Household Fuel Use and Airway Inflammation in Pregnant Mothers: A Comparative Analysis of FeNO Levels in Kandy District

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Household air pollution from biomass fuel combustion remains a critical environmental health concern in Sri Lanka, particularly for vulnerable populations like pregnant women. Exposure to biomass fuel, mainly firewood smoke, is linked to adverse respiratory outcomes, yet the specific physiological impact on airway inflammation among expectant mothers in the Kandy District requires further investigation using objective biomarkers. This study aimed to determine whether fractional exhaled nitric oxide (FeNO) levels, a sensitive indicator of subclinical bronchial inflammation, differ significantly between pregnant mothers who use exclusively gas stoves and those who use a combination of gas and firewood stoves. In this cross-sectional study, 85 pregnant mothers were recruited and categorized into two groups: "Gas Only" (n = 36) and "Both Gas and Firewood" (n = 49). Mothers with active/passive smoking exposure, allergies, or severe asthma were excluded; maternal and gestational ages were not considered as parameters. FeNO levels were measured using standardized breath analysis devices to quantify eosinophilic airway inflammation. Data was analyzed using Welch's t-test to compare mean FeNO levels while accounting for unequal variances between the cohorts. The results revealed that FeNO levels were significantly higher among individuals using both gas and firewood stoves (M = 18.4ppb, SD = 6.96) compared to gas-only users (M = 11.1 ppb, SD = 3.34). This difference was statistically significant, Welch's $t(72.9) = 6.34$, $p < 0.001$, indicating that mixed fuel use is associated with substantially increased airway inflammation. These findings provide evidence that the integration of biomass fuel into household cooking, even alongside cleaner energy sources, poses a significant subclinical respiratory risk. The study concludes that partial fuel switching is insufficient to protect pregnant women from the harmful effects of household air pollution. These results underscore the need for public health interventions and targeted policies that promote the adoption of clean cooking technologies to safeguard both maternal and fetal respiratory health across the Kandy District region.

Keywords: Fractional Exhaled Nitric Oxide (FeNO), Household Air Pollution (HAP), airway inflammation, respiratory health