass-using women showed increased levels of chromosomal breakage as evidenced by increase in micronucleus number in the airway epithelial cells. In addition, comet assay showed extensive DNA damage in the bronchial epithelial cells exfoliated in sputum of these women.

Despite an increase in DNA damage, DNA repair via non-homologous end-joining, mismatch repair and base-excision repair pathways, however, were not adequately up-regulated. As a result, the damaged DNA in airway cells of biomass users was not completely repaired. Besides, the expressions of DNA methyltransferase 1, 3A and 3B enzymes were upregulated among biomass users, suggesting epigenetic silencing of some of the cell regulatory genes. Collectively, the findings suggest increased risk of carcinogenesis in the airways of women who are chronically exposed to high level of IAP due to cooking with biomass.

Project

- Health impact of indoor air pollution from biomass fuel use in eastern and northern India. Sponsored by Central Pollution Control Board, Delhi.

Recent Publications

Project

1. Banerjee A, Mondal NK, Das D, Ray MR. Neutrophilic inflammatory response and oxidative stress in premenopausal women chronically exposed to indoor air pollution from biomass burning. *Inflammation*, 35, 671-683, 2012
2. Banerjee M, Siddique S, Mukherjee S, Roychoudhary S, Bhattacharjee P, Ray MR, Lahiri T. Hematological, immunological, and cardiovascular changes in individuals residing in a polluted city of India: A study in Delhi. *International Journal of Hygiene and Environmental Health*, 215, 306-311, 2012
3. Roychoudhury S, Mondal NK, Mukherjee S, Dutta A, Siddique S, Ray MR. Overexpression of Protein Kinase B (PKB/Akt) and risk of lung cancer among rural women in India who cook with biomass fuel. *Toxicology and Applied Pharmacology*, 259, 45-53, 2012
4. Dutta A, Ray MR, Mukherjee B, Chowdhury S. Increased cardiovascular risk in association with chronic airflow obstruction among premenopausal rural women of India who cook exclusively with biomass. *Air Quality, Atmosphere and Health*, DOI 10.1007/s11869-012-0173-8
5. Dutta A, Ray MR, Banerjee A. Systemic inflammatory changes and increased oxidative stress in rural

- Indian women cooking with biomass fuels. *Toxicology and Applied Pharmacology*, 261, 255-62, 2012
6. Banerjee M, Siddique S, Dutta A, Mukherjee B, Ray MR. Cooking with biomass increases the risk of depression in premenopausal women in India. *Social Science and Medicine*, 75, 565-572, 2012
 7. Dutta A, Ray MR. Prevalence of hypertension and prehypertension in rural women: A report from the villages of West Bengal, a state in the eastern part of India. *Australian Journal of Rural Health*, 20, 219-25, 2012
 8. Dutta Anindita, Bhattacharya Purba, Lahiri Twisha, Ray Manas Ranjan. Immune cells and cardiovascular health in premenopausal women of rural India chronically exposed to biomass smoke during daily household cooking. *Science of the Total Environment*, 438:293-298, 2012
 9. Dutta A, Ray MR. Changes in sputum cytology, airway inflammation and oxidative stress due to chronic inhalation of biomass smoke during cooking in premenopausal rural Indian women. *International Journal of Hygiene and Environmental Health*, 216, 301-308, 2013
 10. Mukherjee B, Dutta A, Roychoudhury S, Ray MR. Chronic inhalation of biomass smoke is associated with DNA damage in airway cells: involvement of particulate pollutants and benzene. *Journal of Applied Toxicology* 33, 281-289, 2013
 11. Mukherjee B, Dutta A, Chowdhury S, Roychoudhury S, Ray MR. Reduction of DNA mismatch repair protein expression in airway epithelial cells of premenopausal women chronically exposed to biomass smoke. *Environ Sci Poll Res*, 2013,doi. 10.1007/s11356-013-2218-4

Extramural projects/ grants

Other academic activities

Ph.D. awarded

- Bidisha Mukherjee (Jadavpur University; Supervisor: Dr. Manas Ranjan Ray)